Police Use of Driverless Vehicles a Preliminary Study

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Abstract

During the last decades road crashe,s have become one of the leading death causes, especially for youths (WHO, 2017; Adminaite et al., 2018). Technology is working on it and is providing solutions to reduce the risk of collisions and road victims (Kyriakidis et al., 2015). Driverless cars are a decisive factor in reducing road crashes in the future (Rowley et al., 2018; Bertoncello & Wee, 2015; La Torre et al., 2017; Fowle & Loeb, 2018; Dia, 2018). Safety, confidence, privacy, reliability and responsibility are the most important factors that are considered before buying or driving this type of car (Becker & Axhausen, 2017; Nordhoff et al., 2018). These factors are fundamental in case of adoption of driverless vehicles for Police activity (Al Suwadi et al., 2018; Al Shouk, 2018).

Keywords: *Autonomous Vehicles, Police Innovation, Road Safety*

Introduction

During last decades' road collisions have become one of the major death causes, especially for youths (WHO, 2017; Adminaite et al., 2018). This is a particularly serious problem facing institution and common people. Also, technology is working on it and is providing solutions to reduce the risk of accidents and road victims (Kyriakidis et al., 2015). Driverless cars are a decisive factor to reduce road collisions in the future (Rowley et al., 2018) and according to engineering studies conducted also by automotive companies, driverless cars can contribute to reduce road crashes (Bertoncello et Wee, 2015; La Torre et al., 2017; Fowle et Loeb, 2018; Dia, 2018). However, not always the collectivity agrees with this vision (Kyriakidis et al., 2015; Kaur et Rampersad, 2018; Hulse et al., 2018). Yet, how much are people inclined to believe in driverless cars safety? How much are they inclined to trust and drive them?

(Goodall, 2018). Safety, faith, privacy, reliability and responsibility are the most important factors that occur before buying o driving this particular type of vehicle (Becker et Axhausen, 2017; Nordhoff et al., 2018). These factor are specifically fundamental in case of adoption of driverless vehicle for Police patrolling activity (Al Suwadi et al., 2018; Al Shouk, 2018). Actual research intends to evidence how these factors linked to psycho-social factors and the knowledge of the actual technologies influence the faith of different road-users in driverless cars as drivers and vulnerable road users (pedestrians, cyclists, kids and older people) and Police officers.

Methodology

On the basis of the above illustrate figures, that suggests an effective role of the new technologies for the road safety, it is appropriate to propose a research to evaluate if there is a real trust on autonomous drive vehicles from people and, if adopted by Police Forces, from Police officers. Starting from this point of view, the proposed research will look to answer the following RQs.

Do people trust driverless cars? It is possible to search and find the answer to this question on the present psychological literature joint with technological researches and evidences.

Do Police officers trust driverless cars for Police activities? This second question is the specific aim of the present research and is focused on the trust of Police officers on driverless car at all, and specifically if used for Police activity.
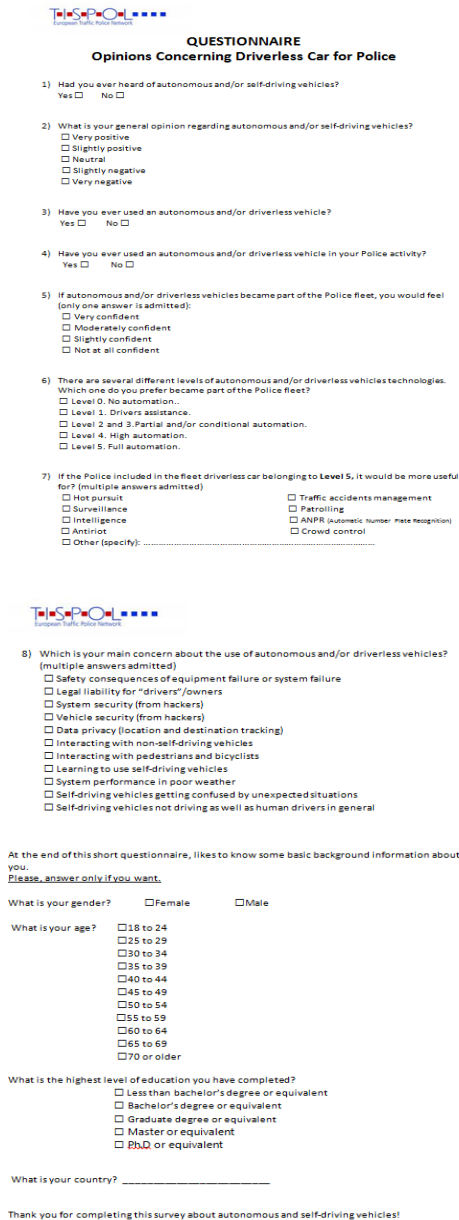
Do people trust driverless cars for Police enforcement? There is now a third question ready for the near future, if and when Police Forces start to adopt driverless car for duty activity. The question is about the trust of people on this new vehicles and possible implications for safety and security. The aim of the research is to discover and define if there is an effective trust and to study possible implications and points of criticisms.

