

Independent research proves the positive influence of satellite navigation devices on driving and traffic safety

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Introduction

In 2006 TNO performed a study into the effects of driving with a navigation system on traffic safety in the Netherlands with four different research methods (see Vonk et al., 2007). Overall the results led to the conclusion that navigation systems have a positive effect on traffic safety.

TomTom has asked TNO to repeat two of the research methods from 2006 in a number of countries other than the Netherlands. TNO contracted TUV and DLR (Germany) and Virginia Tech Transportation Institute (the USA) to conduct an instrumented vehicle study. The survey study is conducted among a representative sample of drivers in Germany, the USA, the UK, France, Italy and Spain (performed by TNS NIPO). The aim of these studies was again to establish the effect of driving with a navigation system on traffic safety.

The instrumented vehicle studies in Germany and the USA followed exactly the same methodology used in the studies described in Vonk et al. (2007). The survey study was performed by TNS NIPO by means of an internet questionnaire in the six countries mentioned above.

Overall the results of the instrumented vehicle studies and survey studies converge to a positive effect of navigation systems on traffic safety. The results from both studies indicate:

- that the use of navigation systems has a positive effect on driver awareness
- that the use of navigation systems reduces the driver's stress
- that the use of navigation systems reduces driver's workload
- that the use of navigation systems has a positive effect on driver behaviour
- that the use of navigation systems reduces travelling distances and time.

Objectives & methodology of the research

Objectives

The aim of these studies was again to establish the effect of driving with a navigation system on traffic safety.

In order to find an answer to this, five questions were formulated.

1. Does the use of a navigation system increase driver awareness?
2. Does the use of a navigation system reduce stress?
3. Does the use of a navigation system reduce the driver's workload?
4. Does the use of a navigation system change driving behaviour?
5. Does the use of a navigation system reduce the number of kilometres driven?

Methodology

1. Instrumented vehicle study

The instrumented vehicle study conducted by TUV and DLR (Germany) and Virginia Tech Transportation Institute (the USA) was designed to be comparable to the instrumented vehicle study conducted in the Netherlands by TNO (Vonk et al., 2007). The effects of driving with a navigation system on driving behaviour and on workload were investigated in a real life drive or driving situation. Subjects had to drive several routes on different road types while their driving behaviour and workload were assessed. Subjects drove both with a navigation system and with conventional methods like paper maps and printed instructions from internet route planners.

Several aspects affect the influence of navigation systems: characteristics of the driver like age, experience and road network knowledge. In the present study these factors were accounted for in the choice of the routes and the selection criteria for the subjects, e.g., routes were selected in such a way that drivers were not familiar with the route (see for a complete description of the method and the results Baumann et al (2008) and Antin et al (2008)).

2. Survey study

In France, Germany, Italy, Spain, the UK and the USA a survey study was conducted to identify the effects of navigation systems on traffic safety. More specific information was sought about the use of navigation systems in relation to driver behaviour, driver awareness, effect on stress and workload and the effects on the travelled distance.

The data collection in these six countries was the responsibility of TNS NIPO. The interpretation of the collected data was the responsibility of TNO.

TNS NIPO was responsible for the online interviews about the possession and usage of navigation systems in France, Germany, Italy, Spain, the UK and the USA. The following two-step approach was used in the interviews.

Step 1: screening/defining penetration rates

The aim of the first step was to obtain penetration rates (or weighing factors) for gender, age, usage of navigation systems and type of navigation systems within the group of persons who live in a household in which at least one car is present.

Step 2: Safety perception survey

In the second step a disproportional sample of people from the screening were asked to complete the safety perception survey. In this case, disproportional implies that 75% of the respondents were people who possess a navigation system and drive a car. The choice for a disproportional sample was made, because otherwise the sample size of the group of people who use a navigation system would have been too small to obtain significant results.

Research results per question

1. Does the use of a navigation system increase driver awareness?

Overall on the different aspects of driver awareness the users indicate they feel more relaxed, more in control and more alert even though drivers indicate they do operate the navigation system while driving.

