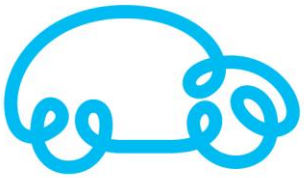
Dream-like simulation abilities for automated cars



DREAMS4CARS

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Executive Summary

According to the focus of Horizon 2020 on converting research into sustainable knowledge, products and services that have a potential impact to strengthen Europe's position within a global market and to bring socio-economic benefits, this document describes strategies adopted in the Dreams4Cars Project for exploitation and dissemination of project results, both at a general project consortium level and at partners level.

This deliverable is designed to multiply the impact of the interim and final results of Dreams4Cars and prepare for the transition towards scientific and industrial uptake in order to fully achieve the expected impacts. The target audiences have been identified and multiple dissemination and communication activities have taken place within the 1st 18 month of project lifetime. The exploitation activities are coordinated by the industrial partner from the Automotive industry CRF in collaboration with the project management and are supported by project partners.

Due to the strong innovative character of Dreams4Cars, it might be difficult to penetrate the automotive-suppliers market with a clear commercial approach. Exploitation, Dissemination and to some extent Communication in Dreams4Cars is rather geared to diffuse information about the benefits of the neuromorphic/bioinspired approach. The advantages will be underpinned by concrete examples that show how the bioinspired way Dreams4Cars manages traffic situations in an efficient way.

Following this approach, related to the introduction of a set of concepts with the potential to improve Advanced Driver Assistance and Autonomous Driving Systems, the deliverable summarises the overall strategy, identified target groups, on-going liaison activities with other research projects and companies, links with standardisation activities, and performed dissemination activities of different types: conferences, workshops, events, papers and articles.

Exploitable results are also identified, and exploitation intentions are described for each partner. Finally, a set of tables is annexed to list all the dissemination and communication activities performed in the period.

Exploitation within Dreams4Cars is built on the main pillars, namely Dissemination (and Communication), Liaison activities. Furthermore, input to and collaboration with initiatives on Standardisation is the focus of Dreams4Cars. Combining these elements forms the Dream4Cars Exploitation strategy.

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1 Dreams4Cars in a nutshell

Dreams4Cars is about developing dream-like (offline) learning methods to be used for the development of Autonomous Driving and –more in general– as mechanisms to increase the Cognition abilities and Autonomy of robots.

The purpose of dreamlike learning (in Dreams4Cars) is to deal with rare dangerous events. That is, to discover potential threats before they actually happen and prepare appropriate action strategies in advance.

Indeed, the main issue with autonomous driving is that very high levels of reliability (of the order of one fatal accident in billions of miles) have to be achieved. The current methods for developing automated driving rely on the human design of software and various forms of subsequent validation and testing. Discovery of the rare conditions that cause fatal accidents is a slow and expensive process and fixing the software and re-testing it is also very slow and expensive. Overall, producing a vehicle that is better than humans (in non-restricted environments) is far from being achieved: so far, the number of accidents during testing of prototype automated vehicles is of the order of one accident every few ten thousand miles; and there has already been injuries and deaths that hint for fatality rates far worse than humans.

One main reason for the slow progress in the development of autonomous driving agents is that their evolution relies on human designers for both the discovery of relevant situations and updating the agent. This, in turn, is a consequence of the implicit choice (often not even realized by the designers) of the Cartesian (sense-think-act) paradigm for the artificial intelligence of the agent. While the division between perception, situation assessment, motor planning and vehicle control may suit the industrial division between suppliers (that produce "perception systems") and the OEMs (that develop "the application"), this choice implicitly induces the development of human-coded behaviours[1]. A further historical push towards human-coded behaviours was the convincement that software modules can be tested against the "intended functionally" (SOTIF: Safety of the intended functionally and related ISO 26262 norm). For simple systems, it is indeed possible to define "how the system should work" in *every* situation. However, for automated driving defining the exact behaviours an agent should produce in all the subtle nuanced situations found in billions of miles is almost impossible; and hence, there definitely is a need for forms of *safe* autonomy.

Dreams4Cars uses an agent architecture that (prospectively) does not need human coding of behaviours and it does not need re-coding to learn and optimize behaviours. Instead of defining behaviours per situations, the Dreams4Cars architecture relies on recent theories of human sensorimotor control (see D2.1 and D3.1) where behaviours are emergent from basic sensorimotor loops that correspond to obstacle avoidance (including inference of obstacle likely intentions) and lane keeping. With this respect the recent project video https://youtu.be/-AxNUxXQRUM is enlightening.

Similar to the human brain (but without the distractions that cause human accidents) the Dreams4Cars architecture looks like a "network of networks" that implement: a) simultaneous action priming, b) optimal action selection, c) high-level biasing and c) learning of forward models via various forms of imagery (D2.1 and D3.1).

1) As is, this architecture has already shown robust behaviours (for example producing correct situations in tricky environments such as, e.g., the mentioned video).
2) Furthermore, the same architecture can be used to implement various types of imagery that are exploited to figure out potential threats and learn newer/improved behaviours.

The combinations of 1 and 2 should allow to highly automatize the discovery/optimization update cycle of robots (including automated vehicles).

[1] Even when deep learning is used, it is almost always used for perception and the application thereafter is human coded.

