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Understanding behavior-based city congestion: The importance of education towards inter-driver cooperation

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Abstract:

Metro Manila is one of the top congested cities not just in Asia but in the world before and during the pandemic. This descriptive study of the city's drivers employed the Driver Behavior Questionnaire based on Guého et al.'s adaptation of the Manchester DBQ where respondents were to self-assess for behaviors related to lapses, errors and violations and positive behaviors. A purposive sampling was conducted across drivers of vehicles four wheels and above across the city. The findings revealed that majority of Filipino drivers did not go through formal driving training. The rating on positive behaviors needs to be improved across all ages and educational levels which were also cross-validated with government-provided empirical data. Recommendation for the mitigation of driver behavior-based congestion is through the education of city drivers particularly leveraging on the Filipino value of "Pakikipagkapwa" or concern for others. This may be achieved through an information campaign on inter-driver cooperation, consistent traffic rules implementation and provision of informative and conspicuous traffic signs in order to prevent the top traffic violations in the city namely, obstruction and disregard of traffic signs. In-depth study and implementation of such recommendations are covered in Levels 3 to 5 of the Industry 4.0 framework in the Integrated Smart Traffic Management Solution.

Keywords:

Philippine DBQ; behavior-based congestion; Pakikipagkapwa; *Sikolohiyang Pilipino*; Industrial Revolution 4.0

1 Introduction

According to a worldwide survey for the year 2019 as published by Statista.com, Metro Manila is at the top of the list of most congested cities in the world. It is at par with Bangalore wherein road travel takes 71% longer as compared to free-flow traffic conditions (Statista, 2020). CNN Philippines confirmed this report with a study ranking 278 Asian cities with a population of more than 5 million people wherein Manila topped the list with a value of 1.5 which is higher than the 1.24 average (Asian Development Bank, 2019). The article mainly attributes the Metro Manila traffic gridlock to the lack of roads as well as the influx of workers from the provinces looking for opportunities in the city.

Various solutions have been formulated but mostly, they were directed toward road infrastructure and traffic management improvements which are extremely necessary but very costly. One very comprehensive report on congestion solutions was proposed by the Victoria Transport Policy Institute, an independent research organization focused on innovative transportation problem solutions (Litman, 2019). Litman (2019) listed down several strategies including the expansion of roadway capacities, improvement of other forms of transport (e.g., walking, bicycling, improved public transport, motorcycles, ridesharing, employee transport management), higher toll rates during rush hour, availability of affordable parking and other smart growth policies. Locally, a transport website also published a detailed analysis on the traffic congestion causes focusing on road infrastructure and traffic management problems including poor urban planning (Miguel, 2020).

On driver behavior, there have been a number of researches conducted in different parts of the world based on a Driver Behavior Questionnaire (DBQ) as published by Reason et al. (1990). This is popularly referred to as the Manchester DBQ wherein the foundation of the items were hinged on the three factors attributable to aberrant driving behavior namely, "violations", "errors" and "lapses." The focus of such inquiries are directed towards driver behavior as a predictor to road traffic accidents.

Parker et al. (1998) defined lapses as those related to lack of attention and forgetfulness while errors are misjudgments or incorrect observations. To clarify the distinction, Martinussen et al. (2014) suggested that errors are intentional while lapses are unintentional. Further, Rimmö and Åberg (1999) denoted lapses as incorrectly executing an action while errors are failures to execute as planned. For example, in overtaking another car, it is an error to miscalculate the speed of an oncoming vehicle and thus may force the driver to move dangerously in front or behind another vehicle in order to avoid collision with the oncoming traffic. In this situation, there was the driver's intention or plan to overtake but it could not be

executed properly due to the inaccurate estimation of the speeds of all vehicles that would be affected including his or her own. On the other hand, a lapse would be to say, getting into the fourth gear when it is already there. As for violations, there is a deliberate infraction of traffic laws or a safety norm which could pose harm to the driver and to others. For example, a driver who is always in a hurry may drive too close to the next vehicle or deliberately ignore the speed limit in the highway.

Several researchers conducted studies for drivers to evaluate their driving practices and adapted the Manchester DBQ based on their intended emphases on accident prevention. Rimmö and Åberg (1999) modified the DBQ to study young Swedish drivers' aberrant driving behavior due to the sensation-seeking tendency. Bener et al. (2008) sought to find the differences in driver behavior among Arab Gulf countries while Sucha et al. (2014) wanted to evaluate the Czech drivers' general behavior. Martinussen et al. (2013) delved into coming up with a shorter instrument as the original Manchester DBQ may be tiresome to fill out and thus, might affect the usability of questionnaire. There are still other DBQ-based studies but Rimmö and Åberg (1999) noted that there are just slight variations in their adapted instruments and these could be due to the differences in the attributes of each country's population.

This research aims to analyze the driving behaviors of Metro Manila drivers by looking into their demographic profiles and their self-assessed behaviors based on the Guého et al. (2014) DBQ modified accordingly as applicable to the Philippine context. The study also aims to discover areas in the cross-checking of results with literature and actual traffic statistics that may provide some valuable inputs in helping ease driver behavior-related traffic congestion and its associated stresses.

2 Theoretical Perspectives

2.1 Industry 4.0 paradigm in Traffic Management

Various literature on the causes of traffic congestion in bustling metropolises in Asia and all around the world abound with different proposed approaches. On the local front, in both formal reports and transport blogs, overcapacity of roads, influx of people looking for greener pastures in the city and the lack of urban planning form the primary causes of heavy traffic in Metro Manila (Asian Development Bank, 2019; Jiang, 2019; Miguel, 2020). While urban planning with respect to road constructions and the whole transport infrastructure may be considered too late by some detractors, the technology solutions like the contactless apprehension system is as of this writing, continuing to be implemented around Metro Manila in order to address the behavior-based congestion (Dadios et al., 2017; Dost-Pcieerd, 2017).

Technology and the human aspect together form the essence of the Industry 4.0 paradigm. What differentiates it from Industry 3.0 which is about smart systems and automation is the real-time collaboration of man and machine (Lom

et al., 2016; Nardo et al., 2020; Nguyen, 2020). In a parallel study, the researcher, in her current involvement in an Integrated Smart Traffic Management Solution for a Metro Manila city government developed the Industry 4.0 traffic management framework (De Ocampo et al., 2021) which was adapted from a manufacturing control system perspective (Nardo et al., 2020) as seen in Figure 1.