Starting from the first question, the research preliminarily refers to existent literature, even very recent, with the aim to identify terms of evaluation and comparison, with respect to the data provided, parametric indices, quantitative figures and, smaller, qualitative.

The first analysis is also focused on specific scientific articles and reviews to validate the hypothesis (Bao et al., 2012) in order to use results correctly and according to the research aim. Recent studies, in fact, are confirmed in their explanatory value and can provide full understanding of trend in evaluating countries (Hollò et al., 2010). Recently studies explored people's feelings concerning driverless vehicles (Power, 2013; Kyriakidis et al., 2015; Bansal et al., 2016), especially concerning people age, gender, education and nominally on the safety perception (Hulse et al., 2018). Other studies are focused on the difference of perception about driverless vehicles between drivers and pedestrians (Hulse et al., 2018). Kaur & Rampersad (2018) studied the perception of safety in the use of driverless cars into closed tracks, into campus, hospital and/or universities. Other researches have studied the ethical aspects of driverless cars use, especially related to collision risks and possible fatal consequences or injuries (Hulse et al., 2017). There are several variables studied by scholars, focused on the perception of safety related to autonomous and/or self-driving vehicles and related to the performance expectancy, the trust in technology, the reliability and security, and on privacy defense matters (Kyriakidis et al.; 2015; Kaur & Rampersad, 2018). Based on the literature findings, it is correctly possible to assume that autonomous and/or driverless cars are currently perceived in a generally positive light and are considered as *"low risk"* vehicles.

In order to finalize the study, descriptive and analytical methods are used, focusing attention on existing and current literature and figures (Freisner, 2004; Rozwadowski, 2007; Soltanifar & Ansari,

2016). It is performed a quantitative research (Barba et al., 2016; Lamas- Leite et al., 2017), using a specific online and paper survey: "*Opinions concerning driverless cars for Police*" (Figure 1).

Figure 1: Survey: "*Opinions concerning driverless cars for Police*"

The specific target of the survey are European Police Force junior and senior officers and in the first phase of the research has been asked to 1.000 Police officers what they thought about the use of autonomous and/or driverless vehicles in the Police fleet. The requested Police officers belonging to Police Forces from Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, The Netherlands, Poland, Romania, Slovakia, Spain, Sweden, United Kingdom. 62% of interviewed Police officers are male and approx. 50% have a University degree. More than 60% of interviewed are between 30 to 50 years age (Figure 2).

Information on the sample	
	%
Gender	62.00
Male	38.00
Female	
Education	
High School	12.90
Bachalor degree	9.60
Graduate degree	41.10
Post graduate	28.50
Ph.D.	7.90
Age	
18-24	0.90
25-29	14.80
30-34	33.40
35-39	10.00
40-44	11.10
45-49	11.30
50-54	11.50
55-59	3.50
60-64	2.60
65-69	0.90

Figure 2: Specific information on the sample

Discussion

From the answer to the survey is possible to collect the following data referred to the main question 91,9% of interviewed have ever heard about autonomous driving vehicles (Figure 3)

Have yo ever heard of autonomous and/or self driving vehicles?	
	%
YES	91.90
NO	8.10

Figure 3: Police officers knowing autonomous drive vehicles

The general opinion about self driving vehicles is strictly positive and only less than one quarter of interviewed is negative (Figure 4) and, generally, Police officers have never used self driving vehicles and specifically never used for Police activities (Figure 5) Despite Police officers never used autonomous vehicles for Police activity (and also for private life) they are very confident in use of driverless cars for Police service and believes that will be useful at operational level (Figure 6)

What is your general opinion on autonomous and/or self driving vehicles?	
	%
Very positive	12.40
Slightly positive	34.40
Neutral	30.00
Slightly negative	18.30
Negative	4.90

Figure 4: The general opinion about self driving vehicles

Have you ever used an autonomous and/or self driving vehicle?	
	%
YES	3.30
NO	96.70
Have you ever used an autonomous and/or self driving vehicle in your Police activity?	
	%
YES	1.50
NO	98.50

