

D7.1 Methodology for the evaluation of interventions.

Interview with Ariane Cuenen & Veerle Ross

The goal of the i-DREAMS system is to keep drivers in the Safety Tolerance Zone (STZ). The platform will therefore offer a series of in-vehicle interventions, meant to prevent drivers from getting too close to the boundaries of unsafe operation and to bring them back into the STZ while driving. The safety-oriented interventions will be developed to inform or warn the driver in real-time in an effective way as well as on an aggregated level after going through an app- and web-based gamified coaching platform, thus reinforcing the acquisition of safer driving habits/behaviours.

A methodology for both real-time and post-trip intervention evaluation is developed and presented in deliverable 7.1. In particular, the methodology will attempt to convey all the features and particularities of each one of the interventions examined, and specify the approach with which the effectiveness of the intervention will be assessed as well as if the processes and actions were executed the way they were intended. A variety of methods and study designs is reviewed in order to estimate the safety effects of interventions as efficiently as possible. Furthermore, an appropriate framework for comparing results among different modes and different countries is outlined.

Hello Ariane and Veerle. Nice to meet you! Today we have D7.1 on the table 'Methodology for the evaluation of interventions'. My goal is to discuss the content of this report with you, to give our readers a better insight in the core message of it. So, what exactly did you do in this report?

Ariane: "The key research question we addressed in this report is: Which are the crucial aspects that the intervention assessment methodology should tackle to keep drivers within safe boundaries? In other words: We confront drivers with interventions in the vehicle while driving and with interventions after the trip. To make sure we know what the impact is of those interventions, it was important for us to develop a methodology for assessing these interventions. That sounds self-evident, but it is more complicated than one might expect."

In every deliverable we are talking about these in-vehicle and post-trip interventions. Can you explain in a bit more detail what they entail exactly?

Veerle: "I will gladly do that. Actually, our intervention mechanism is based on the STZ concept, according to which a driver can be in three phases: (1) the normal driving phase, (2) the danger phase and (3) the avoidable accident phase. The goal is to keep drivers in phase 1 of course. To do that we use a combination of real-time and post-trip interventions. Real-time interventions are signals, given to drivers while driving, using an in-vehicle warning system. Post-trip interventions can also be considered as signals, but they are given to the driver after the trip using a smartphone application. In order to increase the impact of interventions on driver safety, both kinds of interventions are combined, since they are complementary."



In what way are they complementary?

Veerle: “Well, with real-time interventions, drivers have almost no time to think about their actions, hence a nudging approach is utilized. In this approach non-conscious thought processes involved in human decision making are activated. With post-trip interventions on the other hand, drivers have time to think about their future actions, hence a coaching approach is used. This approach activates conscious thought processes in human decision making. Thus, we use two mutually reinforcing approaches for behavioural change: the nudging approach to improve driver safety by manipulating the driving context, while the coaching approach aims to improve driver safety by manipulation of the driver himself.”

And how exactly does ‘improving driver safety’ work?

Ariane: “The principles of what we are doing are based on what is called ‘**The logic model of change**’. This model distinguishes four different levels of driver safety that need to be targeted. Level 1 is the highest level, consisting of the safety outcomes (SO). This is the likelihood of a crash occurring. Our goal is to keep this as low as possible of course. The second level consists of the safety promoting goals (SPG). These are the behaviours that need to change in order for the safety outcome to be realized. For example, to decrease the chance of a forward collision crash (SO), it is necessary that the driver shares the road safely with others (SPG).

The third level refers to performance objectives (PO). These are more specific actions or behavioural parameters that need to change in order for the safety promoting goals to be achievable. For example, to improve interaction with other road users (SPG), a driver needs to reduce risk-prone manoeuvres like tailgating (PO). The lowest and fourth level consists of the change objectives (CO). These are the underlying behavioural determinants that need to change for the performance objectives to become realizable. For example, in order to be able to reduce tailgating events (PO), it is important that the driver demonstrates the ability to maintain a safe headway distance (=CO) at all times.”

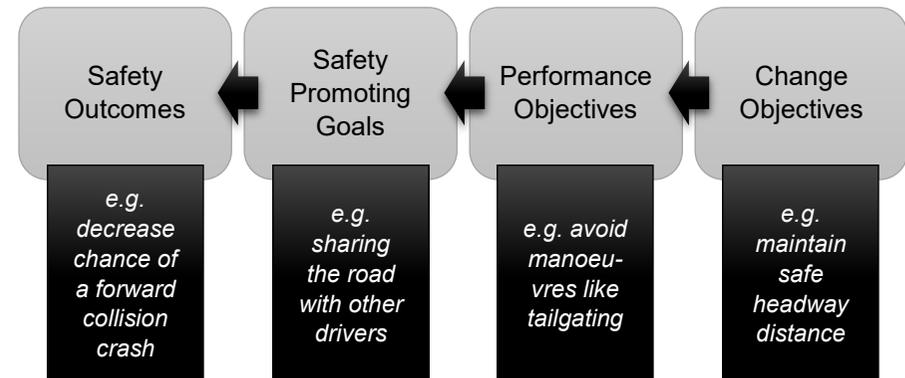


Figure 1: Illustration of how the logic model of change is applied in i-DREAMS



So, if I understand correctly, the change objectives are the aspects you are trying to influence with the real-time and the post-trip interventions?