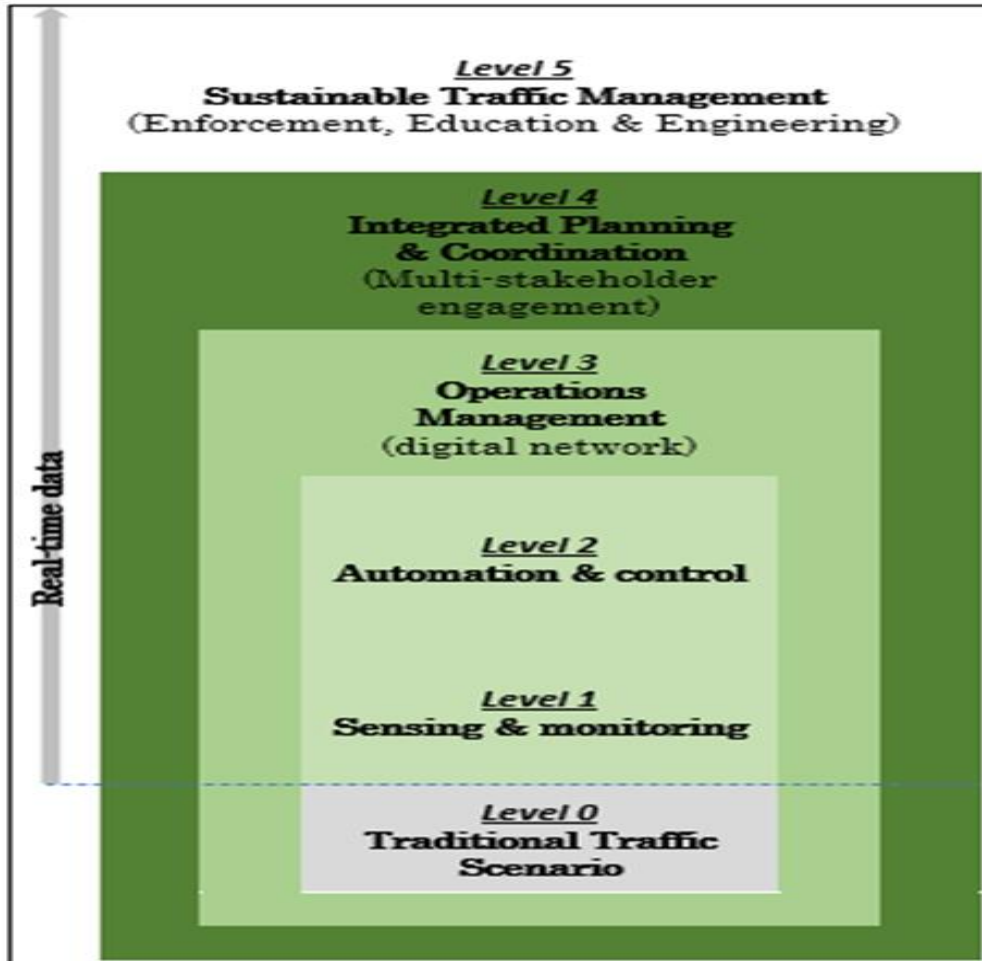


Figure 1 Industry 4.0 Traffic Management Framework (De Ocampo et al., 2021)

As a brief overview of the framework, Level 0 is the traditional traffic scenario wherein traffic lights are standalone and mostly with a fixed timer. There is no interaction with other traffic lights nor with any traffic enforcers. Level 1 (sensing and control) already incorporates digital technology like in the use of CCTV cameras and speed sensors but there is still no real-time access of information. Level 2 (automation and monitoring) already starts incorporating technologies like Internet of Things (IoT), Artificial Intelligence (AI), Machine Learning (ML) and cloud processing. Here is where the contactless apprehension system would fall under where vehicles are monitored and detected for traffic violations. The process has automation in it such video feeds are analyzed without human intervention and violators are identified who will then get their traffic tickets in the mail. Included in Level 2 are the smart traffic lights with adaptive and preemptive capabilities and

as such makes traffic flow decisions without human intervention. Level 3 (operations management) includes generation of traffic conditions real time for humans to make sound decisions in directing traffic in unsignalized intersections. Note that the reality in Metro Manila is that it may not be possible for all intersections to be installed with traffic lights depending on the location. Another aspect of Level 3 is the management of traffic signs which helps in guiding driver behavior in the absence of a device or a person directing traffic and thus, this is still part of operations management. Level 4 (planning and logistics) and Level 5 (overall traffic management), like Level 3, involve real-time information from digital technology for humans to study, analyze, make decisions, recommend and implement action items for traffic maintenance and improvement.

For this paper, the processes to study driver behavior, discover areas of improvement and generate recommendations are situated in Levels 3 to 5 in the Industry 4.0 traffic paradigm.

2.2 "Pakikipagkapwa," an innate Filipino value

Is the Filipino driver by nature undisciplined? Research proves otherwise as in other countries or at least, in the areas in Philippines under American jurisdiction where traffic laws are strictly implemented, they are among the most law-abiding traffic users (Bener et al., 2013; Fianza, 2017).

The following literature review looks into the nature of the Filipino which may be key in understanding driving behaviors and formulating insights for recommendation.

In *Sikolohiyang Pilipino*, "kapwa" (neighbor), which is the root word of *Pakikipagkapwa*, is one of the core values of the Filipino. A person starts having *kapwa* not so much because of a recognition of status given to him by others but more because of his awareness of a shared identity. The *ako* (ego) and the *iba sa akin* (others or literally translated as different from the self) are one and the same in *kapwa* psychology: *Hindi ako iba sa aking kapwa* (I am no different from others) (Enriquez, 1978).

Introspecting into this value, let us revisit Carl Jung, the father of analytic psychology, and his hypothesis on the human psyche having a collective unconscious. This consists in impersonal memories not directly experienced but still exists in the unconscious and passed on through generations as a universal collective among a group of people coming from a common history. He said that instincts originate from this collective unconsciousness--a powerful moving force which impels the individual to act outside of rational behavior (Jung, 1936).

The Filipinos have a common history of Christianity. As a matter of fact, this year 2021, the Philippines is celebrating its 500th year on Philippine soil ("Philippine Church Releases Logo for 500 Years of Christianity," 2019). Its core teaching is both the love of God and love of neighbor. The latter, expressed in Filipino, is "pagmamahal sa kapwa gaya ng sarili" (love of neighbor as oneself) and that is the essence of *Pakikipagkapwa*: doing good towards the other person as if doing it for oneself. It is a recognition of a shared identity coming from the same origin as children of one God and an inner self shared with others. However, in this day and

age, it is a concern of many Christian Churches that majority of the Philippine population does not practice their faith anymore and thus are called nominal Christians or Christians only by name (Isidoro-Romero, 2020). Nevertheless, in a survey conducted by Statista.com since 2015, 83% of Filipinos still consider religion as important to their lives (Statista, 2021). This annual survey has been continuing since 2015 and has been consistently producing numbers above 70%. From the survey, many do not consider themselves as religious particularly in participating in liturgical practices and other church activities but during times of calamities and catastrophes, the Filipino spirit of *pakikipagkapwa* emerges and people from different economic and educational levels willingly help out voluntarily sharing whatever they can even without expectation of recognition or rewards. Viral in social media are stories of marginal workers, for instance, a *magtataho* (street peddler of soybean curd) who gave his merchandise for free to pandemic frontliners ("VIRAL: *Magtataho, Namigay Ng Libreng Taho Sa Frontliners*," 2020). There were stories of youths who risked their lives during the eruption of Taal Volcano amid heavy ashfall affecting road visibility on the way to delivering essential supplies to victims ("Three Taal Volunteers Die in a Car Crash," 2020). Another touching story is that survivors of Typhoon Yolanda (Hurricane Haiyan) in 2013 who received overwhelming support back then did their share and launched a donation drive for the victims of Typhoon Rolly in 2020 (La Viña & Reyes, 2022). Moreover, in the light of successive disasters in the same year, volunteers willingly offered their services despite the risk of COVID 19 virus infection that the world was experiencing. For those who could not afford to leave their homes, many shared their monetary donations as part of their *ambag* (contribution) to the less fortunate ("Filipino *Bayanihan*¹ Spirit Brings Relief, Attention to Typhoon Ulysses Victims," 2020). Such acts of mercy illustrate the inherent value of having concern for others even if it is not rational to give especially from one's own poverty or other inhibiting circumstances. Thus, *pakikipagkapwa*, in Jungian parlance, is instinctual within the Filipino especially in times when it is needed the most.

3 Methodology

3.1 Instrument

For the questionnaire used in this study, the instrument was adapted from the DBQ of Guého et al. (2014) which has the tripartite factor framework of aberrant behaviors of lapses, errors and violations and also an added factor of positive behaviors to complete a 6-factor structure namely, "dangerous errors", "inattention errors", "inexperience errors", "ordinary violations", "aggressive violations" and, "positive behaviors."

¹ *Bayanihan* or "collective effort" is a Filipino "system of mutual help and concern which has become the backbone of family and village life through the Philippines." It is a tradition where the people in a community physically carry together a house made of light materials to move it from one location to another (Eadie & Su, 2018).

