MeBeSafe News

MeBeSafe.eu

The impact of MeBeSafe

A reward for tired drivers

Nudging is all around us

The legacy of MeBeSafe

MeBeSafe

mebesafe.eu

Some words from the project coordinator

Dear readers,

A warm welcome to our final Newsletter on the EU-Project MeBeSafe. Three and a half years of intense research and innovation action have passed by and now we find ourselves at the end of a great project on **Me**asures for **Be**having **Safe**ly in traffic.

Please allow me to resume some selected questions that reached us over the stretch of the project, as I personally do think the answers have the potential to shift light on relevant areas of the project.

How is MeBeSafe motivated? Safety has increased over the last two decades. The EU set ambitious goals in its 2011 Transport White Paper e.g. reducing fatalities close to zero in road transport by 2050. You may agree, today safety still is of primary concern for any transport system. I am convinced that expanding knowledge and further preventive interventions such as appropriate technologies (e.g. ACC), infrastructure (e.g. for speed reduction) as well as services (e.g. coaching) to reconcile safety with efficiency and user-friendliness, contribute significantly to these goals. MeBeSafe took this way and comes up with novel, preventive interventions.

There are already effective interventions out there. What is new about MeBeSafe? Proven effects of existing measures are not in question. The MeBeSafe approach goes one step beyond and takes advantage of existing measures. We wanted to understand human behaviour in interaction with these measures, make out room for improvement and come up with novel interventions, based on this knowledge. For instance, some conventional measures only intervene close to an incident or foster habituation. The MeBeSafe approach is to intervene early in time and to be on demand in order to work against habituation.

Understanding human behaviour better, what does that mean? It is common knowledge that human behaviour is one of the major causes for accidents. Habituation for example goes hand in hand with a degrading level of attention. A certain level of attention however, is precondition for safe driving. Using the concept of "nudging", MeBeSafe developed and tested interventions that aim to work even if human behaviour is inappropriate.

Did MeBeSafe succeed? Well, today we are looking at the great, working interventions the excellent consortium came up with. For instance, the one I am looking at shown on the picture in the background is an infrastructure measure implemented in real traffic in Eindhoven (NL). We could show that it works. This and many more interesting stories you are invited to read in this final edition. Enjoy!

With my best regards,
Stefan

Stefan Ladwig

8 well-evaluated nudges and coaching measures

THE LEGACY OF MEBESAFE

The stories of what MeBeSafe developed and the results when used in real traffic

Surprise rewards to get tired drivers to stop

Real-time symbols to increase drivers' awareness of cyclists

This image is an illustration

This image is an illustration

Soft measures could double the number of tired drivers stopping to take a break. Today, the desire to arrive fast seems so strong that just warning drivers that they are tired might not be enough. MeBeSafe have found one solution in handing out random rewards.

Vulnerable road users are easily overlooked by drivers when they are crossing each other's way. Cyclists could be hidden from the view or drivers could have their attention elsewhere. MeBeSafe have found potential to nudge more than 60% of drivers to slow down or become more aware of crossing cyclists.

PURPOSE:
Have drivers take a break when they are tired

HOW?
When the car detects drowsiness, the driver is told they will get a secret gift if they stop in the next 20 mins. When they stop, a random voucher is given out.

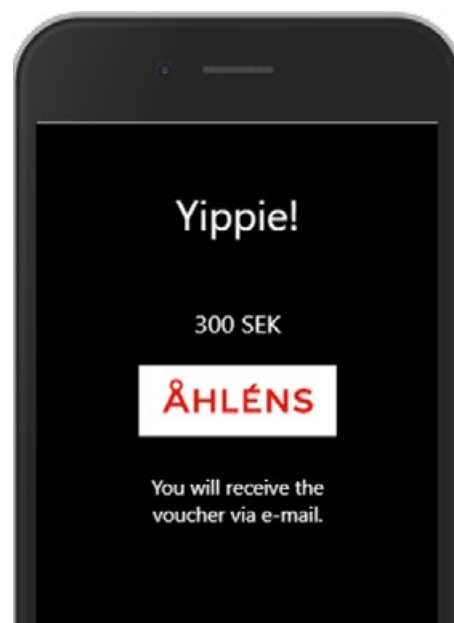**KEY CONCEPTS:**
Curiosity, acquisitiveness

EFFECT:
Twice as many drivers (87%) stopped within 20 minutes compared to only telling them they are tired.

Today, some cars have developed features to detect if drivers are tired, and then inform them that they should stop and take a break. This is manifested in Volvo cars by showing the drivers a coffee cup symbol if they are tired, and this has been found to make 44% of the drivers stop. This is good, but it could be better. Moreover, many cars also don't have this feature.

The new implementation developed by MeBeSafe appeals to people's curiosity, and their love for receiving things. It is based on the existing algorithm to detect when a driver is tired, which was first developed by Volvo Cars in a prior project, but has been packaged in a new interface.

Now when a driver is found to be tired, they will be shown a message that if they stop within 20 minutes, there will be a secret gift card waiting for them. Only when they stop will they know how much it is worth and where it can be used. The message was delivered from a screen within the vehicle (a mobile phone in the field trial). This was found to make 87% of the drivers stop – twice as many as with the coffee cup symbol alone.

The test was carried out on 49 participants, with a baseline period of 6 months and a testing period of 5 months.

Up to 30% of all accidents occur because drivers are not looking properly for traffic potentially crossing their path. Some cars have installed automatic braking features, but they only come into action when a road user is directly in front of the car and a collision is imminent. This could be too late.

MeBeSafe's measure is based on a projection in a head-up display, coinciding with the intersection a driver is just about to enter. The projection is a schematic representation of an intersection shown right above the steering wheel. When the car approaches an intersection where cyclists are about to cross, a notch will appear from that side and the colour of the intersection will change from green to orange to red.

It adresses both the local static hazard, as well as the dynamic hazard. The static hazard is based on the risk of an accident at a specific location. This is useful when approaching cyclists are hidden behind obstacles. The dynamic hazard considers cyclists in direct view of the vehicle. Using an AI-based cyclist prediction model, the risk that the cyclist is going to interfere with the vehicle in the upcoming seconds is estimated. This prediction model is one of the key innovations in MeBeSafe.

The test-implementation of the measure led to 56% of the drivers looking more to the appropriate direction, and up to 64% decreased their speed in 50 km/h speed limit zones. The HMI-measure was tested on 22 participants driving a prescribed 1-hour route in Eindhoven, measuring their direction of gaze and their speed. They drove the route twice to encounter both baseline and treatment conditions.

PURPOSE:
Make drivers' more aware of potential hazards with vulnerable road users

HOW?
A head-up-display projection of an intersection symbol, getting a notch from one side and changing colour when a potential hazard is coming from that direction

KEY CONCEPTS:
Augmented reality, Awareness

EFFECT:
56% of drivers look more to the right direction and up to 64% decrease their speed

*"*Nudging does work! Tests with naïve participants have shown that this solution moves drivers in a very subtle way to pay more attention in hazardous situations when driving in city traffic *– Olaf op den Camp*

This image is an illustration

Flat lines to help cyclists use a safe speed and get aware

Light patterns in the road to get drivers to slow down

Cyclists are sometimes too fast or using too little attention when approaching an intersection where the view is blocked. It's seldom obvious that this is the case. MeBeSafe have developed a nudge based on flat stripes getting closer together to give an illusion of speed, leading to twice as many cyclists slowing down before a dangerous intersection.

Drivers are often going too fast, especially when leaving a high-speed motorway. And motorway exits can have rather sharp curves, leading to potential accidents. MeBeSafe have realised a nudge that could reduce the number of speeding drivers by 40%, by exposing them to lights embedded in the road.

PURPOSE:
Make cyclists slow down and become more aware before accident-prone intersections

HOW?
A number of completely flat stripes going across the road, gradually getting closer together to give an illusion of speed.

KEY CONCEPTS:
Illusion

EFFECT:
Potentially double the share of cyclists reducing their speed 10-30% before an intersection, depending on location. Average speed reduction due to nudge 3-7%

Most accidents between bikes and cars occur at intersections, especially where the view is blocked. Today, there is no real help for cyclists to recognise a dangerous intersection, as they are deceitfully similar to safe ones.
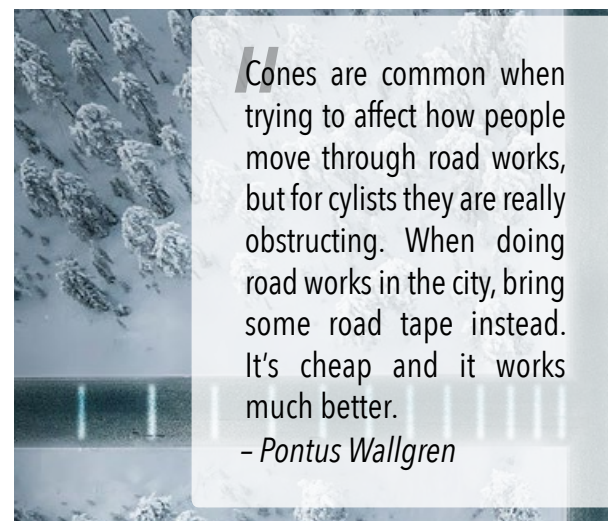
The measure is based on flat stripes on the road, getting progressively closer together. The nudge runs over 19.9 meters, and the first gap between two stripes is 2 meters. This is gradually decreased to 0.6 meters. Cyclists do not actively notice this gradual difference, but are affected by the illusion that they are going faster and faster, meaning that they slow down.

Studies showed that this likely affected the cyclists subconsciously, without them being aware that they slowed down.

The nudge was found to decrease the speed. Up to twice as many decreased their speed 30% when going towards the intersection, with an average of 3-7% extra speed decrease depending on the location. The acceptance from cyclists is very high at 90%.

The nudge worked even in a strong downward slope, indicating effectiveness even in very difficult situations, although with different results.