Ariane: *“That is correct! And these change objectives are based on components from the COM-B model that focuses on Capability, Opportunity, Motivation and Behaviour. The central tenet of the model is that for any behaviour to occur, one or more of these three concepts are required.”*

OK, so how do I understand this? Am I correct if I say that in order for me to show a specific behaviour, I need to be capable to do so, have the opportunity to do so and be motivated enough to do so?

Veerle: *“Yes, that is exactly right. But if you don’t mind, I would like to go a bit deeper into that and explain how we work with that.”*

Please, feel free!

Veerle: *“Well, capability is a person’s ability to perform a certain behaviour or not. It has two dimensions: psychological and physical capability. Opportunity refers to whether there is something that enables or prevents a person to perform a certain behaviour or not. Here we also distinguish two dimensions: physical and social opportunity. And social opportunity then of course has to do with interpersonal influences, social cues or cultural norms. Motivation relates more to a person’s willingness to perform certain behaviour or not. And no surprise there, again two dimensions are distinguished: automatic and reflective motivation.”*

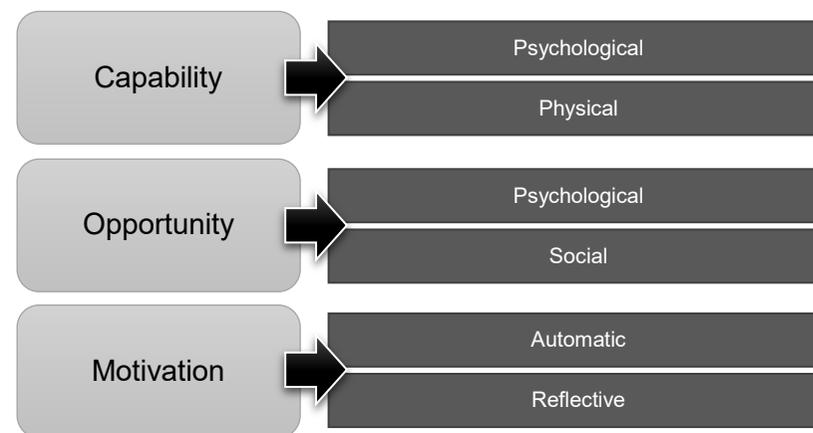


Figure 2: Components of the COM-B model

OK, but where are you going with this?

Veerle: *“What I want to explain is that both for the real-time as well as for the post-trip interventions we identified which of the COM-B model components are relevant and we translated those to determinants that we will target with our interventions. With our real-time interventions we will target determinants such as attention and understanding (= psychological capability), circumstances that discourage undesirable behaviour or encourage desired behaviour (= physical opportunity), and emotions and punishment sensitivity (= automatic motivation) to initiate immediate action whenever required. Post-trip interventions will target drivers’ knowledge and implementation intention (= psychological capability), the skills to master specific behaviours (= physical capability), determinants such as attitude and goals (= reflective motivation), punishment and reward sensitivity (= automatic motivation) and group identity to facilitate desired behaviour (= social opportunity).”*



It is clear to me how you want to create an effect, but then the essence of this deliverable is that you determine how you will evaluate that what you are doing has an effect or not. Can you explain how you will do that?

Ariane: “Actually, Figure 3 illustrates the model that we eventually decided to use for the evaluation of interventions. Of course, we studied many different models and methodologies, but the RE-AIM model was the one with the best fit for i-DREAMS.”

That looks very impressive, but can you explain what I am seeing in this figure?

Ariane: “Yes, of course. Well, first, the abbreviation: RE-AIM stands for ‘Reach, Effectiveness, Adoption, Implementation and Maintenance. Those are all components that we take into account when assessing our interventions, both the in-vehicle as well as the post-trip interventions. ‘Reach’ is the absolute number, proportion and representativeness of individuals who are willing to participate in a given initiative. In i-DREAMS we aimed for 600 participants for testing of the interventions in cars, buses, trucks and rail modes and this in 5 different countries. During the evaluation process, we will check if we succeeded in meeting this ambition. ‘Effectiveness’ is the impact of an intervention on outcomes. This is where our outcome evaluation needs to be situated. Here we will check whether our interventions have an effect on the different outcome levels of the logic model of change. ‘Adoption’ is the absolute number, proportion and representativeness of individuals who are willing to initiate a program. I realize that this sounds a bit abstract, but for i-DREAMS it comes down to how many participants that started our experiments actively participated in every step of the intervention. For example, those who never identified themselves on the display in the vehicle after starting the experiment, could not be considered as active participants. ‘Implementation’ refers to the intervention agents’ “fidelity” to the various elements of an intervention’s protocol. This includes consistency of delivery as intended and the time and cost of the intervention. This is the place in the model where we can situate our process evaluation. Here we

