

D3.3 Toolbox of recommended interventions to assist drivers in maintaining a Safety Tolerance Zone.

The i-DREAMS project aims to set up a framework for the definition, development, testing and validation of a context-aware safety envelope for driving called the 'Safety Tolerance Zone'. The conceptual framework of the i-DREAMS platform integrates aspects of monitoring (such as context, operator, vehicle, task complexity and coping capacity), to develop a Safety Tolerance Zone for driving (see part A in Figure 1). Real-time (in-vehicle) interventions and post-trip interventions will help to maintain the Safety Tolerance Zone and provide feedback to the driver (see part B in Figure 1).

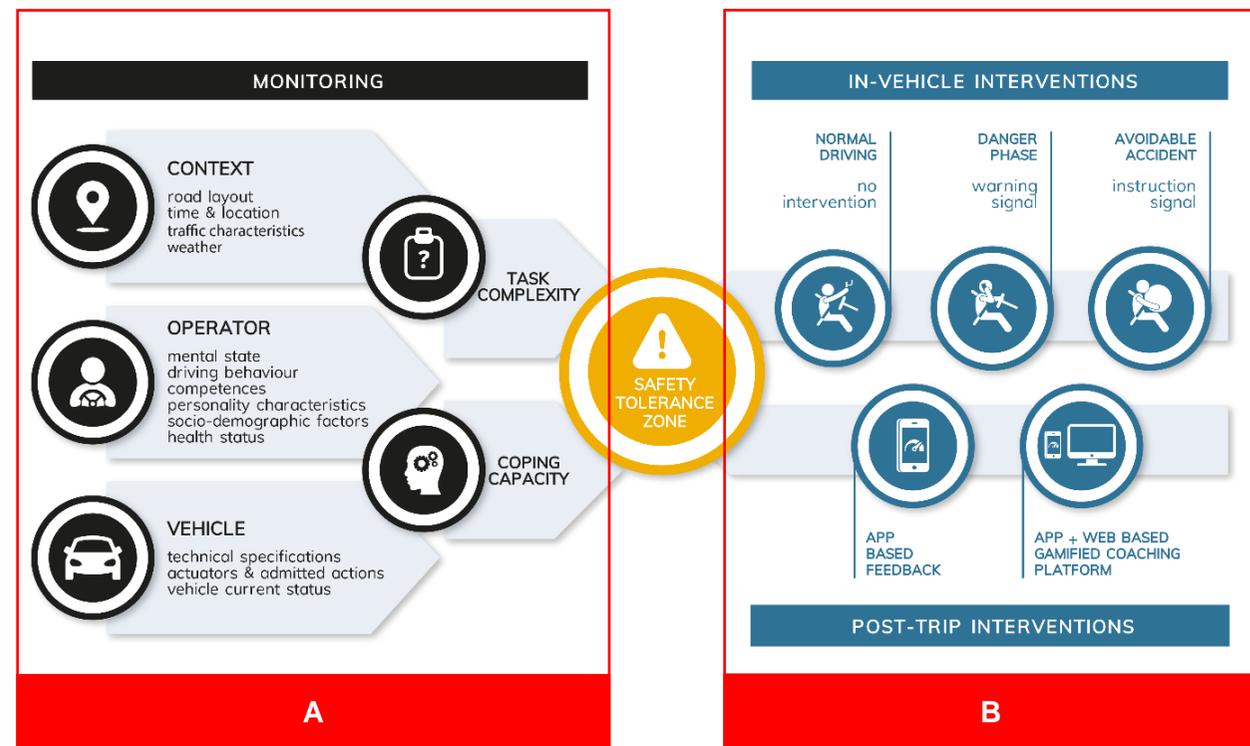


Figure 1: Conceptual framework of the i-DREAMS platform



This conceptual framework will be tested in simulator studies and three stages of on-road trials in Belgium, Germany, Greece, Portugal and the United Kingdom with a total of 600 participants representing car, bus, truck, tram and train drivers.

The main purpose of this deliverable is to explain how exactly the real-time and the post-trip interventions provided by the i-DREAMS platform are operationalized. The more specific goals are:

- To identify the objectives targeted by the real-time and post-trip interventions.
- To select methods for behavioural change which are appropriate to achieve the objectives targeted by the real-time and post-trip interventions.
- To identify critical parameters for the way in which the selected methods will be practically applied in the real-time and post-trip interventions.
- To translate the selected methods for the real-time interventions into material designs (i.e. front-end) that take the critical use parameters into account.
- To translate the selected methods for the post-trip interventions into gamification mechanisms and features (i.e. front-end) that take the critical use parameters into account.