The nudge was tested at two accident-prone locations in Gothenburg, Sweden and one in Eindhoven, the Netherlands. The nudge was active for two months at each location in Sweden, and the test ran for two weeks in the Netherlands.

Many drivers are habitual speeders, i.e. speeding without actually being aware of it. In the field test study, 67% of all drivers at a certain motorway exit were driving too fast; many likely without being aware of it. There is no reason to believe this would be different elsewhere.

The measure is based on an array of lights embedded in the roadsides. When a driver is detected to be driving too fast, lights will start moving towards the car to create an illusion of going faster than they really are. This is made by lighting up every third or fourth light, and alternating them so that it seems that the light itself is moving at a certain speed. A version with only static lights has been tested as well. The nudge is only activated for drivers who are actually speeding.

To make this work, a detection algorithm was developed. Cameras were put up to capture the exit, and the system evaluates each passing vehicle. The speed and deceleration are measured and used to estimate the speed profile in a small gap between the cameras. And although the official speed limit change instantly, the nudge allows for a speed profile more in line with how decelerating actually works. This is the basis for when the lights are turned on.

The measure was found to reduce the amount of speeding vehicles by 40%, and an average speed decrease of 4.9%

The measure was put up on a real exit in Eindhoven with on average 19.000 passages per week, and was evaluated over a period of 5 and a half months.

PURPOSE:
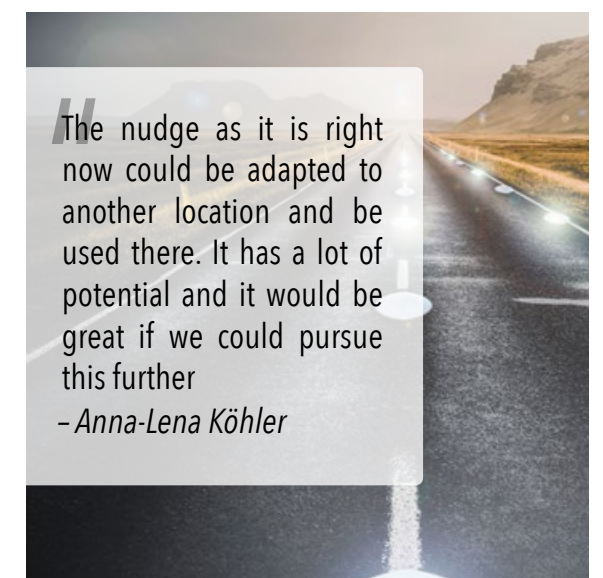Have drivers slow down in accident-prone locations

HOW?
Lamps on the roadsides being lit up statically or moving towards a speeding driver to give an illusion of higher speed.

KEY CONCEPTS:
Illusion, salience

EFFECT:
Speed reduction of 4.9% on average, number of speeding vehicles reduced by 40%

> Cones are common when trying to affect how people move through road works, but for cylists they are really obstructing. When doing road works in the city, bring some road tape instead. It's cheap and it works much better.
> – Pontus Wallgren

This image is an illustration

> The nudge as it is right now could be adapted to another location and be used there. It has a lot of potential and it would be great if we could pursue this further
> – Anna-Lena Köhler

This image is an illustration

ACC IS ON

TOP ACC USERS

1. JOANNE ORWIN — 487 MIN
2. RUPERT DAGLAND — 303 MIN
3. ANDREW OAK — 288 MIN
4. JOSEPHINE ELVENBRANCH — 282 MIN
5. DIANA BLOOMLOCH — 281 MIN
6. JOSEPH HEADMAN — 277 MIN

8774. YOU — 45 MIN

Increase distance between cars by orderly things

This image is an illustration

Accidents can occur when drivers are too close to the car in front of them, and many drivers do so without knowing it. Adaptive Cruise Control always keeps the distance safe, but it is not always used. This is one of MeBeSafe's ACC measures that could increase the use by almost 50%.

PURPOSE:
Increase distance between cars by increasing use of Adaptive Cruise Control

HOW?
Circles on an in-car screen moving around randomly, while starting to behave more and more controlled when using ACC. The screen also tells if ACC is on or off to give a hint of the purpose.

KEY CONCEPTS:
Orderliness

EFFECT:
The use of ACC was increase by 46% to 21% of the time.

If a car has Adaptive Cruise Control (ACC) today, the drivers have to turn it on by themselves. The MeBeSafe field test showed that test drivers have it on for 14% of the time. Two measures were tested to increase their usage.

The first measure is based on people's love for orderly things. It is a graphical visualisation displayed on a screen inside the car and it starts off with ten balls randomly moving around. The balls are accompanied by a text stating whether ACC is on or off, to give a subtle hint of what the balls actually relate to.

For every minute the driver has ACC on, one ball goes from random movement to a controlled slow flow at the centre of the screen. After 10 minutes, all the balls are flowing smoothly in a big circle and will keep on doing so until the next day. This measure led to ACC being used 21% of the time, an increase by 46%.

The two measures had different effects on different people. Some responded much better to one or the other of the measures, and few seemed to have an equal reaction to both.

The test was carried out on 49 participants, with a baseline period of 2 months, and a testing period of 8 months.

Adaptive Cruise Control
Active

Increase distance between cars by scores

This image is an illustration

MeBeSafe's second distance-keeping measure could double the use of ACC. Accidents often occur when drivers are too close to the one in front of them, and many drivers do so without knowing it. Adaptive Cruise Control always keeps the distance safe, but it is not always used. This is MeBeSafe's second way to mitigate this by soft measures.

In the situation of today, Adaptive Cruise Control (ACC) is turned on by the drivers, and MeBeSafe's field test showed that test drivers have it on for 14% of the time. Two measures were tested to increase their usage, and this is the second one.

The second measure is based on a scoreboard, showing an anonymised list of the drivers who have used ACC the most during the last day. Below the list, you can see your position on the list and how much that means in minutes. Similar to the first measure, it is also displayed on a screen inside the vehicle.

The measure applies to people's love for games and competition as an alternative bias.

The gamification scoreboard led to ACC being used 31% of the time, an increase by as much as 118%.

The two measures had different effects on different people. Some responded much better to one of the measures, and few seemed to have an equal reaction to both.

The test was carried out on 49 participants, with a baseline period of 2 months, and a testing period of 8 months.

PURPOSE:
Increase distance between cars by increasing use of Adaptive Cruise Control

HOW?
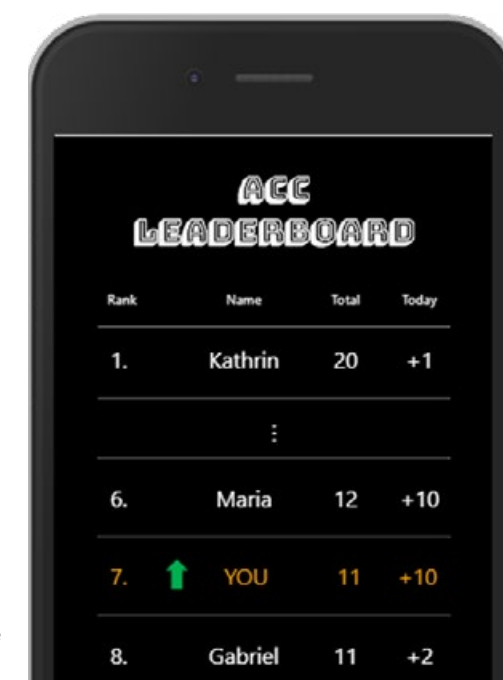A scoreboard with the drivers who used ACC most last week, showing the driver their own score and rank.

KEY CONCEPTS:
Competitiveness

EFFECT:
The use of ACC was increased by 118% to 30.7% of the time.

ACC LEADERBOARD

Rank	Name	Total	Today
1.	Kathrin	20	+1
⋮			
6.	Maria	12	+10
7.	YOU	11	+10
8.	Gabriel	11	+2

Letting truckers coach themselves with the help of data

Truck drivers are experts on the road, and the person with most knowledge to coach them is another trucker. MeBeSafe have designed an app that supports a peer-to-peer coaching scheme based on privacy-focussed data collection – and the empowerment concept has been met with very positive reactions.

PURPOSE:
Make truck drivers ride more smoothly

HOW?
A mobile app collecting anonymous data, providing insights to the drivers and suggesting that they should meet a peer and coach one another on suggested topics.

KEY CONCEPTS:
Peer-to-peer coaching, learning-by-doing, voluntarism, non-monitoring

EFFECT:
Limited data due to COVID-19

The strength is that the coaching is not done by some expert with some attitude or just telling someone 'you're doing this wrong', but it's all about the driver themselves.
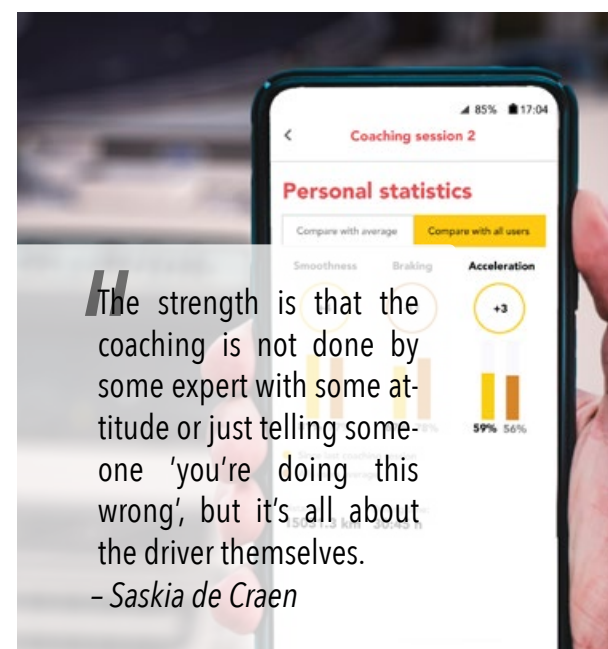– Saskia de Craen

Truck drivers of today rarely have the opportunity to meet one another. They are usually away on long driving trips and have few fellows to talk to about their experiences. Truckers would need a platform where they can learn from each other.