Over 65% (figure 1) of the users in all countries agree with the statement that they are more in control during their trip since they are using a navigation system.

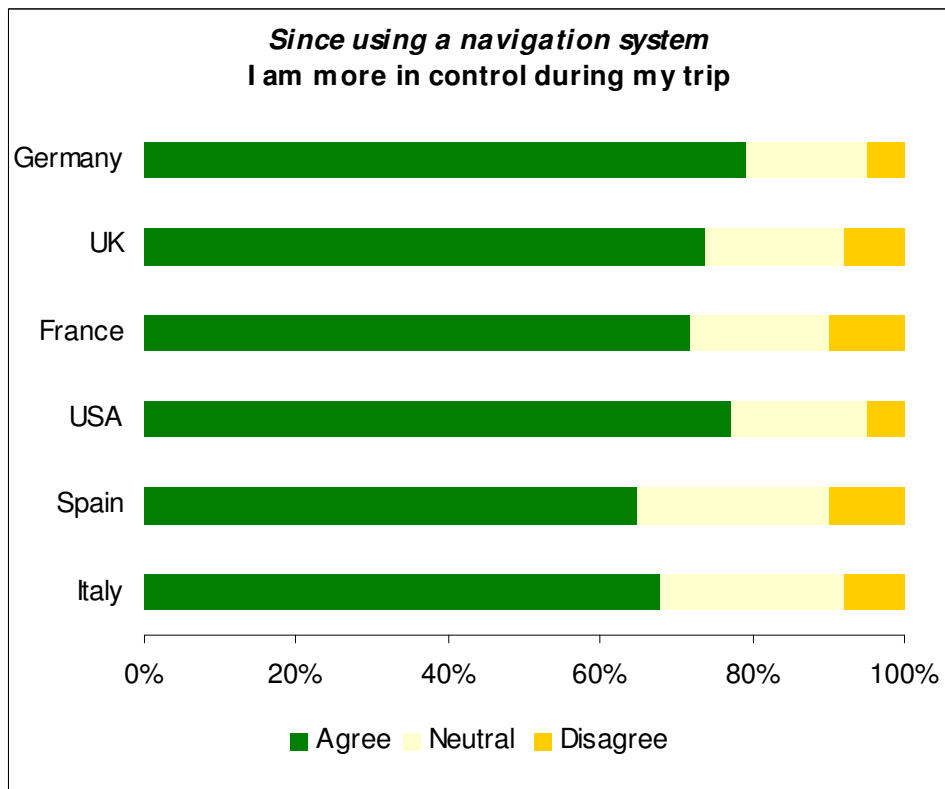


Figure 1

From the survey study in the Netherlands (Vonk et al., 2007) it was also concluded that drivers indicated they were more alert when driving with a navigation system. Approximately 80% of the users indicate that they feel more in control when driving with a navigation system. Alertness showed lower results in the Netherlands, but still 45% of the users claimed to be more alert using a navigation system.

2. Does the use of a navigation system reduce stress?

The survey shows that in all countries a majority of the users of a navigation system indicated that they feel less stressed when they use their navigation system (figure 2).