"Inattention errors" are those unintentionally committed due to the lack of mindfulness or attention of the individual. These are considered lapses, like misreading signs.

"Ordinary violations" are deliberate infractions of traffic rules and accepted driving norms but without aggression, like ignoring speed limits in highways or school zone areas or changing lanes abruptly.

"Aggressive violations" are like "ordinary violations" but with an intention to deliberately cause harm to others. One example is road rage or following closely another driver in anger.

"Dangerous errors" are unintentional acts but has a great risk of causing harm to self and others, e.g., turning left at an intersection but misjudging the speed of an oncoming vehicle which may not be able to stop to avoid collision.

"Inexperience errors" are unintentional but may be dangerous and this is due to the lack of driving experience and knowledge, e.g., making a mistake when changing gears which may dangerously distract the driver from the current traffic situation.

"Positive behaviors" are those acts of consideration to fellow drivers and pedestrians, e.g., avoiding running quickly through a rain puddle so as not to splash water onto other people or avoiding counterflowing so as not to disrupt traffic.

This Guého et al. (2014) DBQ was validated among French drivers using 41 questions and after evaluation, a shorter new version of 23 items was produced according to the resulting factor loading. As this instrument was validated for the French population, in order to be adapted to Metro Manila drivers, language experts were employed by the researcher in the translation to both English and Filipino. This resulted to 39 questions applicable to the Philippine context. Moreover, a five-point scale (1 - Never; 2 - Rarely; 3 - Sometimes; 4 - Frequently; 5 - Almost always true) was used in order to simplify the choices and to avoid confusion in participants of any educational level.

3.2 Reliability test

The first 30 observations were used to do a reliability test using Cronbach's alpha which resulted in the factor of "aggressive violations" to have a scale of 0.559 and thus was not reliable and was, therefore, removed. Unlike other factors, there was no possibility of dropping any item from this set of "aggressive violations" statements to check if the scale would increase to 0.7 or higher. Thus, the whole factor was dropped.

Table 1: Results of Reliability Test

FACTORS	Cronbach's
Inattention errors	0.711
Ordinary violations	0.745
Positive behaviors	0.938
Aggressive violations	0.559
Dangerous errors	0.712
Inexperience errors	0.795

3.3 Administration of DBQ to participants

The self-assessment questionnaire was administered in three ways: (1) online via Google Forms, (2) self-filling of a printed survey and (3) interview for participants who have difficulty in reading or understanding the survey. There was no request for personal details in order to keep the responses anonymous although email addresses may be optionally provided by the respondent should there be an interest to be updated on the results of the research study. Also, as part of the Data Privacy Act of 2012, the participants were not forced to answer any questions that they were not comfortable to respond to National Privacy Commission (n.d.).

The participants were drivers of any age, gender, level of driving experience and educational level who are plying the roads of Metro Manila driving public and/or private vehicles of 4 wheels and above. The sample size for this study of Metro Manila drivers was 395 respondents. (Out of 481 observations, 30 were used for the Cronbach's alpha reliability test, 56 were discarded due to unreliable data, i.e., same choice for all items indicating that they were not read at all, too many missing data, no demographic data provided.

In order to balance the composition of the participants and to address their current situations, the following strategy was employed:

- (a) An online questionnaire was designed to get responses from all drivers with internet access and capability regardless of their age, gender or educational experience. In the invitation to participate, respondents were given a choice to fill in the Google Forms survey either in English or Tagalog. These online surveys were sent out via email and social media platforms especially through Facebook groups.
- (b) Questionnaires were printed compactly into a 3-page format. They were designed to be self-filled by participants who do not have internet access. However, for those with difficulty in reading or understanding the material, interviews were conducted instead.
- (c) In order to have an approximately balanced composition of public utility drivers, the surveys were conducted in the terminals of jeepneys, buses and vans as well as shopping center's parking areas for taxis and other drivers in general. About 40 to 60 copies of the printed surveys were allocated for each type of public utility vehicle.

Results

Majority of the respondents are male at about 96%. Both the mean and median age of drivers are at 42 years old which shows that the composition of the respondents is more matured with driving experience averaging 17 years and a median of 15 years. Approximately 60% of the drivers drive daily, 20% drive 3 to 4 times a week and 20% less than twice a week.

Dividing the respondents into the established generation ranges (Kinnaman, 2018), about 50% are from Gen X, 32% are Millennials and about 15% are Baby Boomers. There were about 3% from Gen Z and less than 1% from the Traditionalist, Elders or Silent Generation.

4.1 Vehicle Use

The profile of the population sample shows a balanced proportion of public and private transport drivers with approximately one-third of each type of driver.

Table 2: Summary Statistics: Vehicle Type

Levels	Count	% Total
Public only	141	35.80%
both Public & Private	129	32.70%
Private only	124	31.50%

Among the PUV drivers, the numbers resulted in a balanced distribution of vehicle type. It is to be noted that there are Public Utility Vehicle (PUV) drivers who are driving multiple types of transport and so, the numbers below from our respondents are not mutually exclusive.

Table 3: Summary Statistics: Public Vehicles Driven

Vehicle	no. of respondents
Jeepney	59
Bus	46
Taxi	57
Van	57

As for transmission-type, 96% of the respondents are driving manually-controlled vehicles. This supports the fact that manual-transmission is still the prevalent type for Metro Manila vehicles.

4.2 Driving Training

Results show that only 15% of the respondents were formally trained in driving schools while about 45% learned driving only through training from an acquaintance. A significant finding in this study is that 40% of the respondents claim to have not

been trained at all and were self-taught. This finding of the majority of Metro Manila drivers as not having proper training is corroborated by a study on the understanding of traffic signs. Fernandez et al. (2020) discovered that only 26% has formal training in accredited driving schools, 54% were trained by either friends or relatives while 19% were self-taught. As for the License classification, about 74% possess Professional Driver’s License and 24% have Non-professional licenses.

Table 4: Summary Statistics: Driving Training

Driving Training	Count	% Total	
Driving School	57	15.00%	
Informal Training	172	45.30%	
Self-study	151	39.70%	

4.3 Education

Majority of the respondents are of high school level at 50.5%. The total of those who have not done any College-level coursework is 72.8%.

Table 5: Summary Statistics: Highest Education

Education	Count	% of Total
None	11	2.90%
Elementary	29	7.60%
High School	193	50.50%
Vocational	45	11.80%
College	82	21.50%
Postgraduate	22	5.80%

4.4 Analysis of variance of DBQ results

The Likert Scale for this DBQ has a rating of 1 or ‘Never’ to 5 or ‘Almost always true.’ Using the concept of the boundary of a number in evaluating the mean responses, the rating interpretations varied from ‘rarely’ to ‘never’ for errors and violations. The summary of the means and standard deviations of each criterion is presented in Table 6.

Table 6: Summary of Behaviors

Criterion	Mean	SD	Interpretation
Inattention Error	1.70	0.45	Rarely
Ordinary Violation	1.58	0.48	Rarely
Positive Behaviors	3.52	0.90	Frequently
Dangerous Errors	1.51	0.50	Rarely
Inexperience Errors	1.69	0.58	Rarely

According to Metro Manila drivers, inattention errors rarely happen (M=1.70, SD=0.45). The highest mean rating and the most common inattention error is missing a turn and thereby taking a long detour.

Ordinary violations are committed less than inattention errors. For this scale, the overall mean is 1.58, SD=0.48, indicating that ordinary violations rarely happen. Among these rarely committed violations, the most common is taking the wrong road whereas, the ordinary violations that are almost never committed by drivers are “beating the red light” and “over-speeding.”