This measure is based on a smartphone app, installed on a phone in their trucks. The app is started by the driver when they begin their journey and uses in-phone sensors to record driving data, such as acceleration and braking. If something special happens, the driver can press a button to document it. The data is collected anonymously, with the driver being the only one who can see it. No manager will have to monitor them. The truck drivers can use the data to get insights about their driving.

The app also suggests that two peers should meet each other and talk. It provides relevant reading material and videos that they could discuss during their session. Drivers are however free to meet and talk about whatever they want, and they only have to show their data if they like to. The scheme relies on freedom-of-choice without surveillance, to build trust.

Due to COVID-19, no evaluated effectiveness of the measure can be given. Drivers were not able to meet and coach one another as planned, and many test drivers were laid-off. Drivers however seemed satisfied, as they kept using the app, even if it didn't work as intended. Interviews showed a very positive attitude from the truck drivers.

The measure was tested on 13 drivers in Norway, and 20 drivers in the UK.

Talking apps to coach drivers to start using ACC

This image is an illustration

Adaptive Cruise Control leads to safe distances between cars, but not all drivers use the feature. MeBeSafe developed a measure to nudge people into using it. But this can only work if the drivers know of ACC. MeBeSafe therefore developed a way to coach drivers into using a new feature, such as ACC.

Today, there are a lot of features in ordinary cars, and people are not aware of all of them. Many cars come without physical instruction manuals, and even if they do; few people will casually search the tome if they are not looking for anything in particular.

The measure is based on an app talking to the driver and informing them of important features within the car. It informs them about the reason for these features and how they should be used. The developed app uses speech interaction to inform the participants.

It was found that the interaction had to be very smooth for this to work, and the provided information must take the local context into account.

The effectiveness of the measure couldn't be evaluated, given that all three tests; in Sweden, USA and UK with a total of 45 test persons; only found people who were already using ACC.

PURPOSE:
Make people aware of Adaptive Cruise Control, so they can use it.
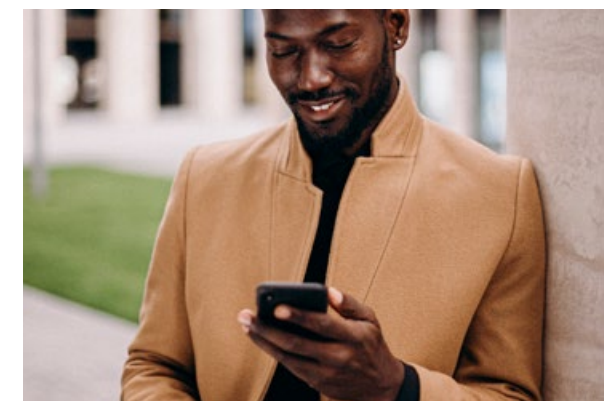
HOW?
Digital coaching app informing the driver about ACC and what it does.

KEY CONCEPTS:
Information

EFFECT:
Unknown, due to all test users already using ACC

Together these 8 measures contribute to
THE LEGACY OF MEBESAFE

Nudging is all around us

but we are not using it to its best potential yet

MeBeSafe is introducing the idea of soft measures (e.g. nudging, coaching) in a traffic safety environment – an area more known for hard measures (e.g. prohibitions, speeding tickets, speed bumps) intended to force a certain behaviour to occur.

MeBeSafe have shown the possibility of nudging road users by using attributes of commonplace infrastructure measures; lines on the street (see page 19) and signalling lights (see page 14). Does that mean that commonplace infrastructure measures are nudges? As some misconceptions of what nudging is and isn't are still prevalent, the short answer is No. The long answer is a grayscale rather than being black or white. Let's start with some similarities.

Nudging is originally an economic concept of deliberately changing the behaviour of people while requiring as little cognitive effort as possible on their part. A nudge should be beneficial for the people involved, not impose limits, while also not having an impact on their private finances. Furthermore, MeBeSafe have strengthened the case for two different kinds of nudges, type 1 and type 2. The former triggers an unconscious decision while the latter triggers a conscious decision.

The idea of infrastructure, in traffic and transportation, is hidden behind the obvious answer that is 'to facilitate traffic and transportation'. The real answer lies

in how we do it – by constructing lanes, road markings and signage that are showing different types of road users how they should interact among each other for each of them to reach their destination safely and efficiently. For this to work, arguably, the purpose of infrastructure can be formulated as streamlining the behaviour of road users to create predictability among them, so they can form a tacit agreement on how to behave.

We can observe that nudging and infrastructure both are about deliberately changing people's behaviour in favour of all involved. So, what is the difference? In brief, a nudge only works in a specific context – described by the sum of all stimuli from the surroundings – and requires modifications to fulfil its purpose in another context. Meanwhile, commonplace infrastructure measures are often copy-pasted for the sake of uniformity. This fact makes infrastructure prone to function better or worse when the surrounding context changes along the journey.

With almost certainty, you as a reader can surely name at least one occurrence where

you've seen infrastructure that didn't function well in practice. Truth is that a lot of things in the immediate surroundings are affecting our behaviour. If a cyclist lane is too close to a building, cyclists will be more prone to increase the distance, to see ahead if someone is coming around the corner. Same with pedestrians who will likely take shortcuts when approaching their destination – so-called desire paths – which sometimes involves running across the road earlier instead of waiting until the crossing.

City planners of course know about these behaviours. However, they are often addressed by imposing restrictions, such as putting up railings, to make people less likely to go where they might put themselves at unforeseeable risk. On the other hand, raise your hand if you've ever seen someone either duck under or jump across one of those railings. The behaviour of wanting to travel a certain path exists because something has triggered them. Senior researcher Pontus Wallgren from Chalmers University of Technology frames this as unintentional nudging:

"There is a huge variety in infrastructure between cities," according to Pontus Wallgren, *"So we think there's quite a lot of unintentional nudging going on and we think that is something very much worth looking into to see how we can be more intentional with how we do nudging."*

If we approach the previously mentioned behaviours with intentional nudging, one tactic could be to make it much easier to walk across the road earlier from a singular point, while another could be to make crossing at the intended location more appealing by some means. In doing the former, we might create a stronger cue for the drivers that this behaviour is indeed happening, and they don't have to be surprised by people suddenly walking across the street from just anywhere. Another example could be to change the visual stimuli, by hiding the destination behind vegetation, so that people will not be triggered to start walking across the street before the crossing. Pontus Wallgren has yet another example:

"Cones are a very common way of trying to affect how people move through some road works," Pontus Wallgren explains. *"It works with cars, but for cyclists they are often in the way and really obstructing. We did a couple of small experiments very early on in the project, where we just taped up some line markings and a bike symbol nearby a road work. Immediately, opposed to the confusion of 'how should I behave here', the people started acting much less chaotic and more controlled."*

It could be argued that when the infrastructure measure itself is the dominant stimuli – like a straight cyclist lane among peaceful meadows on either side – it will work more or less like nudging (type-2) and have the cyclists follow the intended lane. But in locations where cyclists don't follow the lane, it's probably due to other stimuli being more dominant – like when there's a bench or garbage bin on one side of the cyclist lane and a pedestrian lane on the opposite side. This increases the interactions with pedestrians and may have cyclists evade that stretch of lane altogether. It may sound like a stupid arrangement to begin with, but it's more common than you might think.

"We tried things that were really subtle in our design process, and stuff that was not really a nudge at all," Pontus Wallgren continues. *"For bikes we ended up with realizing that a nudge can't be too subtle, because there's a so much happening around you when you're biking, so we need to make it stand out in some way."*

Following the above examples, we can discern how common infrastructure measures could work as nudges or not, depending on the specific location they are observed at. It's also clear that without a great understanding of the location you want to nudge at, you might not be able to nudge people as expected. Because people are people. There's still a lot more to uncover about nudging and infrastructure before nudging is an integral and fine-tuned component of our infrastructure. But the promise is there, and MeBeSafe is paving the way forward.
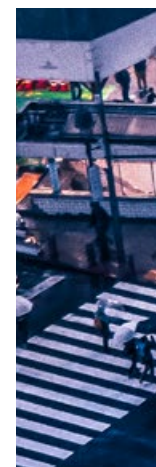
Factors affecting cyclist behaviour

MeBeSafe have framed several elements that affect cyclist behaviour if they are placed on or next to a bike lane. These elements are not nudges per se, but they affect behaviour – in this case speed or trajectory of cyclists – in a similar way. Read more on page 11.

Description of elements	Examples	Interaction or effort *
Popular destinations where pedestrians go to and from	Buildings (shops, houses, schools) or services (bins, benches, bus stops, parked cars)	increases
Longitudinal elements posing as non-traversable barriers for pedestrians	Rivers, high fences, busy highways, back of buildings without doors	decreases
Elements affecting passage or vision for cyclists	Hole, ice patch, leaves, gravel, pool of water, uneven ground, edges of asphalt, maintenance holes, edges of asphalt, gravel, vehicles, 'zig-zag' railing, rumble stripes, tunnels, buildings, high bushes	increases
Elements increasing the distance between lanes	Stones, trees, cobble stones, spacing, railings, fences	decreases
Elevation changes from one point to another for cyclists	Hills, curved bridges, high ground to low ground and back to high ground again	increases
Travel paths for car drivers	Car roads, highways, cyclist boulevards, Shared roads with car drivers and cyclists	increases
Travel paths for cyclists	Bike lanes, cyclist boulevards, shared roads with pedestrians and cyclists, shared roads with car drivers and cyclists	decreases
Travel paths for pedestrians	Pedestrian lanes, shared roads with pedestrians and cyclists	increases
Trajectory segments allowing for easier passage for cyclists	Segments having less interaction with other road users, with less obstacles, being less uphill	decreases