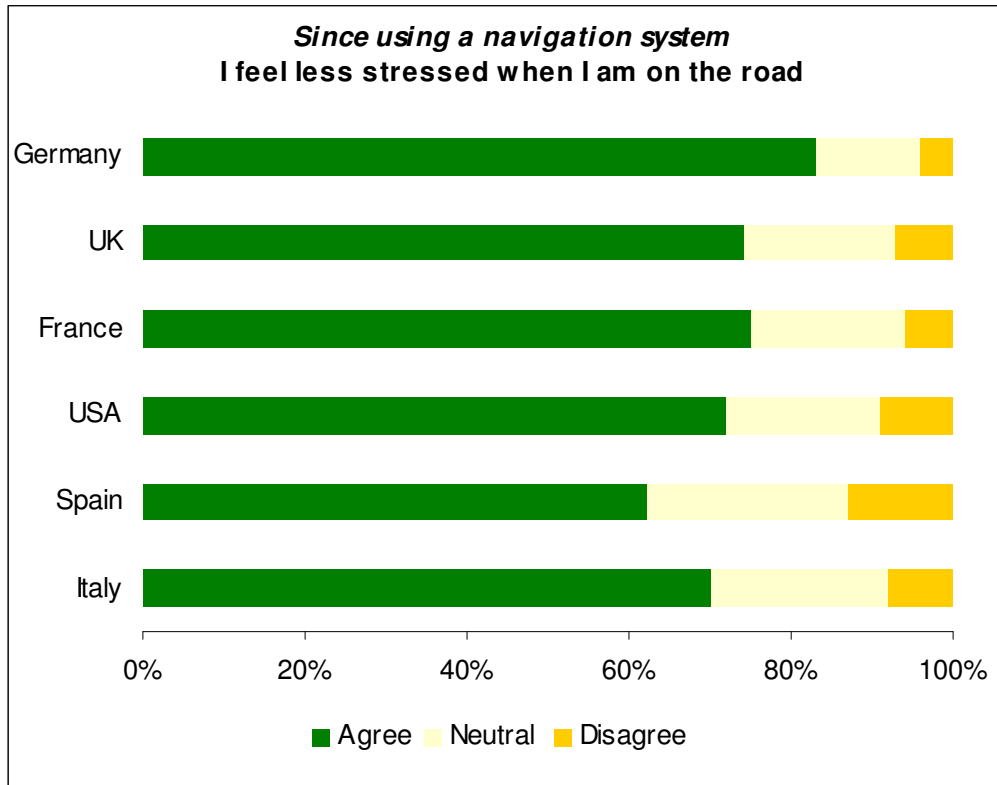


Figure 2

The users of a navigation system indicate they feel calmer in their car when using a navigation system while driving (figure 3).