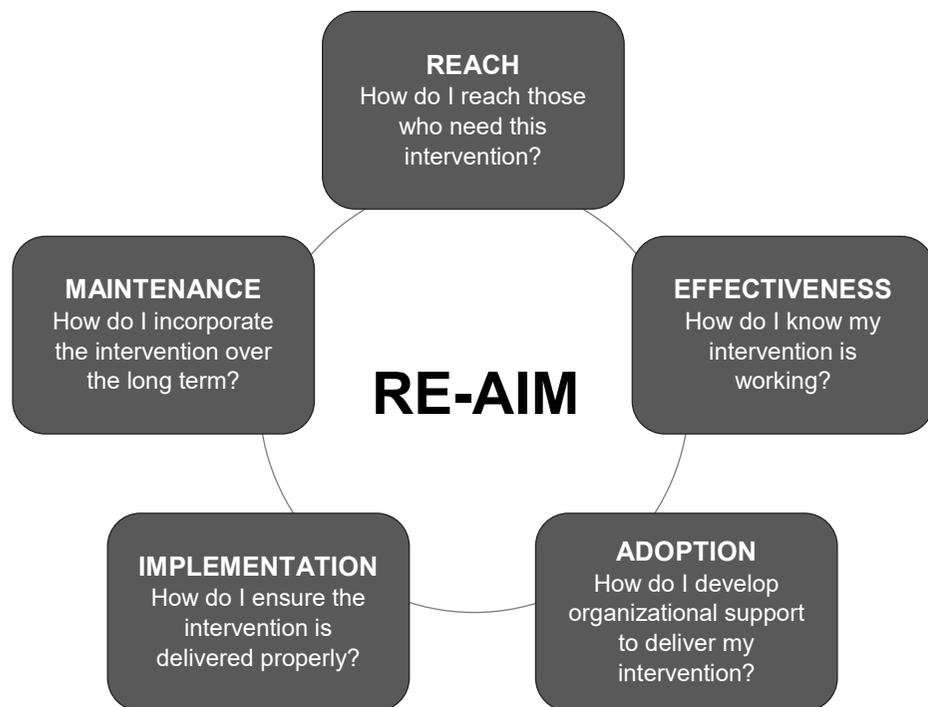


Figure 3: The RE-AIM model



check if all the processes and actions were executed the way they were intended. If that were not to be the case, then of course that would have an impact on the effectiveness of the interventions. And then lastly, 'maintenance' is the extent to which something becomes institutionalized or part of the routine organizational practices and policies. At the individual level, maintenance is defined as the long-term effects on outcomes 6 or more months after the most recent intervention contact. Within the context of the transport companies that participated for example, the company's safety culture might play a role here. A company with an already embedded safety culture will probably succeed better in adopting and implementing the i-DREAMS system and the system will most likely be more effective there, since the safety culture already present, creates a positive context within which the experiment can take place. But also, on the individual level, if you are someone who highly values road safety, the system will probably have better results with you than with someone who doesn't care about it."

Veerle: "I would also like to add to that. This RE-AIM model is the framework that we work in. How we actually do everything in each step, might be a bit complicated to elaborate on. Nevertheless, there are a few things I would like to emphasize. For the outcome evaluation, located mainly in the 'effectiveness' component of the RE-AIM model, we mainly use the collected sensor data and data

from the entry and exit questionnaires. And as Ariane already explained, the outcome results depend on how interventions are implemented and executed. That 'how' focus is the process evaluation, situated mainly in the 'implementation' component of the RE-AIM model. We use three sources of information to get a good insight in that process: (1) the results from our helpdesk that made an inventory of all questions and answers and solutions that were reported, (2) the results from specific questionnaires where we asked how clear, user friendly, attractive, useful, etc. the technology was and (3) objective use indicators such as number of app opens, clicks, etc. I really want to emphasize how important it is to understand that the conclusions from the process evaluation might have an impact on the outcome evaluation. So, I guess, what I am trying to say is that if you want to know if our interventions were effective, you will not find a clear answer in the numbers alone, there is much more to take into account."

OK, thank you ladies. This report was not easy to wrap my mind around, but talking with the both of you, really clarified a lot for me. I hope to meet you again later, but for now I wish you all the best!

Edith Donders

i-DREAMS DisCom manager



Deliverable 7.1 is part of WP7: *Evaluation of safety interventions*

[Download the report here](#)

Researchers in the spotlight



**ARIANE
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Graduated as master in (health and social) psychology in 2012

Employed at the Transportation Research Institute (IMOB) of Hasselt University since 2012

Passionate about my family and cultural activities like music performances, theatre, and educational events

Tasks in i-DREAMS: I assist in the development of several deliverables such as D10.1 ethics requirements, D3.4 experimental control, D5.2 driving simulator studies, D7.1 evaluation of interventions,



**VEERLE
ROSS**

Graduated as Occupational Therapist in 2007 and as Health & Social Psychologist in 2011

Employed at the Transportation Research Institute (IMOB) of Hasselt University since 2011

Passionate about my son Sam, born in 2020, spending quality time with family, reading an interesting article, taking a nature walk, watching Netflix, enjoying a good meal in good company.

Tasks in i-DREAMS: internal reviewing of deliverables, ethics, literature review, intervention design, analyses and reporting.