To better understand what deliverable 3.3 is all about, we interviewed Prof. dr. Kris Brijs, author of the report. Kris, the focus in this report is on the operationalization of the real-time and post-trip interventions. Can you explain what those are?

KRIS BRIJS: “Of course. Real-time interventions are meant to assist and support drivers while driving, so in the vehicle. Post-trip interventions are not operational while driving, but they are based on what happens during the trip. All the raw data that we collect during a trip with the i-DREAMS sensors are further processed and fused into information about a driver’s driving style, how it evolved during a trip, how many safety-critical events occurred and in which circumstances these events happened. This information is then further translated into feedback that can be consulted by drivers via an app. In the case of driving companies, like truck companies or bus companies, we also added a web dashboard in the mix. This dashboard is a web-based coaching platform, containing gamification features, meant to provide company coaches with information to help motivate drivers to drive safely and to further improve their driving style.”

How do these interventions relate to the Safety Tolerance Zone that i-DREAMS is focussing on? What I mean is: how do these interventions make sure that a driver remains in the STZ?

KRIS BRIJS: “The real-time interventions do that in a different way of course than the post-trip interventions. The real-time interventions have an active role during a trip. Depending on how imminent crash risks are, a distinction is made between a ‘normal driving’ phase, a ‘danger’ phase, and an ‘avoidable accident’ phase. In the normal driving phase, no abnormalities in driving style are detected, and there is no sign of a crash going to occur. Consequently, no real-time interventions take place. In the danger phase, abnormal



deviations in the driving style are detected, and the potential for a crash to unfold is present. A warning signal is issued in that case. In the avoidable accident phase, deviations from normal driving have evolved even further, and the risk for a crash becomes imminent if the driver does not adapt appropriately to the circumstances. A more intrusive warning signal supports the driver then to avoid a collision. So, in terms of behavioural change, real-time interventions can be categorized as nudging, while the post-trip interventions align more with the principles of coaching. Whereas nudging is meant to steer vehicle operators' decision-making while driving, coaching occurs after a trip and is primarily meant to empower drivers to take appropriate decisions while driving. So, real-time interventions (nudging) are aimed to manipulate the driving context, while post-trip interventions (coaching) are aimed to manipulate the driver him or herself."

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How did you choose the interventions to manipulate driving context and driver?

KRIS BRIJS: *“That is exactly what we describe in deliverable 3.3 and it is not so easy to summarize. When developing interventions to change behaviour, like in the case of i-DREAMS, numerous choices*

have to be made. These choices revolve around a series of important questions about which interventions work to create behavioural change. For instance: How do you logically assess a road safety problem? How do you get from goals and objectives to intervention strategies? How do you decide which intervention methods to use? How do you link intervention design with implementation? Chapter 3 is completely dedicated to this ‘Intervention Mapping’ like we call it.”

Can you explain what ‘Intervention Mapping’ means?

KRIS BRIJS: *“This is a six-step protocol, providing a vocabulary for intervention program planning, procedures for organizing activities, and assistance in making evidence-based choices in terms of objectives to be targeted, and methods to achieve these. It maps the path from recognition of a need or problem to the identification of a solution, and the evaluation of that solution. Intervention Mapping was used as a roadmap to organize and structure the operational toolbox for the real-time and post-trip interventions.”*

And how will this operational toolbox come about?

KRIS BRIJS: *“As I said, Intervention Mapping will be used as a roadmap to operationalize interventions. The first four steps are described in this deliverable and cover: (1) the logic model of the problem, (2) the logic model of change, (3) the interventions design and (4) the interventions production. The last two steps (5) intervention implementation and (6) intervention evaluation, are covered elsewhere. The results of this exercise will be the operational toolbox.”*





Figure 2: Structural overview of the compartments inside the operational toolbox for the i-DREAMS interventions

What do we find in this ‘operational toolbox’?

KRIS BRIJS: “You can find six different compartments in the toolbox (see Figure 2). The safety outcomes represent the highest level of impact targeted by the i-DREAMS interventions. For example, that can be a reduction of crashes. In order to realize that outcome, the driver will need to perform better in ‘speed management’ (= safety promoting goal). By monitoring the parameter ‘speeding’ (= performance objective) we can see if he/she improves. To help the driver improve his/her speeding behaviour, we will confront him/her with specific real-time and post-trip interventions to target specific behavioural components (= change objectives). An example of such a component is a driver’s psychological capability to do better in speeding. This implies that the driver needs to be mentally ready to adapt speeding behaviour when necessary (= attention) and that the driver needs to know (= knowledge) how to appropriately do that. Real-time interventions will target different behavioural components (or change objectives) than post-trip interventions. In order to maximise the effect of both types of interventions, we will select specific change methods. And lastly, we will translate these methods into practically applicable formats taking into account critical design parameters. Gamification mechanics are used for that purpose.”