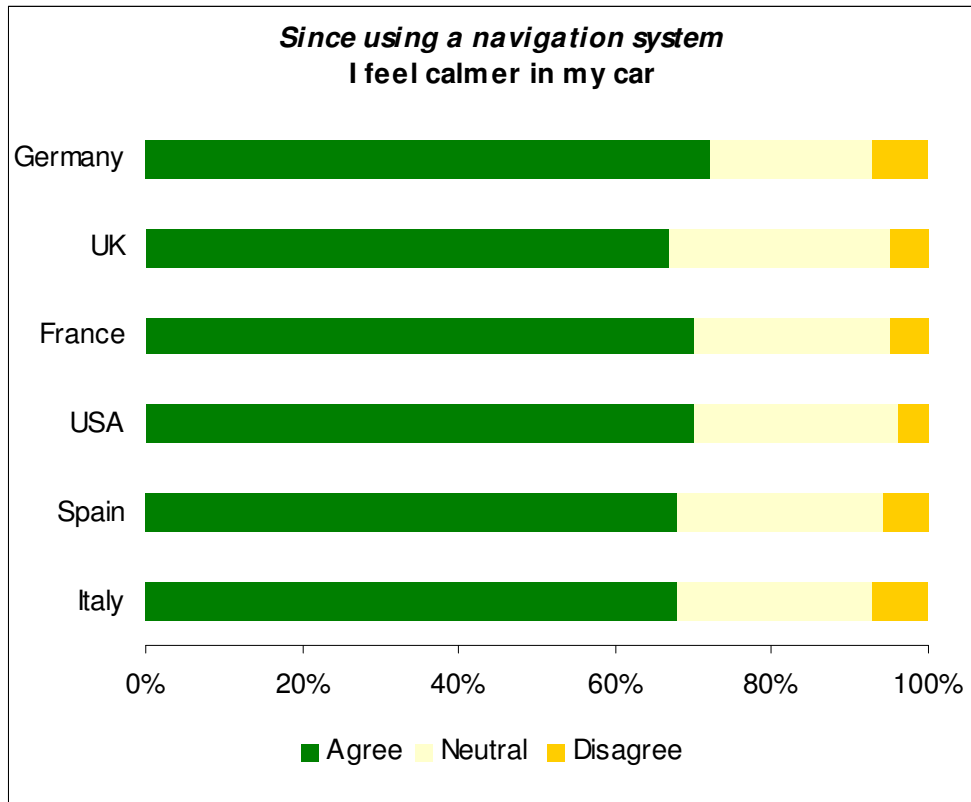


Figure 3

The majority of the users of a navigation system (59% to 86%, dependent on the country) indicate they agree with the statement that they use a navigation system to feel more relaxed while driving.

The above results are in line with the user survey conducted in the Netherlands (Vonk et al., 2007) concluding that drivers indicated they have less stress when driving with a navigation system.

3. Does the use of a navigation system reduce driver workload?

From the studies with the instrumented vehicle by TUV and DLR (Germany) and by Virginia Tech Transportation Institute (the USA) it is clear that the use of a navigation system reduces driver workload when driving in an unfamiliar area. Workload in these studies was measured objectively - by means of the Peripheral Detection Task - and subjectively - by means of the RSME (Rating Scale Mental Effort) (figure 4).

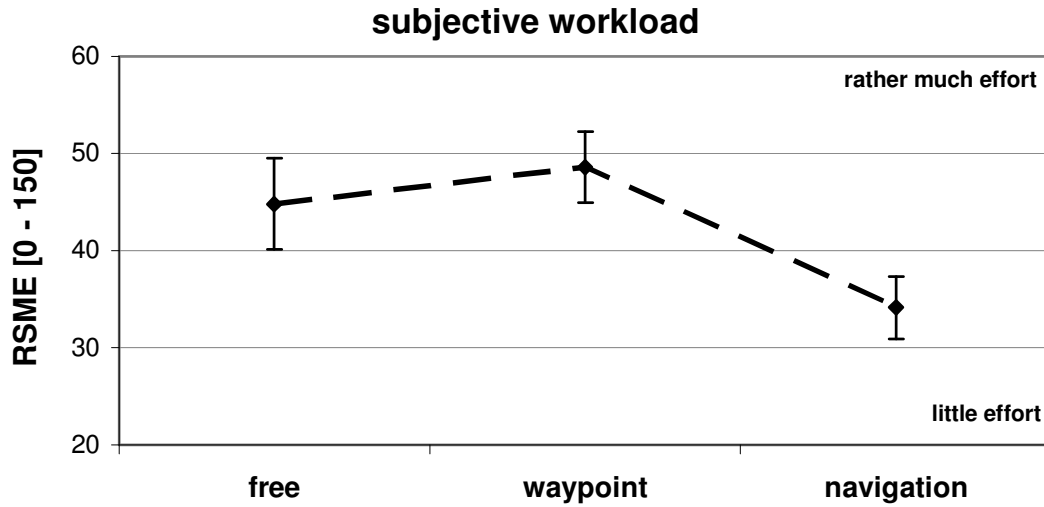


Figure 4

In the survey the majority of the users in most countries indicate that the use of a navigation system makes it easier to keep their attention to the road (figure 5), which is in line with the workload findings from the instrumented vehicle studies.