Even with the traffic problems in the metro, drivers seem to not lack positive behavior on the road. Tied at being the most frequent are giving considerations to pedestrians and other drivers when parking and driving slowly when there’s water on the road to avoid splashing. The criteria for this scale are borderline sometimes and frequently observed by drivers, with the overall (M=3.52, SD=0.90) interpreted as frequently.

As for Dangerous Errors, drivers in Metro Manila report rarely exhibiting such behaviors on the road. Underestimating the speed of an oncoming vehicle when overtaking is at the top of the list such that the self-evaluation barely made it to the “rarely” category with a mean of 1.51.

The last variable measured by the DBQ was Inexperience Errors which seemed to be a seldom occurrence based on the self-report by drivers. All descriptors rarely happen with overtaking a slower driver by the right using the shoulder of the road as the most frequent, landing the scale a mean of 1.69, interpreted, rarely.

A breakdown of results comparing public and private vehicle drivers can be seen in Table 7 where it can be observed that drivers of private vehicles commit inattention and dangerous errors than drivers of public vehicles. However, the drivers of private vehicles display more positive behaviors. Inattention errors are more frequent for private drivers while inexperience errors for drivers of public vehicles.

Table 7: Comparison of behaviors between public and private vehicle drivers

Scale	Mean		Std Deviation	
	Public	Private	Public	Private
Inattention Errors	1.59	1.77	0.45	0.45
Ordinary Violations	1.55	1.67	0.43	0.51
Positive Behaviors	3.48	3.74	0.93	0.89
Dangerous Errors	1.53	1.61	0.45	0.51
Inexperience Errors	1.7	1.67	0.61	0.61

Note that generally, the ratings for both public and private drivers for all factors except for positive behaviors are on the ideal side indicating that they rarely do not commit driving violations and errors nor exhibit dangerous behaviors. Moreover, the public transport drivers rated themselves significantly higher than the private vehicle drivers for avoiding inattention errors, ordinary violations, dangerous errors and inexperience errors which implies better driving skills over private transport drivers. On the other hand, the mean of positive behaviors was

slightly higher for private vehicle drivers than their public counterpart. However, the aggregate means for both public and private drivers indicate that the self-assessed ratings were very near the boundary of 'sometimes' and 'frequently' which indicates a general inconsistency of positive behaviors

An analysis of variance (ANOVA) was conducted to determine whether there were significant differences in driver behavior when respondents are grouped according to education, driving training, and vehicle use.

Prior to running the ANOVA for each of the five scales, the tests of assumptions were performed. The assumption of normality was established using the Q-Q plot and further ascertained by invoking the Central Limit Theorem, with the sample size being more than 200 and sufficiently large for the analysis. For homoscedasticity, residuals were plotted against the predicted values and checked if the points appear randomly distributed with a mean of zero and no apparent curvature. For the homogeneity of variance, Levene's test was utilized, and for the outliers, the studentized residuals were used for detection. After having met these assumptions (some with modifications like removal of outliers), the analyses of variance were performed.

4.4.1 Inattention Errors

The analysis of variance was examined based on an alpha value of 0.05. The results of the ANOVA were significant, $F(8, 371) = 2.81, p = .005$, indicating there were significant differences in Inattention Errors among the levels of Education, Driving Training, and Vehicle Use. The main effect, Education was significant, $F(4, 371) = 2.72, p = .029, \eta_p^2 = 0.03$, indicating there were significant differences in Inattention Errors by Education levels. The main effect, Driving Training was not significant, $F(2, 371) = 0.06, p = .940$, indicating there were no significant differences of Inattention Errors by Driving Training. The main effect, Vehicle Use was significant, $F(2, 371) = 3.20, p = .042, \eta_p^2 = 0.02$, indicating there were significant differences in Inattention Errors by Vehicle Use. (See Table 8.)

Table 8: Analysis of Variance Table for Inattention Errors by Education, Driving Training, and Vehicle Use

Term	SS	df	F	p	η_p^2
EDUCATION	2.16	4	2.72	.029	0.03
DRIVING TRAINING	0.02	2	0.06	.940	0.00
VEHICLE USE	1.27	2	3.20	.042	0.02
Residuals	73.46	371			

Paired *t*-tests were calculated between each pair of measurements to further examine the differences among the variables. Tukey pairwise comparisons were conducted for all significant effects based on an alpha of 0.05. For the main effect of Education, the mean of Inattention Errors for College ($M = 1.80, SD = 0.47$) was significantly larger than for Elementary ($M = 1.56, SD = 0.46$), $p = .031$. For the main effect of Education, the mean of Inattention Errors for Elementary ($M = 1.56, SD = 0.46$) was significantly smaller than for Postgraduate ($M = 1.91, SD = 0.45$), $p = .030$. No other significant effects were found.

4.4.2 Ordinary Violations

The analysis of variance was examined based on an alpha value of 0.05. The results of the ANOVA were significant, $F(8, 371) = 2.56, p = .010$, indicating there were significant differences in Ordinary Violations among the levels of Education, Driving Training, and Vehicle Use. The main effect, Education was significant, $F(4, 371) = 3.42, p = .009, \eta_p^2 = 0.04$, indicating there were significant differences in Ordinary Violations by Education levels. The main effect, Driving Training was not significant, $F(2, 371) = 0.07, p = .929$, indicating there were no significant differences of Ordinary Violations by Driving Training. The main effect, Vehicle Use was not significant, $F(2, 371) = 0.15, p = .861$, indicating there were no significant differences of Ordinary Violations by Vehicle Use types. (See Table 9.)

Table 9: Analysis of Variance Table for Ordinary Violations by Education, Driving Training, and Vehicle Use

Term	SS	df	F	p	η_p^2
EDUCATION	3.10	4	3.42	.009	0.04
DRIVING TRAINING	0.03	2	0.07	.929	0.00
VEHICLE USE	0.07	2	0.15	.861	0.00
Residuals	84.01	371			

Paired *t*-tests were calculated between each pair of measurements to further examine the differences among the variables. Tukey pairwise comparisons were conducted for all significant effects based on an alpha of 0.05. For the main effect of Education, the mean of Ordinary Violations for HS ($M = 1.52, SD = 0.46$) was significantly smaller than for College ($M = 1.74, SD = 0.56$), $p = .009$. For the main effect of Education, the mean of Ordinary Violations for College ($M = 1.74, SD = 0.56$) was significantly larger than for Vocational ($M = 1.43, SD = 0.40$), $p = .006$. For the main effect of Education, the mean of Ordinary Violations for Vocational ($M = 1.43, SD = 0.40$) was significantly smaller than for Postgraduate ($M = 1.81, SD = 0.47$), $p = .030$.

4.4.3 Positive Behaviors

The analysis of variance was examined based on an alpha value of 0.05. The results of the ANOVA were significant, $F(8, 371) = 5.63, p < .001$, indicating there were significant differences in Positive Behaviors among the levels of Education, Driving Training, and Vehicle Use. The main effect, Education was significant, $F(4, 371) = 7.90, p < .001, \eta_p^2 = 0.08$, indicating there were significant differences in Positive Behaviors by Education levels. The main effect, Driving Training was significant, $F(2, 371) = 3.87, p = .022, \eta_p^2 = 0.02$, indicating there were significant differences in Positive Behaviors by Driving Training. The main effect, Vehicle Use was not significant, $F(2, 371) = 0.16, p = .854$, indicating there were no significant differences of Positive Behaviors by Vehicle Use types. (See Table 10.)