Figure 5: Use of driverless vehicles by Police officers

If autonomous and/or self driving Vehicles became part of the Police fleet, you would fell?	
	%
Very confident	10.30
Moderate confident	36.30
Slightly confident	35.10
Not at all confident	18.30

Figure 6: Police Officers confidence in driverless cars

Approx. 50% of Police officers believes that best autonomous vehicles to be used for Police activities should be vehicles with level 2 and level 3 of automation, but they prefer to continue to have the control of the vehicle in particular operational circumstances (Figure 7)

There are several different levels of autonomous and/or self driving vehicles technologies. Which one do you prefer became part of the Police fleet?	
	%
Level 0	
No automation	8.00
Level 1	
Driver assistance	29.80
Level 2 and 3	
Partial and/or conditioned automation	48.50
Level 4	
High automation	9.50
Level 5	
Full automation	4.20

Figure 7: Possible level of automation preferred by Police officers

Looking to the future it is possible to affirm that Police Forces will use level 5 automation driverless vehicles and in this option interviewed Police officers believes that these category of vehicles should best used for automatic number plates recognition activity (64,6%) and video surveillance (45,5%). Otherwise no specific trust (7,5%) there is for possible anti-riot use of driverless vehicles in Police activity, as well for crowd control (13,6%) (Figure 8)

Most sensitive (59%) is about safety consequences of equipment failure or system failure, as well as (51,8%) the possibility that autonomous vehicles getting confused by unexpected situations. Important

concerns (42,6%) are also about system security. Police officers believes that no big problems will came from the difficulty to learn to use self driving vehicles (7,7%) and from possible lack of performance in poor weather (Figure 9)

If the Police include in the fleet autonomos or/and self driving vehicles belonging to level 5, it would be more useful to?*

*multiple answers admitted	%
ANPR (Automatic Number Plate Recognition)	64.60
Surveillance	45.50
Patrolling	37.50
Traffic accidents management	31.10
Intelligence	27.90
Pursuit	15.50
Crowd control	13.60
Antiriot	7.50
Other	2.90

Figure 8: Best use of driverless vehicles in Police Activity

Which is your main concern about the possible Use of autonomous and/or self driving vehicles?*

*multiple answers admitted	%
Safety consequences of equipment or system failure	59.00
Self driving vehicles getting confused by unexpected situations	51.80
System security (from hackers)	42.60
Interaction with pedestrian and bicyclists	37.20
Vehicle security (from hackers)	37.00
Interaction with no self driving vehicles	31.40
Legal liability for "drivers"/owners	22.70
Self driving vehicles not driving as well as human drive vehicles	22.20
Data privacy (location and destination tracking)	15.90
System performance in poor weather	10.30
Difficulty to learn how to use self driving vehicles	7.70

Figure 9: Police Officers concerns about use of self driving vehicles for Police services

Conclusions

Findings and resulting figures underline a general trend, for Police officer, to trust in autonomous and/or driverless vehicles (46.8% of the sample). Concerns are specifically about:

(a) Safety consequences of equipment failure or system failure.
(b) System security (from hackers).
(c) Vehicle security (from hackers).
(d) Interaction with non-self-driving vehicles, pedestrians and bicyclists.
(e) Self-driving vehicles getting confused by unexpected situations.

European Police officers who were interviewed seems to be inclined to use vehicles with an automation level 2 and 3. However, they seem to be not completely convinced of total autonomous and/or self-driving vehicles. Research Police officers sample prefer to maintain human presence in the Police activity. They feel comfortable with the help that this kind of cars can give in the following fields of Police activities: ANPR, Surveillance, Patrolling, Traffic accidents management and Intelligence

At least, coming back to the third question of the present research, if people trust driverless cars for Police Enforcement, the only possible answer sounds like *probably...!* And because of this the study continues, extending the survey to the civilian population

Based on the results of the survey, should be preferable to continue the research, extending the survey to the European civilian population and to a larger number of Police officers. It is appropriate to study the possible interaction with similar research on the civilian population and related findings. One option could be, also, disseminate research results to illustrate to strategical and executive Police officers the potential of autonomous and/or self-driving vehicles for the Police activity and explore specific fields of possible use of autonomous and /or self-driving vehicles for Police activity.

At least should be appropriate to develop the *extravaganza* as a best *(brave)* practice for better results in the future.

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Contribution Statement

The article is the result of a common research and reflection of the Authors. However, Methodology and Discussion must be attributed to Scala N.M., Introduction to Rufa G., and Conclusions to Cestra P.

Declaration of Competing Interests

The Authors report no competeing interests.

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