* Cyclists' required effort or interaction with other road users
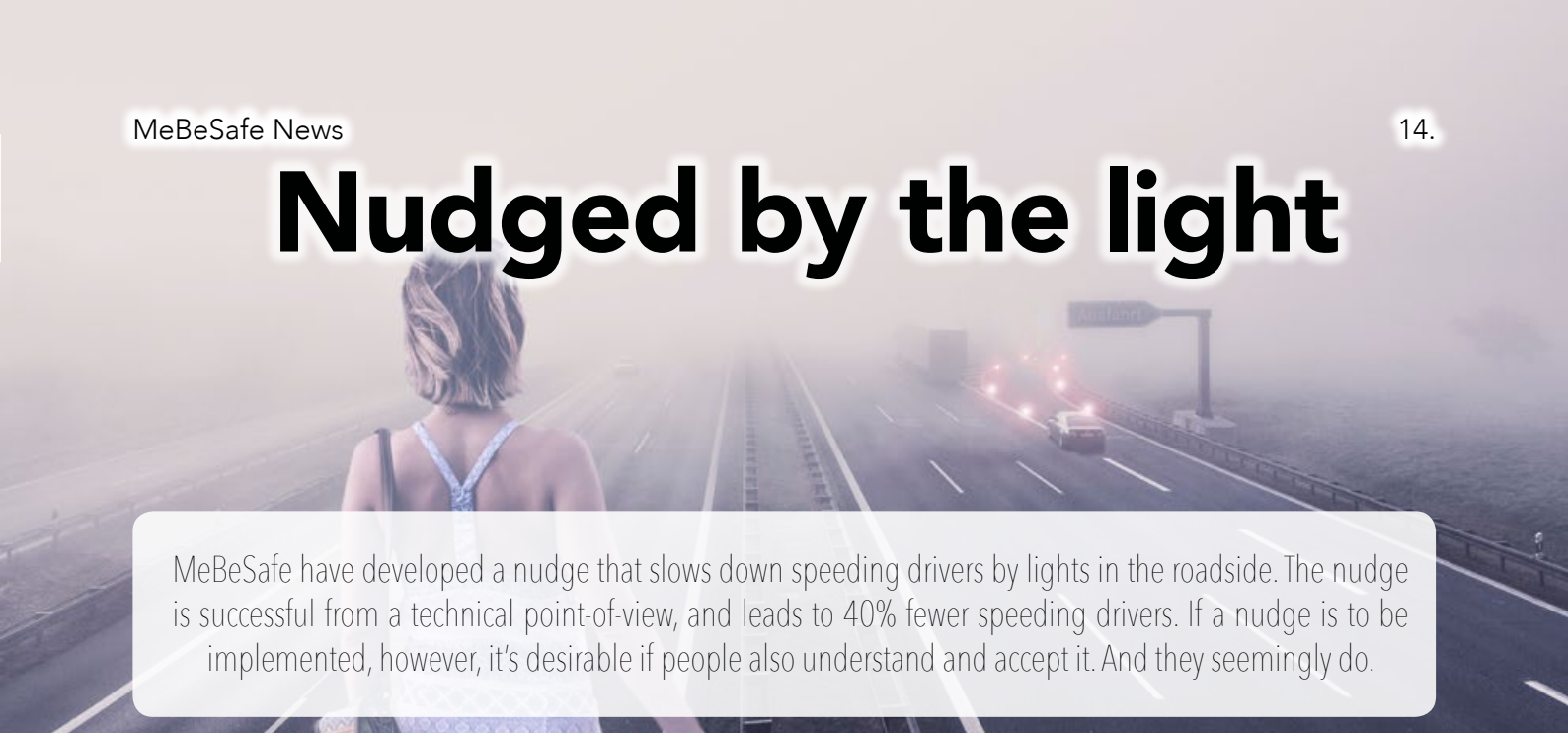
Nudged by the light

MeBeSafe have developed a nudge that slows down speeding drivers by lights in the roadside. The nudge is successful from a technical point-of-view, and leads to 40% fewer speeding drivers. If a nudge is to be implemented, however, it's desirable if people also understand and accept it. And they seemingly do.

From early ideas, rough modelling, simulator studies and up to a real-life road exit in Eindhoven, the Netherlands – the light nudge has had a long journey to reality. The principle is as simple as ingenious – speeding drivers are met by lights in the roadside moving towards them to create an illusion of speed, or simply by static guiding lights. And both are successes.

Results from the field test show that drivers slow down – and the faster they go, the more they slow down. What this means is that the measure works very well for its intended purpose, to only nudge drivers going above the appropriate speed. It also seems to work well for habitual speeders – going too fast without being aware of it. This is important, since their unawareness normally won't allow them to react – making traditional speeding tickets futile in trying to change their subconscious habit.

Then again, when a nudging system is effective in reducing the amount of speeding drivers, it would be even more satisfactory if the affected drivers also accept it. It's however not the simplest of feats to capture people's reaction when they're exiting a motorway in a car. The drivers are highly enclosed inside their car and it's not a brilliant idea to walk out and talk to them on a busy road.
    Early simulator studies with 90 drivers found that red was the colour most associated with slowing down, which led to using red lights. The drivers also understood that the lights could help them become more alert and adopt a safer speed. But this alone was not enough to determine the acceptance of roadside lights in the real world.

To capture the experience of people passing through the nudge in Eindhoven, MeBeSafe used the fact that it was installed at a road exit leading more or less only to a specific housing area. People living there were bound to have taken the exit, so they were contacted and invited to answer questions on how they perceived it. Naturally, this would not capture their first-time reactions, but the 346 respondents gave plenty of insight into how they perceived and would rate the nudge.

And the surveyed people were indeed using the exit. Only 7% took it less than once a week. They were really positive towards the nudge, regarded it as a safe and appropriate way to increase attention and reduce speed. A very interesting aspect was also brought up; that the lights would help guide drivers through the road curves when it is dark outside.

When asked which one of three alternatives they preferred – only a speed limit sign, complemented with the lights, or complemented with a speed camera, the sign along with the nudging lights were by far preferred the most, with almost 90% respondents selecting it as their first or second option.

It therefore seems like although moving lights could sound intrusive and distracting – they were in fact not perceived as such. And based on data analysis of almost 90 thousand drivers passing the nudge, the setup yields a 40% decrease in the amount of speeding drivers before the sharp curve of the exit. Together, these results could very well speed up adoption of soft measures in the hard traffic infrastructure.

🐘🐘Nudging for safe distance between cars

Cars often drive too close to one another. Adaptive Cruise Control (ACC) can automatically keep the distance safer, but many people who have ACC do not use it.
Is a nudge enough to make them use it more?

Adaptive Cruise Control (ACC) is a remarkable achievement. While ordinary Cruise Control only keeps a set speed, ACC takes it a step further by also maintaining a safe distance to the car in front. To make this work, several sensors interact. Based on your speed and the distance to the car in front and its speed, it calculates an ideal speed profile in order to maintain a certain time gap between your vehicle and the one in front.
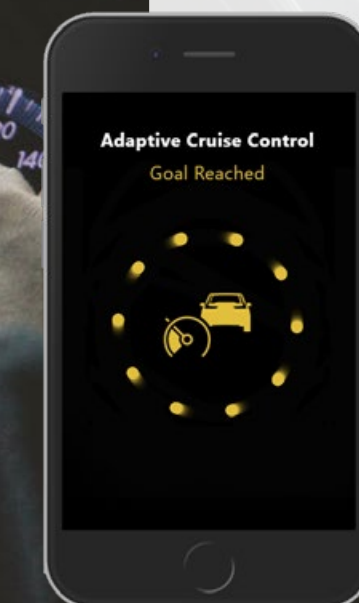
The key challenge with ACC is that many people do not use it very often, despite it being a common feature in cars today. Some might not be aware of its existence while others, for example, disregard it because they want to be in charge of the driving. But out of the people who know about it and yet don't use it – might there be some that could be nudged to use it more? Pär Gustavsson from Volvo Cars is one of the researchers looking into this issue for MeBeSafe.

"We wanted to make people aware of ACC, and with nudging there is so much space to be creative! So we got together and held a workshop on how such a nudge could look" Pär explains.

The participants at this workshop came up with lots of different ideas, some more interesting than others. One of those ideas resonated really well with them, namely appealing to people's love for orderly things.

"Many people really appreciate having good order around themselves. For example, at their desktops. If there were a simple button they could press to make everything orderly, a lot of people would likely choose to press it. And this is the basis for our design to make people use ACC more" Pär explains.

The resulting nudge, displayed on a screen inside the car, is an interface that consists of multiple dots moving around – seemingly without any plan. It might appear slightly annoying, although at the same time it has been designed to not distract people from driving. The good thing is, there is a simple way to create order. When you have ACC activated, the stray dots start to move into a circle, one by one, until all of them are flowing around in a perfect circle.

"We have set a goal of driving ten minutes with ACC per day. For each minute, you get another dot moving away from its chaotic bouncing towards the nice and orderly circle in the centre" Pär explains. *"And as this actually is as simple as pressing a button, we believe many people will do it to get a nice and orderly collection of dots."*

ACC is however not the most obvious function in your car. Without further clues, you could easily be misled to think that the dots mean something different. To hint that they actually are associated with ACC, Pär and his colleagues use a subtle message.

"We won't tell people explicitly that it is about ACC, because that could bias the results. But the screen has a small text in the corner stating if ACC is on or off at the moment, and if it can be activated right now. Then you are free to make the connection yourself" Pär explains.