Table 10: Analysis of Variance Table for Positive Behaviors by Education, Driving Training, and Vehicle Use

Term	SS	df	F	p	η_p^2
EDUCATION	23.74	4	7.90	< .001	0.08
DRIVING_TRAINING	5.82	2	3.87	.022	0.02
VEHICLE_USE	0.24	2	0.16	.854	0.00
Residuals	278.71	371			

Paired *t*-tests were calculated between each pair of measurements to further examine the differences among the variables. Tukey pairwise comparisons were conducted for all significant effects based on an alpha of 0.05. For the main effect of Education, the mean of Positive Behaviors for HS ($M = 3.42, SD = 0.83$) was significantly smaller than for College ($M = 3.85, SD = 0.87$), $p = .003$. For the main effect of Education, the mean of Positive Behaviors for HS ($M = 3.42, SD = 0.83$) was significantly smaller than for Postgraduate ($M = 4.30, SD = 0.59$), $p < .001$. For the main effect of Education, the mean of Positive Behaviors for College ($M = 3.85, SD = 0.87$) was significantly larger than for Elementary ($M = 3.34, SD = 0.99$), $p = .018$. For the main effect of Education, the mean of Positive Behaviors for College ($M = 3.85, SD = 0.87$) was significantly larger than for Vocational ($M = 3.19, SD = 1.00$), $p < .001$. For the main effect of Education, the mean of Positive Behaviors for Elementary ($M = 3.34, SD = 0.99$) was significantly smaller than for Postgraduate ($M = 4.30, SD = 0.59$), $p < .001$. For the main effect of Education, the mean of Positive Behaviors for Vocational ($M = 3.19, SD = 1.00$) was significantly smaller than for Postgraduate ($M = 4.30, SD = 0.59$), $p < .001$. For the main effect of Driving Training, the mean of Positive Behaviors for Informally Trained ($M = 3.61, SD = 0.87$) was significantly larger than for Driving School ($M = 3.41, SD = 0.85$), $p = .028$. No other significant effects were found.

4.4.4 Dangerous Errors

The analysis of variance was examined based on an alpha value of 0.05. The results of the ANOVA were significant, $F(8, 371) = 4.33, p < .001$, indicating there were significant differences in Dangerous Errors among the levels of Education, Driving Training, and Vehicle Use. The main effect, Education was significant, $F(4, 371) = 6.06, p < .001, \eta_p^2 = 0.06$, indicating there were significant differences in Dangerous Errors by Education levels. The main effect, Driving Training was not significant, $F(2, 371) = 0.89, p = .411$, indicating there were no significant differences of Dangerous Errors by Driving Training. The main effect, Vehicle Use was not significant, $F(2, 371) = 0.54, p = .586$, indicating there were no significant differences of Dangerous Errors by Vehicle Use. (See Table 11.)

Table 11: Analysis of Variance Table for Dangerous Errors by Education, Driving Training, and Vehicle Use

Term	SS	df	F	p	η_p^2
EDUCATION	6.02	4	6.06	< .001	0.06
DRIVING_TRAINING	0.44	2	0.89	.411	0.00
VEHICLE_USE	0.27	2	0.54	.586	0.00
Residuals	92.18	371			

Paired *t*-tests were calculated between each pair of measurements to further examine the differences among the variables. Tukey pairwise comparisons were conducted for all significant effects based on a an alpha of 0.05. For the main effect of Education, the mean of Dangerous Errors for HS ($M = 1.51, SD = 0.50$) was significantly larger than for Vocational ($M = 1.22, SD = 0.39$), $p = .005$. For the main effect of Education, the mean of Dangerous Errors for College ($M = 1.66, SD = 0.58$) was significantly larger than for Elementary ($M = 1.39, SD = 0.44$), $p = .031$. For the main effect of Education, the mean of Dangerous Errors for College ($M = 1.66, SD = 0.58$) was significantly larger than for Vocational ($M = 1.22, SD = 0.39$), $p < .001$. For the main effect of Education, the mean of Dangerous Errors for Elementary ($M = 1.39, SD = 0.44$) was significantly smaller than for Postgraduate ($M = 1.80, SD = 0.48$), $p = .022$. For the main effect of Education, the mean of Dangerous Errors for Vocational ($M = 1.22, SD = 0.39$) was significantly smaller than for Postgraduate ($M = 1.80, SD = 0.48$), $p < .001$. No other significant effects were found.

4.4.5 Inexperience Errors

The analysis of variance was examined based on an alpha value of 0.05. The results of the ANOVA were not significant, $F(8, 366) = 1.12, p = .348$, indicating the differences in Inexperience Errors among the levels of Education, Driving Training, and Vehicle Use were all similar. The main effect, Education was not significant, $F(4, 366) = 1.95, p = .102$, indicating there were no significant differences of Inexperience Errors by Education levels. The main effect, Driving Training was not significant, $F(2, 366) = 0.39, p = .678$, indicating there were no significant differences of Inexperience Errors by Driving Training types. The main effect, Vehicle Use was not significant, $F(2, 366) = 1.10, p = .335$, indicating there were no significant differences of Inexperience Errors by Vehicle Use types. (See Table 12.)

Table 12: Analysis of Variance Table for Inexperience Errors by Education, Driving Training, and Vehicle Use

Term	SS	df	F	p	η_p^2
EDUCATION	2.65	4	1.95	.102	0.02
DRIVING_TRAINING	0.26	2	0.39	.678	0.00
VEHICLE_USE	0.75	2	1.10	.335	0.01
Residuals	124.60	366			

There were no significant effects in the model. As a result, post hoc comparisons were not conducted.

Discussion

The results of the study established the profile of Metro Manila drivers wherein the majority are highly-skilled in driving even without formal training. Some of the results of the statistical analysis in this study show that (1) driving training and driving frequency were not significant to driver behaviors; (2) those who went to driving schools were even more prone to errors and violations; (3) those who have reached college level and up tended to commit more inattention errors, ordinary violations and dangerous errors and;

(4) ordinary violations and dangerous errors tended to increase with age.

An important finding in this study, though, shows that the higher the education, the higher is also the tendency towards positive behaviors. Also, as the age increases, the propensity towards exhibiting more consideration to other road users also increases.

5.1 Obstruction and Compliance with Traffic Signs

Data from the Metro Manila Development Authority (MMDA) recorded the most frequent violations in 2018 along EDSA as can be seen in Table 13.

Disregarding traffic signs is the recorded top violation. 92% of the respondents of this study claim that they almost always follow traffic signs particularly avoiding to beat the red light. In another study, Felicio et al. (2015) showed in their own survey that 99.5% claimed that they follow the traffic light changes. This did not correspond to the actual behavior showing 7% higher than expected instances of beating the red light and this was attributed to majority of the drivers not having gone through formal driving training.

Obstruction is the second highest violation in the MMDA list. (Illegal parking is listed separately but is also another form of obstruction.) From this study, about 43% of the respondents purported that they are sensitive to not being an obstruction to other drivers particularly, staying out of intersections bounded by yellow box road markings while 67% claim that they avoid counterflowing or driving in the lane of the opposite direction. A recent Business World article, however, reported that drivers obstructing intersections or those inside yellow box markings as well as counterflowing are commonplace in Metro Manila and are actually daily occurrences (Tort, 2019). Tort (2019) noted that while such violations are dangerous as they might lead to collisions. The reason why these persist is that the traffic authorities are lenient in enforcing the rules.

The driving skills aspect of the drivers of PUV's may be supported by available 2018 crash statistics from the LTO (2019) 2018 Annual Report where about half of the total annual accidents were car-related while PUV's except vans account each in single-digit percentages. (See Table 14.)

The discrepancy between claimed and observed behaviors in self-assessment questionnaires were also observed in the studies of Felicio et al. (2015) and Lajunen and Summala (2003). Lajunen and Summala (2003) explains the difficulty to accurately measure aberrant behaviors and as such, it is through self-assessed surveys like DBQ's where such behaviors can be studied in order to provide insights.