You lost me at ‘change methods’ ...

KRIS BRIJS: “OK, I will try to explain it a bit better. Take the ‘speeding’ example. In order for the driver to improve his/her speeding performance, we will try to make him/her psychologically more capable (= change objective) of managing his/her speed performances. It is important that we select the correct methods to do so, and in the case of real-time interventions, we will choose different methods than for post-trip interventions. Real-time interventions will help to influence the drivers’ ‘attention’ and ‘knowledge’. A sensory prompt or cue in the vehicle, each time the driver exceeds the speed limit, will help to attract attention to this issue. The real-time feedback which becomes more intrusive if the driver exceeds the speed limit even further, can create better insight or understanding. Post-trip feedback on speeding behaviour can contain tips on how to improve or can consist of goals a driver can take up to challenge him or herself to improve speeding behaviour. This is what I meant with using different methods to realize a change in one’s behaviour.”



Thank you, that indeed clarifies it for me. In your explanation on what we can find in the operational toolbox, you were also talking about translating methods into practical applications while taking critical design parameters into account. Can you elaborate on what you mean when you talk about critical design parameters?

KRIS BRIJS: *“For the practical application of a theoretical change method to have effect, it is important that you take into account as much as possible the characteristics of the method that will determine its effectiveness. This is what we call the critical design parameters. They will be different for real-time and post-trip interventions.”*

What are the critical design parameters for the real-time interventions?

KRIS BRIJS: *“The success, in terms of effectiveness, of real-time interventions depends on its salience, preciseness and meaningfulness. In other words, the intervention must attract attention, it should trigger a learning process and it should induce the appropriate motivation. This will depend on three specific design features: the display, timing and information. For the display we took into account a bunch of design recommendations from empirical research, applicable standards and design guidelines pertaining to in-vehicle interfaces. For the timing of the messages, we developed an intelligent, dynamic and personalized messaging strategy, based*

on real-time assessment of actual traffic risk levels, as well as driver status and performance, and key-environmental factors. To make sure interventions inform the driver sufficiently, we chose intuitive visuals that can be instantly interpreted by the driver within a very short time window.”

And what are the critical design parameters for the post-trip interventions?

KRIS BRIJS: *“The goal of the post-trip interventions is to support the driver to take good decisions. In order to achieve that goal, four critical design parameters are taken into account. The first one is relating to the fact that people will be motivated differently depending on where they are in the process of behavioural change. The interventions will be different in both quality (what we want to change) and quantity (how much we want to change). Secondly, the GDE-matrix¹ is used as a structural blueprint for post-trip interventions to maximise efficacy, but also to ensure successful adoption of interventions. Thirdly, the post-trip intervention platform will function as an automated expert system that provides support to all the stakeholders involved, thus not only to drivers but for example also to driver coaches and management of a company. And lastly, the post-trip interventions will be internet-based, since this provides the option of delivering sophisticated versions of individualized, computer-tailored interventions. To make sure visitors’ loyalty to an intervention over an extended period of time is guaranteed, a lot of attention goes out to user engagement and retention.”*

¹ GDE-matrix: Goals for Driving Education-matrix that gave direction to the requirements proposed in the EU Directives that regulate the minimum

requirements for obtaining a private car driving license and for initial qualification and periodic training of professional drivers.



Deliverable 3.3 is part of WP3:
Operational design of i-DREAMS

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And with respect to the practical application, how do you approach that?

KRIS BRIJS: *“The principles of gamification and persuasive design will be used to put the chosen theoretical change methods into practice. We will highlight two elements specifically. On the one hand we will propose recommendations on what technology is preferably used, for both the real-time and the post-trip interventions. Although the final selection of the technology will take place later. Final selection of technology for real-time interventions will be revealed in D4.4, for post-trip interventions via smartphone in D4.5 and for post-trip interventions on the web in D4.6. On the other hand, we will propose a selection of gamification mechanics that are preferably used. But here the final selection will also take place later, more specifically in D4.5 and D4.6.”*

What do you think is the biggest advantage of this intervention approach?

KRIS BRIJS: *“For me that is the fact that real-time and post-trip interventions are combined to complement and reinforce each other, despite the fact they represent quite different approaches towards behavioural change (nudging versus coaching).”*

Kris, I found this conversation very enlightening. Thank you for your time and I wish you all the best in the rest of the project.

Edith Donders
i-DREAMS DisCom manager

Researcher in the spotlight



**KRIS
BRIJS**

Graduated as master in Roman Philology in 1999

Employed at Hasselt University since 1999

Passionate about spending time with the kids,
playing soccer, reading a good book

Tasks in i-DREAMS: Development and evaluation
of real-time and post-trip interventions