Ten minutes of driving with ACC might seem like a simple goal, especially if you are a long-distance commuter. After ten minutes of ACC driving, the dots won't go back to being unordered, no matter how you drive the rest of the day. Still, the team believes that people will get inspired and keep using ACC, even after this simple goal has been achieved.
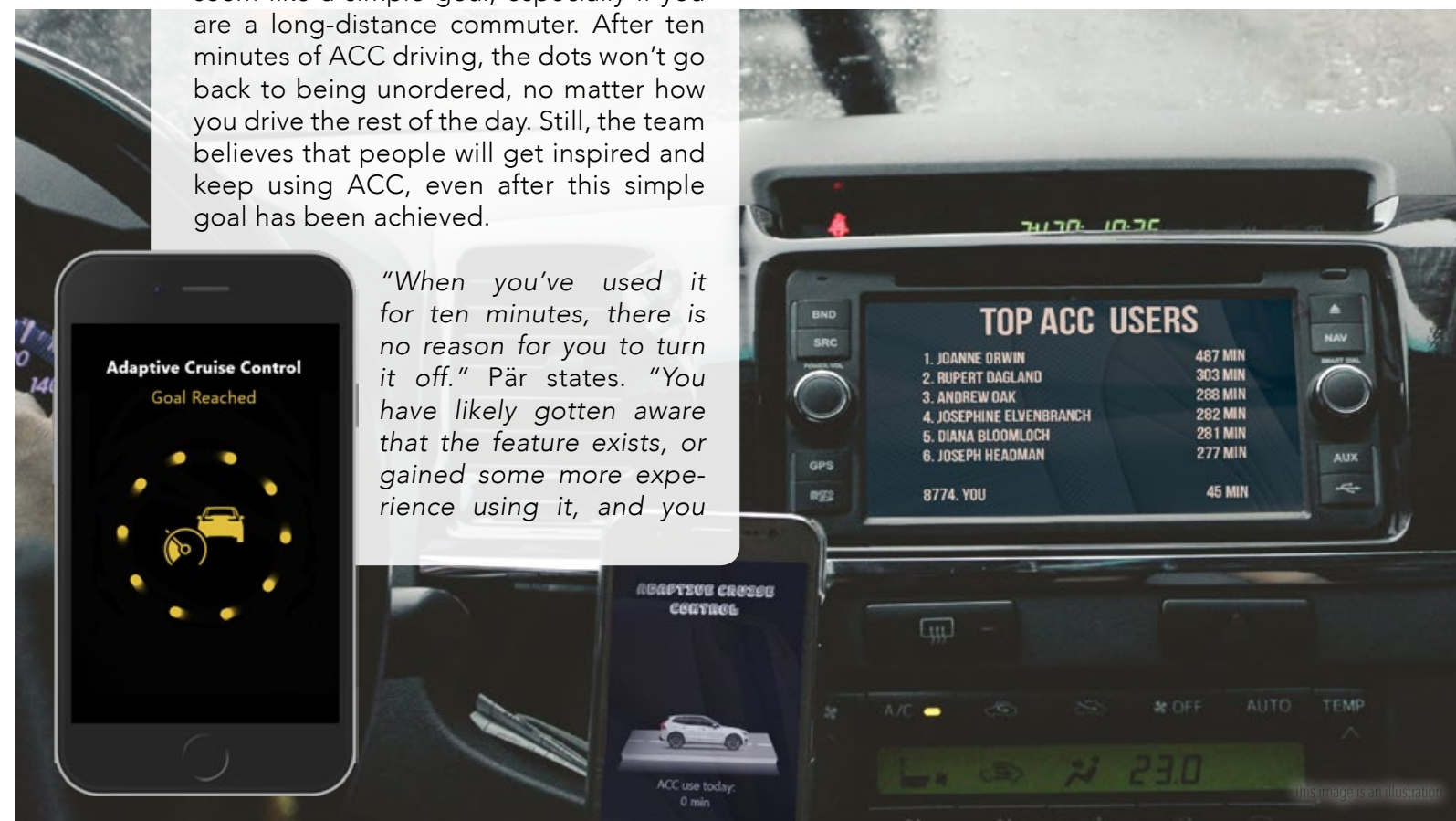
"When you've used it for ten minutes, there is no reason for you to turn it off." Pär states. *"You have likely gotten aware that the feature exists, or gained some more experience using it, and you won't forget it during that trip."*

Alongside this, another approach – gamification – is being tested to increase the use of ACC. It is a popular method to increase engagement by introducing aspects traditionally related to the fun of playing games. For the ACC nudge, the gamification idea consists of a scoreboard, placing you among other based on how many minutes you've had ACC on and showing you what time to beat to be in the lead.

This competitive measure is also one to be tested by the Volvo team, as a way to check if people react differently to this compared to the nudging dots. The results indicate that ACC usage could increase 50-120%, depending on the implementation. Pär is positive.

"Some people really seem to have increased their use of ACC, and that is really great. But others not so much – and you can wonder why. Maybe they belong to a different group of people that would respond differently to another measure. Many people have a strong competitive instinct, and they might be more compelled to increase their ACC use to win rather than getting an orderly desktop."

Adaptive Cruise Control
Available

Adaptive Cruise Control
Goal Reached

ADAPTIVE CRUISE CONTROL

ACC use today:
0 min

TOP ACC USERS
1. JOANNE ORWIN   487 MIN
2. RUPERT DAGLAND   303 MIN
3. ANDREW OAK   288 MIN
4. JOSEPHINE ELVENBRANCH 282 MIN
5. DIANA BLOOMLOCH   281 MIN
6. JOSEPH HEADMAN   277 MIN

8774. YOU   45 MIN

A reward for tired drivers
to make them take a break

GET A SECRET REWARD TAKE A REST

Drivers are known to keep on driving when getting tired, especially if they only have a little bit further to go. But taking a break could mean the difference between safe arrival and an accident. MeBeSafe investigated how to make taking that break more appealing.

The monotonous motorway seems to continue with no end. Few new impressions reach your mind, and your level of attention is likely to drop further and further. Many years ago, you would have been on your own in fighting the sleep. But in 2007, Volvo Cars introduced an advanced drowsiness detection system – Driver Alert Control – that since then has been able to detect when you are tired.

The system, which has been trained on data from sleep-deprived test drivers, is informally called the coffee cup, as it manifests like such an icon in the dashboard. It lights up in the dashboard anytime you are found to be drowsy, reminding you that you should stop and take a (coffee) break. With this world-first technology, you get something to help you assess the state you are in. The only problem is that it does not always lead to the desired action. Pär Gustavsson, a researcher from Volvo Cars, explains that people in essence just want to arrive now.

"The drowsiness detection itself is really good, but many people have planned their route way in advance. If the coffee cup lights up when they only have ten more minutes to go, they will likely think they can manage the last bit too and just go on"

This is a natural bias where you believe that if the journey has gone well so far, it will keep doing so for the last, brief, part. Sadly, this is not an absolute fact. Accidents are more likely to happen when you are really tired, no matter how good you were driving when you felt more awake. And a lot of people just keep pushing on, because it's really hard to make a new plan when you are really tired.

While similar drowsiness detection technologies have become commonplace among car manufacturers, a new step might be necessary to actually make people stop and take a break in the middle of their trip. MeBeSafe have set out to combine the technology with a new ap-

proach; rewarding the people who actually stop to take that break.

"Instead of just showing the coffee cup symbol, we thought – what if we could actually give them real coffee instead?" Pär describes.

Offering coffee to people who stop when drowsy was the initial idea that started it all – to turn that little icon on the dashboard into something tangible that you can really drink. The idea lived on, but had to be developed further in order to really work.

"There were a few practical challenges with this idea. Not everyone loves coffee and there might not be any suitable place nearby where they could get it – and they might not think it is worth it." Pär states. *"That's why we decided to raise the stakes"*

A workshop was held on what kind of rewards would motivate drivers to take a break, and this resulted in the idea of a surprise gift with secret content. In practice, when drivers are found to be tired, they will be informed that they will receive a gift if they stop their car within the next few minutes. However, they won't know what gift it will be until they actually stop. This way, it appeals both, to people's appreciation for gifts and for surprises. And it is a surprise that keeps on giving.

"We have opted for gift cards from a lot of different stores." Pär explains. *"It's completely random what you will get, except that you will not get the same card twice, so the surprise element is always there"*

Now, whenever something is free, there is always a possibility that it will be overused or abused. There is the theoretical risk that

drivers might hit the road when they are tired in order to get a gift, or just stopping for a short time when they've been awarded the gift – only to drive tired again and get another gift. There are naturally checks in place to counter any such tendencies, for example that only one gift per a set period of time can be obtained. All in all, Pär is hopeful that the system will not only work but also stimulate safer behaviour even when the system is not used.

"We hope that the measure will actually change behaviour. If you receive a gift when you stop to rest, you might associate stopping to rest with something positive. And then you might learn to do so, even if you're not driving a Volvo or not being offered a reward for stopping" Pär proclaims.

The new implementation seems to make twice as many drivers stop and rest within 20 mins, with gift values ranging from small amounts up to 90€, to see what works best. Not surprisingly, the giveaway-aspect of the measure is a future puzzle-challenge. Given that it works, who will pay for the rewards in the long-run and how valuable must the offer be to have lasting effects? Pär is cautiously positive that the pieces of the puzzle will fit together in the end.

"We will continue our research to see if we can find a reward level and an implementation model which is able to break through that "wall of drowsiness" you may experience when driving really tired, without the reward costs breaking the bank." Pär says. *"Since true drowsiness events actually are quite rare, it could be that reward levels can remain quite high without this becoming an expensive countermeasure against drowsy driving. Time will tell."*

Traffic nudge increases cyclists' safety margins

There have been many attempts to "slow down" cyclists in general by using rumble stripes or bumps, but these hard, punishing measures have little effect. Still, cyclists are unprotected against cars, and many accidents occur at intersections. MeBeSafe made a cyclist-centred nudge that can help twice as many to adapt a safer speed when it's really needed.

Bicycling is a healthy and sustainable way of moving around our globe, avoiding congestion in both the city streets and in your body. The amount of cyclists has risen during the recent pandemic, as it is a natural way to keep distance to others in an outdoor environment. But when the pandemic is over, it is important that cycling stays attractive, so that reduced risk of infection is not the main selling point. Basically, cycling must be attractive to people for them to cycle more.

More or less – a well-functioning infrastructure may 'nudge' people towards biking more. It's therefore unreasonable to keep building hard measures like rumble stripes, as cyclists must be able to get where they want within in a reasonable time without having to slow down. Except in hazardous intersections.