In the evaluation of self-assessed questionnaires and respondents' tendencies, Paulhus (1986) discussed the concepts of "impression management" and "self-deception." He defined impression management as a conscious effort to project a positive image of oneself to an audience while self-deception is a "positively biased response that the respondent actually believes to be true" (Paulhus, 1986). In this regard, the responses may introduce some deviation from actual conditions. Lajunen and Summala (2003) proposed that the self-reporting of aberrant behavior may be lesser due to one's perception of what is an acceptable attitude and true to one's situation at the time of the survey in consideration to various factors in the environment and so, to minimize such biases, conducting the questionnaires should be done anonymously.

Table 13: 2018 Most Frequent Violations along EDSA

VIOLATION	# of cases
Disregarding Traffic Sign	44,433
Obstruction	32,155
Loading/unloading in Prohibited Zone	13,854
Truck Ban	8,316
Stalled Vehicle	4,018
Reckless Driving	3,113
Illegal Parking	4,779

Source: Most common requested data from the MMDA foi webpage

Table 14: Crash Statistics 2018

Motor Vehicle	Accidents	
Motorcycle	29,261	13.7%
Car	117,225	54.7%
Jeepney	9,617	4.5%
Taxi/FX	5,667	2.6%
Bus	11,447	5.3%
Van	22,954	10.7%
Truck	18,163	8.5%

This is the value of evaluating questionnaires together with empirical data. In this study, the responses of the participants in the survey were compared with actual violations and accident statistics. Parker et al. (1995) mentioned that cross-validation tended to support the findings of the self-assessment instruments.

In the case of the severe situation of the Metro Manila traffic and some discrepancies in the rating of the respondents, this may point to a lack of awareness of the integration of the various factors affecting the overall traffic situation and in order to have a better understanding, the individual driver would have to expand his sphere of concern from just the self to fellow drivers. This underscores the importance of an information campaign on not just a review or elucidation of traffic rules and norms but also on driving ethics in order to increase positive behaviors on the road which may lessen traffic-related stress and hopefully, avoid unnecessary gridlocks on the road. Mahmassani et al. (2013), in their discussion of Chicago gridlocks, spoke of "inter-vehicle cooperation" as one of the ways of recovering from gridlocks. If there is a concern for fellow drivers on the road, these positive behaviors could either avoid or mitigate the effect of traffic jams. On this, campaigns on a larger scale regarding increasing awareness among drivers of rules and their enforcement by the authorities have been widely used with success (Özkan & Lajunen, 2011; Parker et al., 1995; Savage, 2018). This underscores the importance of educating drivers not just on traffic rules and reading signs but also on driving ethics.

The beneficiaries of this study are entities which need to do traffic management, both public, (e.g., Land Transportation Office, Metro Manila Development Authority, Department of Human Settlements and Urban Development, City Local Governments), and privately-owned businesses involved in building and managing urban developments (e.g., expressways collecting tolls, commercial and residential development companies building financial and lifestyle complexes like Bonifacio Global City).

Apart from planning and building efficient road infrastructure, making appropriate traffic management policies would avoid congestions, increase productivity, conserve energy and lessen the carbon footprint and these can be translated into more profitability by reducing congestion costs on various levels. Sweet (2011) discussed on the 3 levels of economic impact of congestions, i.e., to systems and users, to businesses and the overall economy and these are translatable to monetary terms. On the health aspect and safety of drivers, planning should also take these into consideration. In a Shell study, Arayata (2018) reported the finding that Filipino drivers are in constant stress and they have the highest stress when driving to work. In this regard, traffic management authorities must include the psychology of Filipino drivers taking into consideration the demographics and behaviors of drivers in the overall urban planning and design of solutions including the education of Filipino drivers.

Recommendations

Driving is not just a matter of operating a machine as the action of each driver on the road contributes to the resulting overall traffic situation. Wang et al. (2014) discussed about longitudinal and lateral driving. Longitudinal driving behavior is related to the direction to where the vehicle moves while lateral is that

which involves the perpendicular direction or how the driver relates to other drivers on the road hence, the need for positive behaviors on the road.

From the results of the self-assessment tests, one notable finding is that 85% of the sample of Metro Manila drivers were informally trained. The passing of the certification test to earn a driver's license does not guarantee comprehension of traffic rules and positive driving behaviors as observed in the study conducted by Fernandez et al. (2020) such that Filipino drivers have a poor level of understanding of traffic signs and a general lack of discipline. This corroborates this study's finding of the respondents not faring well on positive behaviors. Therefore, there is a need for the education of Filipino drivers of all ages but especially those of high school or the secondary level. This is an area of development which could be accorded focus on by traffic management authorities together with the more obvious solutions related to the improvement of road infrastructure and implementation of effective traffic management policies. The latter includes rules reinforcement or discipline implementation to alleviate congested conditions brought about by human factors.

6.1 More consistent Traffic Rules Enforcement

In the Business World article entitled "Yellow box and counterflow," Tort (2019) noted that driver behaviors contributing to congestion persist due to the leniency of traffic enforcement. With the roll out of the "Contactless Apprehension of Traffic Violators on a 24-Hour Basis and All-Vehicle Detection System" or CATCH-ALL which was introduced in 2017 (Dost-Pcieerd, 2017), it is expected that such incidences of traffic violations particularly in areas equipped with cameras will decrease as the expensive traffic tickets could be a deterrent to undisciplined behavior. This project, as of this writing, is continuing to be being rolled out in different cities in Metro Manila and is being done in phases due to the high cost of implementation of the solution. However, in places where there would be no opportunity for such kind of installations, authorities should formulate strategies which are repeatable, consistent and decisive on the part of traffic enforcers.

6.2 More informative and conspicuous Traffic signs

Another finding in this study through the interview was the confusion of drivers in following traffic signs which were difficult to read, e.g., signs too small, or sometimes even placed inconspicuously such that it is hard to notice or sometimes even covered by trees or other obstacles. As noted in the previous MMDA statistics, disregarding traffic signs is one of the top causes of violations in the city. This underscores the need to design and create effective traffic signs in order to avoid any confusion. Moreover, traffic signs may also be used in the education of Metro Manila drivers through succinct yet affective reminders of traffic rules and driving ethics.

6.3 Education through an Information Campaign: “Pakikipagkapwa”

One of the most successful information campaigns was undertaken by the Swedish government when overnight on September 3, 1967, its motorists were directed to shift to driving on the right-hand side of the road to conform with the rest of its European neighbor countries in order to arrest the increasing numbers of fatal road accidents (Savage, 2018). The objective was to reach 100% of its road users in order to curb deep-rooted driving habits and thus, the country engaged in a widespread campaign which included advertisements in television, radio, newspapers, billboards, buses, milk cartons as well as talks and endorsements by popular personalities. One theory of the effectivity of such public communication campaigns is based on the Communication-Persuasion Matrix in which the effects on the target audience are accomplished in the learning, yielding and behavior levels (Atkin & Rice, 2013). The *learning* aspect is focused on the increase in information and enhancement of skills. *Yielding* involves the imbibing and changing of values and belief systems while *behavior* or enactment of the value is the actualization of the learned information and acquired attitudes.

In the case of Metro Manila drivers, majority learned the driving informally wherein the focus was on the mechanical aspect of operating a vehicle. In this regard, engaging in a wide-scale education campaign would focus only on understanding traffic rules and comprehending traffic signs which should be at all the 3 levels of *learning*, *yielding* and *behavior*.

For new drivers, recently, the government instituted a more stringent training and testing system before acquiring a driver’s license (Announcement Phils, n.d.; Galvante, 2020). However, this does not address the rest of the driving population who constitute the majority of road users and thus, this underscores the need for the aforementioned education campaign.