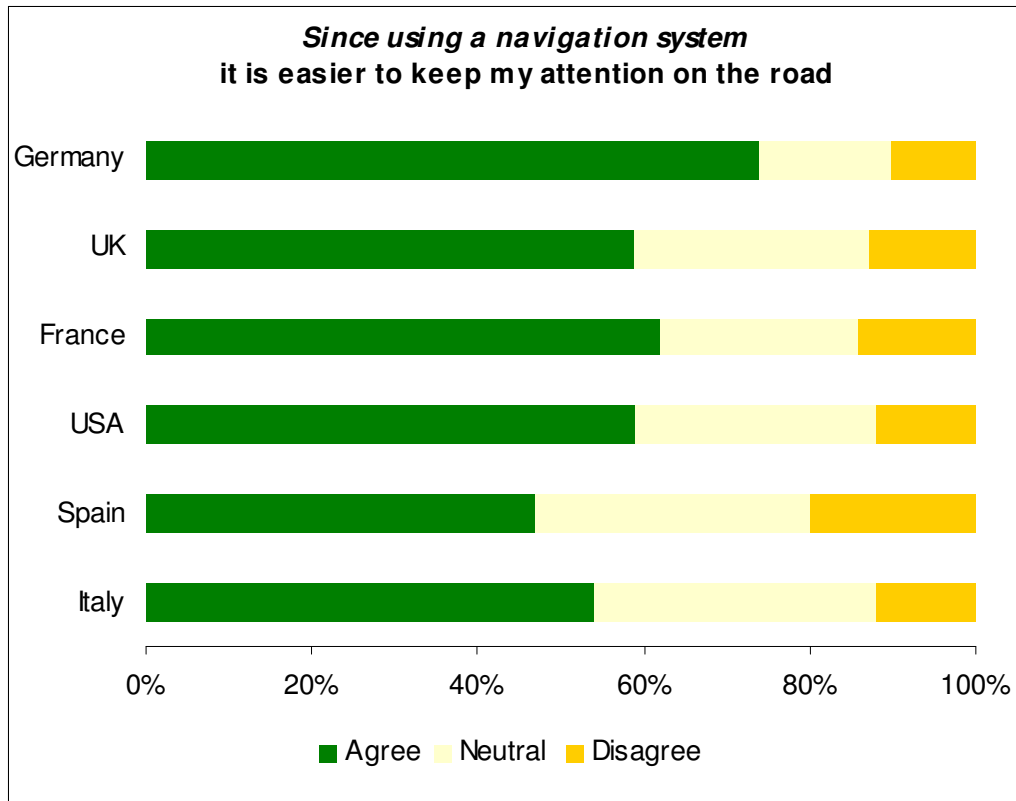


Figure 5

Again, the results from the user survey in the Netherlands (Vonk et al., 2007) support the above findings concluding that navigation systems make it easier to keep their attention on the road, that the objective workload reduces when driving with a navigation system in an unfamiliar area and also more than two thirds of users do not agree with the statement that they are more distracted by the use of a navigation system.

4. Does the use of a navigation system change driving behaviour?

Changes in driving behaviour were observed by the experimenter/driving instructor that was sitting next to the participant in the three instrumented car studies. When driving with the navigation system significantly less driving errors were observed. The USA study also showed more wrong actions on the road and more unsafe driving without a navigation system.

Three questions in the survey study on traffic safety all showed the same picture: users of a navigation system indicate they feel safer since they are using it. A majority of the users also indicates they think 'you drive more safely with a navigation system'.

5. Does the use of a navigation system reduce number of kilometres driven?

Both the instrumented vehicle studies by TNO, TUV and DLR showed that the mean distance travelled to reach the destination was shorter and the time needed to reach the destination was shorter when driving in an unfamiliar area with a navigation system. The USA study showed no significant effects on these faster and shorter trips, although the navigation system did produce the fastest and shortest trips. On top of this the Dutch study also showed that the halt time was shorter and that fewer stops were made when driving with a navigation system. These effects can all be attributed to more efficient navigation when guided by a navigation system.

In terms of fuel efficiency (l/100 km), no differences were found between the situation with and without a navigation system (a little improvement in the Dutch study). But given the reduction in the number of kilometres/miles driven in combination with unchanged fuel efficiency, the total consumption was reduced with a navigation system.

Involved

About TomTom

TomTom NV is the world's leading provider of navigation solutions and digital maps. TomTom NV has 4000 employees working in four business units – TomTom, Tele Atlas, Automotive and TomTom WORK.