There are certain spaces where different types of vehicles share the road, and these are the most dangerous in traffic. Here everybody has been taken out of their comfort zone – without knowing it. Many keep on behaving as if they were the only type of vehicle there, with disastrous consequences. MeBeSafe have developed a nudge for car drivers to help them spot cyclists in time and react (see page 21). But to make cyclists something more than a passive actor and acknowledge their role as a real actor in traffic, we need to give them the ability to act as well.

MeBeSafe have investigated how cyclists can be made more aware of dangerous intersections and adapt their speed to cope with potential dangers lurking behind a hidden corner. The process has been made in close collaboration with cyclists to find a nudge with good potential and great acceptance. This led to all haptic measures – things you can feel when you bike – being disregarded. Rumble stripes or bumps had close to no effect on speed, but a very large effect on disapproval. Indeed, many cyclists would even take another route altogether to avoid haptic obstacles.

The MeBeSafe cyclist nudge is instead completely visual. It consists of a number of flat stripes – made of road tape – that have been set up from 20 meters before a dangerous intersection. The stripes run across the road, like a zebra crossing with slim bands, but the gaps between the stripes are gradually reduced. The distance goes from 2 meters, down to almost half a meter. But as it is gradually narrowing down, our mind does not understand the difference, and instead registers it as an illusion of speed. And illusions persist even if we know that they are fake. So, we think we are going faster than we really are and will therefore naturally slow down.

The nudge has been tested over time, both in Sweden and in the Netherlands, and leads to an excess speed decrease that's on average 3-7% depending on the location. Twice as many cyclists slow down a safe amount when the nudge is installed, compared to when it's not. The reduced speed over the distance leading up to the intersection results in a larger timespan in which drivers and cyclists can spot one another – and in turn reduce the amount of accidents.

Acceptance from cyclists has been found to be very high – both in pre-studies as when being put up in actual commuting traffic. More than 9 out of 10 cyclists appreciate having the nudge in front of dangerous intersections, where it makes sense to approach with a lower speed. The re-maining 1 out of 10 does not dislike it per se, but is without exception disapproving because they did not understand the purpose and therefore found it unnecessary.

Pre-studies have found that the cyclist-nudge is sometimes seen, and sometimes not – the effect on speed is still the same. More or less, it acts on our subconscious minds, leading to a larger potential in the long term. This shows that the illusion works without being overly prominent. Indeed, it has been found not to draw any attention to the lines themselves but instead preserving cyclists' attention on the surrounding traffic.

As the nudge is very simple to build – made of flat road tape, that can be permanently attached to a road without any machines – it is also very cost-effective. In about 20 minutes, it can be up and running. It's not surprising that this simple but effective measure has attracted attention from stakeholders of cyclist safety. It's after all a soft measure that not only makes traffic safer but is also appreciated by people.

As long as the nudge is put up where it really makes sense, to build a sustainable future where biking is safe and better prioritised, the effect is nothing but positive. And in the end, that is what nudging is all about – helping people to make a better choice for themselves, for others and for the future.

Pulling drivers' attention to the right place

When there's lot of things happening around the road, it could be difficult to prioritize what is important to consider and not. Technology can help us detect potential issues, and a nudge can then help us redirect our attention to where it needs to be. MeBeSafe have developed a nudge that increase drivers' attention in 6 out of 10 times.

Attention is a strange phenomenon. Sometimes you have a lot of it to spend, and sometimes you've almost totally run out of it. And your attention could be divided between internal matters; such as what to have for dinner; as well as external factors; such as people walking along the sideway when you're driving.

The process of attention happens within the brain, and it's notoriously hard for somebody else to know where you have placed it. So, nobody can actually make sure that you focused your attention right where it should be, such as on a cyclist about to bike out in front of your car. One of the MeBeSafe nudges set out to help you focus on that cyclist – but how could we know if something as abstract as your attention has actually changed?

One strong indication that you are aware of something is that you're looking at it. But it's impossible to know if you actually process that information consciously, or if your eye simply happens to rest at that place. The longer you look, the more likely it is that you have actively spotted something. But while you're in traffic, there are always numerous other things you have to look towards as well. So, you don't necessarily have to look at something for a long time to notice it.

A potential effect of noticing the cyclist could be that you slow down more to make space for them to pass or mitigate the effects of an impact. But slowing down is not always necessary, if the cyclist already will manage to pass safely. Then you just need to keep track of them. So to know which people have reacted, you need to know both the amount of time looking in the right direction as well as amount of speed decrease. This will capture both potential outcomes; watching the biker for a long time to see if you need to react; or directly spotting it and deciding to slow down.

MeBeSafe developed a nudge that is shown as a symbol in the head-up display. It looks like a stylized intersection and is placed in such a way, close to the windshield, so that the driver see it in their immediate

peripheral view when they are looking at the road The closer the driver gets, the larger the symbol becomes. And the more critical the situation gets, the more red the symbol becomes. The symbol turns up when the driver is 6 seconds away from the intersection where a cyclist might cross, to make them aware and anticipate potentially crossing cyclists.

Over this time period, the ideal direction in which to look will change. When you're far away, you don't need to look so much towards the side to see the potential risk area as when you are very close – when the cyclist is directly to your left or right. It's all about the perspective. MeBeSafe calculated the necessary viewing angles and used this for the evaluation of the gaze. When it comes to the speed, measuring is naturally much more straight-forward. A lower speed would indicate that you've reacted.

22 participants were recruited to come and drive an encounter-prone route in Eindhoven in a nudge-equipped car. The nudge was activated for the whole ride, but at a few locations it also indicated that something was approaching when there in fact was nothing there. And at some other locations, it didn't activate, although it could have. This made it possible to compare the effects of the nudge, to see if it was the nudge and not the approaching intersection per se that drove the attention.

And very well indeed, it was found that drivers overall spend more time looking towards the potential hazard. 56% of the drivers looked more in the correct direction and 64% decreased their speed.

It's worth noticing that very short glances towards the dangerous direction could be enough for a driver to get aware and slow down. These so-called micro-glances could however not be captured with the cameras used in the field trial. There's still more exciting research to be done, but the results have so far shown the promising future of having such a nudging system in addition to current advanced driver assistant systems.

Today, the nudge-system is developed to support a human driver. With such a measure, drivers will be notified well ahead and have enough time to react – thereby preventing accidents from even getting close to happening. But in a future with self-driving cars, the underlying systems detecting cyclists and predicting their behaviour, often based on artificial intelligence, will be essential for a safe performance of such automated driving functions. Together with the other measures developed by MeBeSafe, this is an important step in the grand mission of making traffic safer – with proactive measures that remove accidents before they even were thought of.

Trust in truck drivers to coach themselves

MeBeSafe have invented a novel concept on self- and peer-to-peer coaching for truck drivers to drive more smoothly. Although Covid-19 made it impractical to evaluate the effect, drivers have been found to accept and trust the concept. The heart-warming response might hint at great potential.

The coaching measure will empower truck drivers in becoming even better at driving than they already are. Truck drivers, who regularly drive long-distance shifts for hours on end along main roads, are without a doubt already experts on driving. And if it's possible to make truck drivers better, there's potential for increased safety also for other types of drivers through coaching.

When out and about on the road, smooth driving helps drivers avoid potential accidents. It combines modest acceleration with anticipated braking, which helps drivers increase the grip on the road and maintain control when driving. This will in turn increase safety and comfort for all road users.

The measure provides coaching via a mediating app, that on the one hand collects and displays driving insights in terms of a smoothness-score, and on the other suggests when two peer drivers could meet and discuss their driving. The app will then propose relevant topics to help the peers get started, but they are actually not mandated to talk about them for the peer-to-peer coaching to have an effect. The discussion in itself between peers could arguably be a catalyst to stimulate insightful reflection upon driving habits. This is in essence trusting the truck drivers. Senior researcher Saskia de Craen from Shell, who has been part of the development since the very start, states that this way of empowering the drivers is really the strength of this measure.

"Everyone that we have spoken to is very enthusiastic about this concept!" Saskia proclaims, *"There are many apps that collect data on driving behaviour, but our focus on empowerment is new and drivers seem to like it more than existing systems that tend to focus on monitoring."*

Indeed, the feasibility of delivering peer-to-peer coaching in trucking companies is affected by the willingness to adopt the measure. During the field trial, the app was introduced to 33 truck drivers in the UK and Norway.

Followed by a few bugs in the app and an omnipresent pandemic that limited everyday life and made peer-to-peer coaching unthinkable, the drivers of course stopped using the app. Except they didn't. The drivers in fact kept using it, recording journeys and collecting insight for themselves, and showed an ever-present loyalty and acceptance of the app despite not being able to meet up and coach one another.

"Acceptance is equally important as the effectiveness of a system in changing behaviour" Saskia explains, *"Because if no-one wants to use it then you're done. It's like intelligent speed adaptation, we've known for fifteen years that it is one of the most effective tools to save lives, but no-one wants to use it ✱."*

Although MeBeSafe, due to the imposed restrictions in response to Covid-19, hasn't been able to interpret the effects that peer-to-peer coaching has on driving behaviour, the good reception among truck drivers really prompts interest of what the results could have been. Further research is needed to definitively say anything about effects, but then again, with the response from the truck drivers it's natural to expect good results.

"We really believe that it could work", Saskia emphasizes, *"and I have hopes for a potential follow-up on all the valuable knowledge we've gathered in MeBeSafe"*

Seen the MeBeSafe movie?

volume 5, November 2020

We know it. It's hard to read and take in all that amount of information. It's much easier to get it delivered in a film. MeBeSafe listened to you and made an infotainment movie about the project and what nudging is.

MeBeSafe

http://bit.ly/MeBeMovie

PSST! HERE WE ARE,
BEHIND
THE SCENES!

MeBeSafe (ika, RWTH)   Olaf Op den Camp   Bram Bakker (Cygnify)   Mikael Ljung Aust

Breakout Session II:
In-Vehicle Nudges

MeBeSafe held a DIGITAL Final Event

No pandemic could keep the first European traffic nudging project from spreading its results. MeBeSafe readjusted their final event to the world wide web where the results were presented the public, with an even better outreach than anticipated.