Further than the driving skill and the operational knowledge required in navigating the city streets safely is the aspect of increasing positive behaviors through value formation on driving ethics. For this, leverage could be built on the success of advertising in the country as a means of mass education wherein renditions of daily life and Filipino values of family and other Filipino values could quickly go viral locally and abroad (Abad, 2018; Gochuico, 2019; Uy, 2017; Vergara Jr, 2018). In this social media generation, the campaigns on encouraging *Pakikipagkapwa* could be targeted to various demographics but special attention should be given to PUV drivers who are experienced and of high school level and below. Note that *Pakikipagkapwa* on the road is more than just inter-driver cooperation that releases gridlocks as mentioned by Mahmassani et al. (2013). To be a *kapwa* to another is to treat him or her as someone not different from the self. The golden rule stated in the positive sense says “do unto others what you want others to do unto you.”

6.4 In-depth studies on driver motivations and circumstances

As the human mind is complex, the aforementioned recommendations need a deeper study beyond this descriptive research in order to plan effectively for a successful implementation towards a long-term effective traffic management. It is important to have an understanding of the city driver's motivations and circumstances as well as the general traffic culture which must be taken into consideration in the planning of a widespread driver education campaign to emulate the success of Sweden in 1967 when overnight, the country changed from driving on the left-hand side of the road to driving on the right (Savage, 2018). It is very important to formulate strategies that will reach all the sectors of the driving population which could make an impact both cognitively and affectively enough to change the current traffic culture. Previously, it was mentioned that the government has tightened on the issuing of licenses to new drivers but what about the majority of the drivers? The education campaign and general traffic management must include policy changes as well as other behavior change strategies.

Conclusion

In this day and age where swift developing technologies continually evolve, still the human factor could play a part in easing traffic congestion. The recommendations of having a more consistent traffic rules enforcement, producing more informative and clear traffic signs and more importantly, driver education sits in Levels 3-5 of the Industry 4.0 Traffic framework and thus requires a man-machine interface in order to properly analyze, plan and implement effectively. Specifically for the information campaign, encouraging *Pakikipagkapwa*, a value innate in the Filipino psyche, together with the basic knowledge of traffic norms, could naturally motivate inter-driver cooperation in the consciousness of Filipino drivers and thus, would have a more enduring effect through generations to come.

So, what is a few minutes of waiting in order for a *kapwa* driver to pass and not to be a cause of obstruction on the road causing the delay of many? Or would it be a huge loss of time to allow a signaling vehicle to enter your lane in order for that fellow driver not to miss his or her turn? Small acts of *Pakikipagkapwa* could prevent driver behavior-based congestion but beyond that, it could also prevent unnecessary stress on the road which could possibly lead to road accidents.

Author Contributions

B.D.O. designed the study, conducted the survey and wrote the paper. M.T. provided guidance on methodology and did the statistical analysis with writeup. C.L. assisted in gathering of related literature. All authors have read and agreed to the published version of the manuscript.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

Request for data should be directed to the first author. Availability is subject to the Data Privacy Act of 2012.

Conflicts of Interest

The opinions and assertions contained herein are those of the authors and do not necessarily reflect the official policy or position of the respective universities of the authors. The study was self-funded and there are no conflict of interests.

References

- Abad, R. (2018). *McDo, Jollibee lead H1 2018 YouTube Ads Leaderboard*. Business Mirror. <https://businessmirror.com.ph/2018/08/27/mcdo-jollibee-lead-h1-2018-youtube-ads-leaderboard/>
- Announcement Phils. (n.d.). *LTO Announces Free 15-Hour Theoretical Driving Course (TDC)*. Announcement Philippines. <https://announcement.ph/lto-free-15-hour-theoretical-driving-course-tdc/>
- Arayata, M. C. (2018). *Shell reveals study on driver behavior*. Philippine News Agency. <https://www.pna.gov.ph/articles/1026799>
- Asian Development Bank. (2019). *Asian Development Outlook (ADO) 2019 Update: Fostering Growth and Inclusion in Asia's Cities*. Asian Development Bank (ADB). <https://www.adb.org/publications/asian-development-outlook-2019-update>
- Atkin, C. K., & Rice, R. E. (2013). Public Communication Campaigns. In R. E. Rice & C. K. Atkin (Eds.), *Public communication campaigns* (Fourth Edition ed., pp. 2-19). SAGE Publications, Inc. <https://dx.doi.org/10.4135/9781544308449.n1>
- Bener, A., Özkan, T., & Lajunen, T. (2008). The driver behaviour questionnaire in Arab gulf countries: Qatar and United Arab Emirates. *Accident Analysis & Prevention*, 40(4), 1411-1417. <https://doi.org/10.1016/j.aap.2008.03.003>
- Bener, A., Verjee, M., Dafeeah, E. E., Yousafzai, M. T., Mari, S., Hassib, A., Al-Khatib, H., Choi, M. K., Nema, N., & Özkan, T. (2013). A Cross "Ethnical" Comparison of the Driver Behaviour Questionnaire (DBQ) in an Economically Fast Developing Country: DBQ in Arab Gulf and South Asian countries. *Global journal of health science*, 5(4), 165-175. <https://doi.org/10.5539%2Fgjhs.v5n4p165>
- Dadios, E., Fillone, A., & Sybingco, E. (2017). *Contactless Apprehension of Traffic Violators on 24-Hour Basis and All-Vehicle Detection System (CATCH-ALL)*. <https://pcieerd.dost.gov.ph/pmis/view.php?id=RGpQUUR3PT0=>

- De Ocampo, B. M., Clark, E., & De Pedro, M. (2021). An Industry 4.0 framework towards an integrated smart traffic management solution. In *9th National Business and Management Conference*.
- Dost-Pcieerd. (2017). *Dost-pcieerd, Dlsu Launch Contactless Apprehension for Traffic Violators*. <https://pcieerd.dost.gov.ph/news/latest-news/279-dost-pcieerd-dlsu-launc>
- Enriquez, V. G. (1978). On the Standardisation of Psychological Terms in Pilipino. In *Papers from the Conference on the Standardisation of Asian Languages, Manila, Philippines, December 16-21, 1974* (pp. 207-211). Pacific Linguistics. <https://openresearch-repository.anu.edu.au/bitstream/1885/253131/1/PL-C47.207.pdf>
- Felicio, G. P., Grepo, L. C., Reyes, V. F., & Yupingkun, L. C. (2015). Traffic light displays and driver behaviors: A case study. *Procedia Manufacturing*, 3, 3266-3273. <https://doi.org/10.1016/j.promfg.2015.07.879>
- Fernandez, J. J., Paringit, M. C., Salvador, J. R., Lucero, P. I., & Galupino, J. G. (2020). Understanding of traffic signs by drivers in the city of Manila, Philippines. *Transportation research procedia*, 48, 3037-3048. <https://doi.org/10.1016/j.trpro.2020.08.183>
- Fianza, F. (2017). *The Filipino driver*. Manilastandard.Net. <https://manilastandard.net/opinion/columns/duty-calls-by-florencio-fianza/242928/the-filipino-driver.html>
- Galvante, E. C. (2020). *Memorandum Circular No.2020-2134: Guidelines Relative to the Full Implementation of the Lto Automated Certification and Education of Student-drivers (Aces) - Uploading Facility*. Land Transportation Office: Department of Transportation. <https://lto.gov.ph/latest-issuance/522-memorandum-circular-no-2020-2134-guidelines-relative-to-the-full-implementation-of-the-lto-automated-certification-and-education-of-student-drivers-aces-uploading-facility.html>
- Gochuico, R. (2019). *Depicting Filipino Values: A Semiotic Analysis of McDonald's Commercials from 2016-2018*. (Unpublished Undergraduate Thesis). University of the Philippines College of Mass Communication. https://iskomunidad.upd.edu.ph/index.php/Depicting_Filipino_Values:_A_Semiotic_Analysis_of_McDonald%E2%80%99s_Commercials_from_2016-2018
- Guého, L., Granié, M.-A., & Abric, J.-C. (2014). French validation of a new version of the Driver Behavior Questionnaire (DBQ) for drivers of all ages and level of experiences. *Accident Analysis & Prevention*, 63, 41-48. <https://doi.org/10.1016/j.aap.2013.10.024>
- Isidoro-Romero, P. (2020). The mission of evangelization of Catholic educational institutions in the Philippines: Challenges, opportunities and hurdles. In *Religious Education in Asia* (pp. 139-162). Routledge. <https://www.taylorfrancis.com/chapters/edit/10.4324/9780429321351-10>
- Jiang, Y. (2019). *Looking for a fix for Asia's traffic woes*. Asian Development Bank. <https://blogs.adb.org/blog/looking-fix-asias-traffic-woes>