TomTom's products are developed with an emphasis on innovation, quality, ease of use, safety and value. TomTom's products include all-in-one navigation devices which enable customers to navigate right out of the box; these are the award-winning TomTom GO family, the TomTom XL and TomTom ONE ranges and the TomTom RIDER. Additionally, independent research proves that TomTom products have a significant positive effect on driving and road safety.

Tele Atlas delivers the digital maps and dynamic content that power some of the world's most essential navigation and location-based services (LBS). Through a combination of its own products and partnerships, Tele Atlas offers digital map coverage of more than 200 countries and territories worldwide.

The Automotive business unit develops and sells navigation systems and services to car manufacturers and OEMs.

TomTom WORK combines industry leading communication and smart navigation technology with leading edge tracking and tracing expertise.

TomTom NV was founded in 1991 in Amsterdam and has offices in Europe, North America, Middle East, Africa and Asia Pacific. TomTom is listed at Euronext Amsterdam in The Netherlands. For more information, go to www.tomtom.com.

About TNO

TNO is a prominent, independent knowledge company whose expertise and research contributes significantly to the competitiveness of businesses and organisations, to the economy and to the quality of life as a whole. Versatility and capacity to integrate this knowledge makes TNO unique. TNO employs some 4500 professionals.

TNO operated in five core areas:

- TNO Quality of Life
- TNO Defence, Security and Safety
- TNO Science and Industry
- TNO Built Environment and Geosciences
- TNO Information and Communication Technology

In the field of Traffic and Transport TNO combines expertise in vehicle engineering, broad experience of ICT applications and knowledge of driver behaviour and the traffic system. All this in a social context where quality of life and pressure for space are issues. The relevant expertise and experience of some 400 TNO professionals throughout the organisation enable us to provide the right kind of advice and deliver clever products that integrate elements of policy, behaviour and technology.

About TÜV

TÜV Rheinland supports research and development in the automotive industry through market and innovation research, a wide range of vehicle tests for active and passive safety and consulting on certification issues for international markets.

About DLR

DLR is Germany's national research centre for aeronautics and space. Its extensive research and development work in aeronautics, space, transportation and energy is integrated into national and international cooperative ventures. DLR's mission comprises: exploration of the Earth and the solar system research aimed at protecting the environment development of environmentally-friendly technologies to promote mobility, communication and security.

DLR's research portfolio ranges from fundamental research to innovative development of the applications and products of tomorrow. In this way, DLR contributes the scientific and technical know-how that it has gained, thus enhancing Germany's industrial and technological reputation. DLR operates large-scale research facilities for the center's own projects and as a service provider for clients and partners. It also promotes the next generation of scientists, provides advisory services to the German government and is a driving force in the regions centered on its various locations.

About Virginia Tech Transportation Institute

The Virginia Tech Transportation Institute (VTTI) continues to serve as Virginia Tech's largest university-level research centre and is dedicated to conducting research to save lives, save time and save money in the transportation field by developing and using state-of-the-art tools, techniques, and technologies to solve transportation challenges. Its cutting-edge research is effecting significant change in public policies in the transportation domain on both the state and national levels.

The Institute conducts applied research to develop new techniques and technologies to study transportation challenges from various perspectives: vehicle, driver, infrastructure and environment. To accomplish its ground-breaking research, the Institute has at its disposal a wide-range of tools to explore transportation problems including facilities such as the Virginia Smart Road and VTTI's internally-developed Data Acquisition System (DAS).

About TNS NIPO

TNS is a global market information and insight group. Its strategic goal is to be recognised as the global leader in delivering value-added information and insights that help its clients make more effective business decisions. TNS delivers innovative thinking and excellent service across a network of 80 countries. Working in partnership with clients, TNS provides high-quality information, analysis and insight that improves understanding of consumer behaviour.

TNS is the world's leading provider of customised services, combining sector knowledge with expertise in the areas of Product Development & Innovation, Brand & Communications, Stakeholder Management, Retail & Shopper and Customer Intelligence. TNS is a major supplier of consumer panel, media intelligence and audience measurement services.



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