The results from the MeBeSafe project are quite remarkable. That traffic can be made safer without additional rules or hard smacks is a novel concept. It's not surprising that the Final Event attracted people from all over the world, tuning in to hear how this could be done in reality.

Local government, Members of national parliaments, EU parliament MEPs, road safety advocates, researchers, companies interested in road safety – they were all there to listen and take the shared knowledge with them to use in their everyday life. Such an outreach would never have been possible before the dramatic covid-induced rise of digital communication platforms.

From ika, SAFER, Shell, TNO and Volvo Cars – the audience got to hear each measure leader explain how each measure was planned, constructed and tested together with the effect it had on people's behaviour. After each session, they also got to engage with the researchers and a lot of curious questions were raised. To

conclude the event, everyone also got to know more regarding how many lives and accidents the measures could possibly save each year, according to the impact analysis lead by VUFO. And the numbers are remarkable.

But the most remarkable thing is how the measures of nudging and coaching have moved road safety from being more or less reactive – attending to a problem when it has already happened or is due to happen – like safety belts in case of a crash or automatic emergency car braking in case a pedestrian falls out in front of you on the road. MeBeSafe have shifted the dialogue of road safety from reactive solutions to instead prevent risky situations from happening in the first place.

Without a doubt, MeBeSafe is paving the new road ahead and making traffic proactively safer. Instead of mitigating risky situations when it might already be too late, MeBeSafe is introducing novel ways to remove the danger altogether.

The impact of MeBeSafe

How much difference nudging can make

The nudging and coaching measures of MeBeSafe have been found to work. They are truly proven to make road users behave better in traffic. But what does this mean in reality? How much does a certain speed decrease mean in terms of saved lives? MeBeSafe set out to get an answer of the final impact of MeBeSafe.

It's one thing to measure the direct effect of a certain measure. A difference in average speed, average braking or how much a certain function is used. These are all measurable. And by measuring it before building a nudge as well as when the nudge is there we can get a number on how much it could change.

Such direct effects are fairly straightforward to deal with. But there are also secondary effects on a larger level. How many lives could be saved by the nudges and how much money could the society save? These effects are much harder to get a number on.

Accidents are fortunately not so common that you will run into one during a test run of a nudge. And even if you somehow would, they would be so few that the random chance has a much larger impact than the nudge itself. Somehow you need to relate the behaviour you know has changed to the behaviour that is actually causing accidents – and by this estimate if the change would mitigate some of the accidents. This was an important task set out for Johann Ziegler from VUFO to see what MeBeSafe could really mean.

The German state has long been good at collecting and storing road safety information, and there is nowadays a huge database on road safety. More than 2000 accidents are added each year, and include a lot of contextual information about each of them. Accidents related to what MeBeSafe's measures aim to change were found, and these were assessed one-by-one. The governing question was how large the difference in behaviour would have to be to make sure the accident never happened.

For example, how much slower would the car have had to go for the injured cyclist to escape from the car's path? Or how much would it have had to slow down to make an actual stop? These figures were calculated and compared to the behaviour that was found by the nudges, taking the variance into account. And the assessment had to include how common the nudges might get in the future; because not everybody or every place will have them. Nudges within cars might only exist in certain brands, and everybody will not have bought a new car recently.

This naturally leads to a large degree of uncertainty. To make up for all the unknown variables, two scenarios were calculated. One was a worst-case scenario, with very little implementation and use. The other was a best-case scenario, with a large-scale implementation. The real figure will then be somewhere in between these. Not higher, but also not lower.

The figures indicate that somewhere between 150 and 500 lives per year could be saved in the EU 2030, and somewhere between 21 000 and 65 000 injuries prevented. By estimating the most likely spread, use and effect of each measure, it's also possible to get a most likely estimate within this span. In 2030, it is most probable that the MeBeSafe measures will save 366 lives and, eliminate 40 000 injuries. On a societal scale, this could lead to saving of 3.3 billion euros. Per year.

The abstract results in speed decreases and looking to the left and right suddenly become something tangible. The nudges as they are today could very well be implemented and lead to this tremendous impact on traffic safety. But they could at the same time also be further researched and refined, to find new modifications that make them stand out even more – or in which locations they make most sense. The MeBeSafe project is the first EU project focusing on nudging and making use of nudging in traffic.

The MeBeSafe torch has now been lit, and the fire it started will hopefully continue to burn and inspire future research in the novel concept of nudging to make traffic safer.

MeBeSafe's guide
on how to make traffic safer
WITH NUDGING AND COACHING

If you want to go out and develop a nudge yourself, it requires you to know what a nudge is. Before MeBeSafe, nudging was largely enclosed within economic settings, making it necessary for the MeBeSafe project to create a framework adapted to a traffic-safety setting. And the framework is now readily available for anyone to learn and develop upon.

Originally an economic concept, nudging is about influencing the behaviour of people while requiring as little cognitive effort as possible on their part. You are without a doubt familiar with how certain products (e.g. candy) are placed closer to the cashiers in grocery stores. This makes it more likely for you to buy these products as you are about to exit, but you are however not forced to do it. This particular case is called a sludge – as candy might not be good for your health. If we instead place healthier options (e.g. fruit) it becomes a nudge.

Within these market settings, one would argue that behavioural influence is well defined and widely used. In a traffic-safety setting, it is however not – at least not intentionally (see page 11). The purpose of the MeBeSafe project has therefore been to evaluate the feasibility of soft measures – like nudging and coaching – in the context of traffic-safety. It is however not an easy feat. For one, it's necessary to redefine the purpose of nudging. MariAnne Karlsson, senior researcher in design and human factors at Chalmers University of Technology and a main figure in the development of the framework, explains.

"Our biggest challenge, and now accomplishment, was to define what nudging is when we are speaking of traffic safety. There are cases where nudging has been adapted to different contexts, but they were about completely different things than traffic safety" MariAnne Karlsson states. *"There was quite little to build on except the general nudging theory, but our framework is definitely something I think that can benefit other traffic safety researchers and solution makers."*
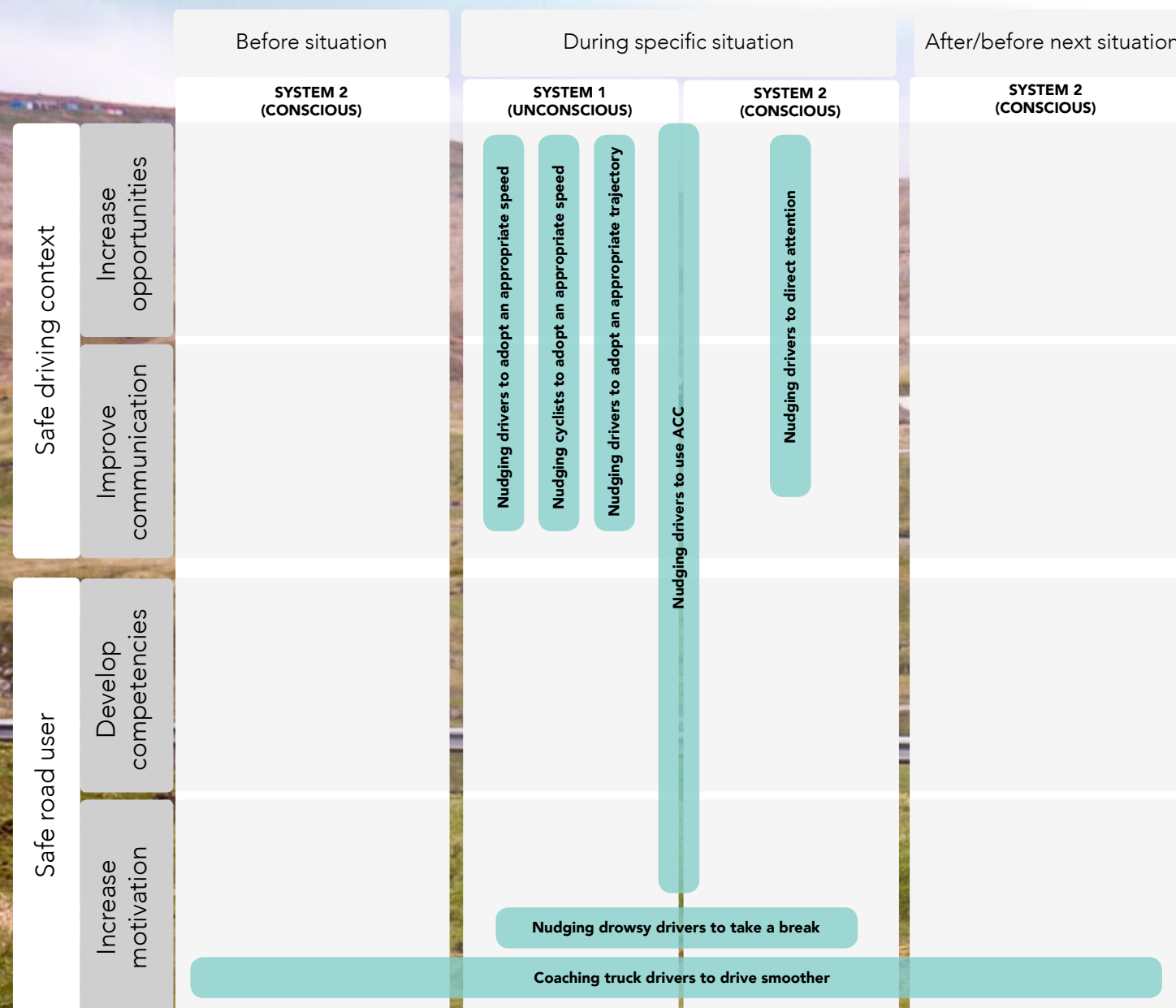
Nudging can influence people's behaviour in a predictable way without forbidding any options. This predictability is highly attractive in a traffic-safety context, as predictability is what infrastructure is mainly intended to accomplish. For example traffic lights to increase the anticipation of each other's actions, and road markings and signs to inform what kind of vehicles are expected and actions are allowed. MeBeSafe consequently adapted nudging to entail decisions that increase safety for both yourself and others.