- Jung, C. G. (1936). The concept of the collective unconscious. *Collected works*, 9(1), 99-104. <http://www.bahaistudies.net/asma/The-Concept-of-the-Collective-Unconscious.pdf>
- Kinnaman, D. (2018). *The Culture, Beliefs and Motivations Shaping the Next Generation*. Barna Group and Impact 360 Institute. <https://shop.barna.com/products/gen-z>
- La Viña, A. G., & Reyes, J. J. M. (2022). Anthropocene, Capitalocene, and climate change. In *The Routledge Handbook of Global Development* (pp. 158-169). Routledge. <https://www.taylorfrancis.com/chapters/edit/10.4324/9781003017653-17>
- Lajunen, T., & Summala, H. (2003). Can we trust self-reports of driving? Effects of impression management on driver behaviour questionnaire responses. *Transportation research part F: traffic psychology and behaviour*, 6(2), 97-107. [https://doi.org/10.1016/S1369-8478\(03\)00008-1](https://doi.org/10.1016/S1369-8478(03)00008-1)
- Litman, T. (2019). *Smart Congestion Relief*. Victoria Transport Policy Institute. www.vtpi.org/cong_relief.pdf
- Lom, M., Pribyl, O., & Svitek, M. (2016). Industry 4.0 as a part of smart cities. In *2016 Smart Cities Symposium Prague (SCSP)* (pp. 1-6). IEEE. <https://doi.org/10.1109/SCSP.2016.7501015>
- LTO. (2019). *LTO Annual Report 2018*. Land Transportation Office: Department of Transportation. <https://lto.gov.ph/transparency-seal/annual-reports/file/634-annual-report-2018.html>
- Mahmassani, H. S., Saberi, M., & Zockaie, A. (2013). Urban network gridlock: Theory, characteristics, and dynamics. *Procedia-Social and Behavioral Sciences*, 80, 79-98. <https://doi.org/10.1016/j.sbspro.2013.05.007>
- Martinussen, L. M., Lajunen, T., Møller, M., & Özkan, T. (2013). Short and user-friendly: The development and validation of the Mini-DBQ. *Accident Analysis & Prevention*, 50, 1259-1265. <https://doi.org/10.1016/j.aap.2012.09.030>
- Martinussen, L. M., Møller, M., & Prato, C. G. (2014). Assessing the relationship between the Driver Behavior Questionnaire and the Driver Skill Inventory: Revealing sub-groups of drivers. *Transportation research part F: traffic psychology and behaviour*, 26, 82-91. <https://doi.org/10.1016/j.trf.2014.06.008>
- Miguel, C. G. B. (2020). *A primer to traffic congestion in the Philippines: The causes, effects, and possible solutions*. Philkotse.com. <https://philkotse.com/safe-driving/a-primer-to-traffic-congestion-in-the-philippines-5797>
- Nardo, M., Forino, D., & Murino, T. (2020). The evolution of man-machine interaction: The role of human in Industry 4.0 paradigm. *Production & manufacturing research*, 8(1), 20-34. <https://doi.org/10.1080/21693277.2020.1737592>
- National Privacy Commission. (n.d.). *The Data Privacy Act of 2012*. National Privacy Commission. <https://www.privacy.gov.ph/data-privacy-act-primer/>

- Nguyen, H. P. (2020). Core orientations for 4.0 technology application on the development strategy of intelligent transportation system in Vietnam. *International Journal on Advanced Science, Engineering and Information Technology*, 10(2), 520-528. <https://doi.org/10.18517/IJASEIT.10.2.11129>
- Özkan, T., & Lajunen, T. (2011). Person and Environment: Traffic Culture. In B. E. Porter (Ed.), *Handbook of Traffic Psychology* (pp. 179-192). San Diego: Academic Press. <https://doi.org/10.1016/B978-0-12-381984-0.10014-1>
- Parker, D., Lajunen, T., & Stradling, S. (1998). Attitudinal predictors of interpersonally aggressive violations on the road. *Transportation Research Part F: Traffic Psychology and Behaviour*, 1(1), 11-24. [https://doi.org/10.1016/S1369-8478\(98\)00002-3](https://doi.org/10.1016/S1369-8478(98)00002-3)
- Parker, D., Reason, J. T., Manstead, A. S., & Stradling, S. G. (1995). Driving errors, driving violations and accident involvement. *Ergonomics*, 38(5), 1036-1048. <https://doi.org/10.1080/00140139508925170>
- Paulhus, D. L. (1986). Self-deception and impression management in test responses. In *Personality assessment via questionnaires* (pp. 143-165). Springer. https://doi.org/10.1007/978-3-642-70751-3_8
- Reason, J., Manstead, A., Stradling, S., Baxter, J., & Campbell, K. (1990). Errors and violations on the roads: a real distinction? *Ergonomics*, 33(10-11), 1315-1332. <https://doi.org/10.1080/00140139008925335>
- Rimmö, P.-A., & Åberg, L. (1999). On the distinction between violations and errors: sensation seeking associations. *Transportation Research Part F: Traffic Psychology and Behaviour*, 2(3), 151-166. [https://doi.org/10.1016/S1369-8478\(99\)00013-3](https://doi.org/10.1016/S1369-8478(99)00013-3)
- Savage, M. (2018). A 'thrilling' mission to get the Swedish to change overnight. BBC. <https://www.bbc.com/worklife/article/20180417-a-thrilling-mission-to-get-the-swedish-to-change-overnight>
- Statista. (2020). *The world's most traffic jam prone cities as of 2019*. Statista.Com. <https://www.statista.com/statistics/1023100/most-traffic-jam-prone-cities-worldwide/>
- Statista. (2021). *Share of importance of religion among respondents in the Philippines from March 2018 to November 2020*. Statista Research Department. <https://www.statista.com/statistics/1116815/philippines-importance-religion/>
- Sucha, M., Sramkova, L., & Risser, R. (2014). The Manchester driver behaviour questionnaire: self-reports of aberrant behaviour among Czech drivers. *European transport research review*, 6(4), 493-502. <https://doi.org/10.1007/s12544-014-0147-z>
- Sweet, M. (2011). Does traffic congestion slow the economy? *Journal of Planning Literature*, 26(4), 391-404. <https://doi.org/10.1177/0885412211409754>
- Tort, M. (2019). *Yellow Box and counterflow*. BusinessWorld. <https://www.bworldonline.com/editors-picks/2019/06/19/237530/yellow-box-and-counterflow/>

- Uy, S. L. (2017). *The Inside Scoop on How Jollibee Broke the Internet (and Our Feelings)*. Esquire Mag. <https://www.esquiremag.ph/culture/movies-and-tv/jollibee-ads-a00049-20170210>
- Vergara Jr, R. (2018). *Behind Jollibee's heart-warming viral videos is data*. BusinessWorld. <https://www.bworldonline.com/sparkup-trends-mccann-philippines-gino-borromeo-advertising-kwentong-jollibee/>
- Wang, J., Li, K., & Lu, X.-Y. (2014). Effect of human factors on driver behavior. In *Advances in Intelligent Vehicles* (pp. 111-157). Elsevier. <https://doi.org/10.1016/B978-0-12-397199-9.00005-7>