The finalized MeBeSafe framework consists of several tables that support a nudge-designer to find an appropriate approach to deal with a traffic problem of their choice. It does not provide straightforward specifications, as that would be impractical; Although a specific nudge design works in one kind of situation, it doesn't necessarily work in another kind. A crude example of this is the actual "nudge" per se; you can nudge someone on their back so they will not get hit by a falling object, but if you nudge on their back on the top of a staircase, that person will certainly risk having an accident. Same nudge, but different situations.

The framework supports you step-by-step in finding out what aspect of three tactics you should approach your selected traffic safety problem with (see table at next page). Firstly, the measure should either trigger a conscious or unconscious decision. Is the traffic safety problem an unintentional error or intentional violation? The former could be exemplified by a habitual speeding behaviour that you as a driver are unconscious of, and the framework then suggests creating a nudge that triggers an unconscious decision that supports the driver in overcoming habitual speeding.

Secondly, the measure should enable safer road users by increasing their abilities or enable safer road context by altering the infrastructure. The questions here are whether road users are able and willing to adopt a safe driving behaviour, or the driving context is supporting road users to adopt a safe driving behaviour. The latter

		Before situation	During specific situation		After/before next situation
		SYSTEM 2 (CONSCIOUS)	SYSTEM 1 (UNCONSCIOUS)	SYSTEM 2 (CONSCIOUS)	SYSTEM 2 (CONSCIOUS)
Safe driving context	Increase opportunities		Nudging drivers to adopt an appropriate speed · Nudging cyclists to adopt an appropriate speed · Nudging drivers to adopt an appropriate trajectory	Nudging drivers to direct attention	
	Improve communication				
Safe road user	Develop competencies		Nudging drivers to use ACC		
	Increase motivation		Nudging drowsy drivers to take a break		

Coaching truck drivers to drive smoother

The power of nudging specifically is that it can influence the decision-making of individuals and groups as effectively – or more – than instructions, legislation, or enforcement. As with everything, more research is necessary to further develop an understanding of how to better adapt soft measures like nudging to make traffic safer.

The many examples of soft measures produced by MeBeSafe will work as a good foundation. In essence, what this means is that traffic is intently designed in order to create the predictability that enables road users to naturally make better decisions for themselves and others.

could imply a poorly designed crossing where accidents occur regularly and would suggest a redesign that lessens this occurrence.

Thirdly, there's a need to determine whether the measure should be implemented prior to, during, or after a specific dangerous situation. Nudges can address behaviour at the specific traffic situation. Coaching, although not nudging, has been integrated into the framework to address behaviour related to a traffic problem prior to, during or after an event.

Lastly, the framework suggests plenty of intervention strategies (e.g. "Simplify in-

formation to reduce the driver's cognitive burden in a specific situation") which you are instructed to combine into an intervention concept. It's good to remember that any traffic safety problem can be addressed from multiple angles and that the framework supports in finding **a** solution and not **the** solution.

"Our framework provides intervention strategies, and questions that systematically lead you to a better approach," MariAnne Karlsson explains. *"Since exact specifications are unrealistic, we stress that it's necessary to ask these questions and then reason yourself forward based on your answers."*

The framework is readily available at the MeBeSafe website (bit.ly/MeBeFramework) with a smaller quick guide here (bit.ly/NudgeFramework)

DID YOU KNOW?

If you've ever pondered why the MeBeSafe logo is an elephant behind a car, the answer lies in the cover of the book *Nudge* by Richard H. Thaler and Cass R. Sunstein, which introduced nudging. The cover refers to how elephant mothers are nudging their calf in front of them, so they go in the right direction. Respectively, MeBeSafe want road users to go in the safer direction.

Nudge

© Thaler and Sunstein

The voices of MeBeSafe

I'm proud to see an idea that started on paper, for the first time in action in a live environment and the system is interacting with each individual driver. I've learned generally that we can improve traffic safety with nudging. Over time we will see more different nudging solutions in the infrastructure based on the research done within MeBeSafe to increase traffic safety

Vincent de Waal
Heijmans

This is one of the first projects in the relatively new field of nudging, where we tried to convert theory into practice. I hope we proved that nudging can be successful in changing behaviour, and more creative applications will follow. Resilience is crucial competence when running a project within an ever changing multinational, but also when conducting a field test during a worldwide pandemic.

Saskia de Craen
Shell

In my opinion MeBeSafe is the initial step to introduce nudging measure on a broader scale for improving traffic safety. However, many more steps have to follow. It's a great experience to have worked in a great, dedicated and efficient team for more than 3 years. I'm so proud of the delivery of our results ... obviously!

Felix Fahrenkrog
BMW

MeBeSafe have shown that human behaviour in traffic can be influenced by smart nudging. People react and adapt their behaviour mostly to the better. It's interesting to see that some measures, with minimal effort, encourage road users to rethink their behaviour. Psychological approaches combined with technical expertise led to a successful combination in the MeBeSafe project to make the roads in Europe safer for the future.

Johann Ziegler
VUFO

CRF are very proud of making driver attention sensor work and measuring the visual driver behavior. This allowed us to understand the positive impact of MeBeSafe nudging HMIs respect to the driving without the HMI. The multidisciplinary approach followed since project proposal preparation has been very successful, because has allowed to have a complete and interdisciplinary view on the new challenge topics

Antonella Toffetti
Centro Ricerche Fiat

FCA are very proud of the multimodal approach used for the final experiment on the hazard models. Notwithstanding the Covid-19 restrictions the right division of the rules allowed TNO and Cygnify to complete the tests in time. The use of nudging concept coupled with HMI is to be pursued in the future to guarantee a higher safety without only alerting/warning drivers but using also gentle information to modify behaviours

Anita Fiorentino
Fiat Chrysler Automobiles

A core message is that it is possible to help drivers behave safely in traffic by nudging (and coaching) them towards safer behavior. Bringing ideas and developments from the lab to the field and showing that they work there as well is the first part of MeBeSafe's accomplishments.

Anna-Lena Köhler
ika, RWTH Aachen

EU is not only about having a strong European position in the global world to live and protect European values, but also about advancing research, technology and innovation together. The challenges of our time cannot be solved alone, they require global solutions. In MeBeSafe we were fortunate to have such a wonderful consortium that lived up to this.
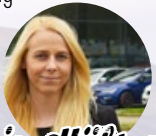
Kathrin Hülsen
ika, RWTH Aachen

We have had the right mixture of great people in place to set up, work on and successfully accomplish challenging objectives using a broad variety of tools, reaching from paper and pencil work, over simulation activities to real life testing. As I can now look at the project, it becomes obvious that interweaving human factors, IT, engineering and further specialists turns out to be a winning approach.

Stefan Ladwig
ika, RWTH Aachen

With nudging we can proactively make accidents less prone to occur, instead of only relying on reactive measures. I now find it self-evident that we should construct and reconstruct our environment until healthier and safer behaviour naturally become the default. The MeBeSafe legacy is redefining of what nudging is and could be used in a traffic safety context.

Cedrik Sjöblom
Chalmers University of Technology

The MeBeSafe project really showed how nice and effective good teamwork can be. And I'm really proud of the many things we developed which improve traffic safety. This will hopefully lead to safer roads.

Dario Niermann
OFFIS

MeBeSafe have successfully demonstrated that nudging is an effective method to support road users in behaving safely in traffic and hence, to diminish risky situations thereby providing enlarged safety margins. The legacy of the project is the great potential of a scientifically well-investigated measure for higher safety to be implemented in real-world traffic.

Sabine Bertleff
ika, RWTH Aachen

I learned that nudging is unintentionally incorporated in bicycle infrastructure all the time, and that nudging measures therefore needs to be very carefully designed in order to have the desired effect. I think that MeBeSafe really has been able to put nudging on the map for people working with traffic safety and that we will see nudging being considered a viable solution when designing new bike infrastructure .

Pontus Wallgren
Chalmers University of Technology

MeBeSafe showed me the importance of a multi-disciplinary approach to the development of new knowledge on traffic safety! It also showed the importance of involving road user - in our case bicyclists - is in the development process of measures! The final legacy of MeBeSafe will hopefully be that impacts can be achieved with small means!

MariAnne Karlsson
Chalmers University of Technology

MeBeSafe have really shown that collaboration across the borders is very important to achieve good results! And it's been a great collaboration! MeBeSafe have more than anything before highlighted the importance of using behavioral science to prevent accidents and save lives on the roads.

Ruggero Ceci
Swedish Transport Administration

In MeBeSafe I've truly learned of the importance of controlling for the influence of traffic environment when measuring driver behaviour, and how to do this. It was a great collaborative effort and I'll always remember all the fun we had.

Anders af Wåhlberg
Cranfield University

As an engineer, I learned a lot about psychology and how important it is in traffic. The best experience was probably when I was first nudged myself in the actual motorway exit. At that moment I was finally convinced that this measure could actually work to slow people down and to make traffic safer.

Moritz Berghaus
ISAC, RWTH Aachen

The legacy of MeBeSafe is not only the specific nudging measures. Equally important are the demonstrations of proof of principle. That is, the demonstration that nudging can work effectively in the context of traffic safety and intelligent transportation systems. Which can, and in my expectation will, serve as inspiration for a lot of future work.

Bram Bakker
Cygnify

I want to believe in people, and give them the ability to make their own choices about their own lives. Nudging is the ultimate compromise between letting people decide themselves and helping them to do it in a good way. MeBeSafe truly demonstrated that this is the way to go.

Victor Bergh Alvergren
Chalmers University of Technology

This is only a small part of all the great people who have contributed to MeBeSafe.

They have all been very important - and MeBeSafe would never have reached this far without all the wonderful persons involved.

Follow MeBeSafe on social media!

@ mebesafe

MeBeSafe   MeBeSafe

Measures for behaving
Safely in traffic MeBeSafe   MeBeSafe

mebesafe.eu

Read our previous newsletters

mebesafe.eu/newsletter