1.1 Exploitation opportunities

Based on the above introduction, there are basically two types of exploitation opportunities (for both commercial products and reuse for scientific exploitation – for example reuse of the OpenDS simulator or the MIA test vehicles):

One is related to point 1, i.e., exploitation of the framework that implements the brain (the network of networks) of the agent, both in terms of the overall software/theoretical framework and in terms of the individual components (for example networks that implement particular loops such as those described in D2.1, or ancillary software).

A second exploitation category is related to point 2, i.e., the exploitation of all the methods for imagery, discovery of novel situations, training and validation of the agent; including the offline simulation environment OpenDS (for example the methods described in D3.1).

2 Exploitation strategy

Horizon 2020 has a strong focus on converting research into sustainable knowledge, products and services that have a potential impact to strengthen Europe's position within a global market. For a true European Project like Dreams4Cars it is essential that the valuable public investment is converted into socio-economic benefits for the society through a targeted exploitation and dissemination. Dissemination - and to some extent communication - are closely linked to exploitation. Publicising the benefits of Dreams4Cars is key to a successful exploitation of the project outcomes. In addition to extensive dissemination Dreams4Cars is fully committed to the Open Access to Scientific Publications and Research Data. It is expected that Open Access to Research Data generates trust in our developments.

The Exploitation Plan (this Deliverable) is designed to multiply the impact of the interim and final results of Dreams4Cars and prepare for the transition towards scientific and industrial uptake in order to fully achieve the expected impacts. The target audiences have been identified and multiple dissemination activities have taken place within the 1st 18 month of project lifetime. The exploitation activities are coordinated by the industrial partner from the Automotive industry CRF in collaboration with the project management and are supported by the beneficiaries.

Due to the strong innovative character of Dreams4Cars (see Section 1.), it might be difficult to penetrate the automotive-suppliers market with a clear commercial approach. Exploitation and Dissemination in Dreams4Cars is rather geared to diffuse information about the benefits of the neuromorphic/bioinspired approach. The advantages will be underpinned by concrete examples that show how the bioinspired way Dreams4Cars manages traffic situations in an efficient way.

Exploitation within Dreams4Cars is built on the main pillars, namely Dissemination (and Communication), Liaison activities. Furthermore, input to and collaboration with initiatives on Standardisation is the focus of Dreams4Cars. Combining these elements forms the Dream4Cars Exploitation strategy.

2.1 Dissemination and communication

Dreams4Cars follows the guidance on Dissemination and Communication of the EU Commission and Horizon 2020 especially. Communication is different from dissemination although both activities are strongly linked to each other. A Dissemination and Communication Plan (D6.1) that takes account of the specific needs of target audiences has been developed. This plan describes the dissemination- and communication strategy and provides guidance to implement related activities.

Making the project and is interim and final results known all over the EU and beyond is essential to generate the desired impact and to prepare the ground for exploitation. As the resources dedicated to dissemination/communication are restricted, cost-effective ways were chosen to achieve a maximum of publicity for the project.

2.1.1 Target groups

As bridge to exploiting Dreams4Cars in the most efficient way it is necessary to define the main target groups. As mentioned above the main target group(s) are those who are deeply involved in research in the automotive and robotic sectors. Putting the focus on research communities does not exclude the industrial and supplier sector. They are in one way or another also involved in the application of research findings, and are therefore active in the research community. In addition, Dreams4Cars will also address these groups directly by certain activities (e.g. joint workshops or bilateral contacts).

The main target groups Dream4Cars is addressing are:

The ITS community

Intelligent Transport Systems (ITS) community combines university and research centres that are involved in long-term research in Intelligent Transportation systems. These ideally gathers around groups like the IEEE Intelligent Transportation System Society and /or journals like the IEEE Transactions on Intelligent Transportation Systems. This community forms the more scientific-oriented part of our target group, that may be interested in the scientific output of Dreams4Cars (in particular for what concerns bringing ideas originated in Cognitive Science and Robotics to applications in the ITS domain where the vast majority of approaches today use the Cartesian perception-decision-action paradigm). Two main conferences are organized yearly: the IEEE Intelligent Vehicle Symposium and the IEEE International Conference on Intelligent Transportation Systems (where we have already addressed workshops and papers).

The Automotive community

This target group is slightly different from the above: it is formed by researchers in the industry (such as, e.g, research centres of Suppliers and OEM) and/or researchers in spinoff and start-up companies that aim to develop *and sell* solutions for autonomous driving. Among these there are traditional Suppliers (i.e., those who are already suppliers of the Automotive Industry and would like to expand their product offerings) as well as new potential Supplier (e.g, NVIDIA, AMBARELLA, INTEL etc.) that would like to enter the marked of products for autonomous driving. Among the OEM there also are traditional manufacturers (e.g., the EU automotive industry) as well as new potential manufacturers (e.g., Tesla, Apple) or potential providers of mobility services (e.g., UBER, Waymo, etc.). Potential targets in this group are generally more oriented into the transfer of knowledge into products. Publications for this group may be found in different types of forms such as, preprints in ArXiv, Transportation magazines, as well as in industry-focused conferences such as the ITS world congress (where we have addressed one paper) the TRA (Transport Research Arena) and others. One form to get in touch with these potential "customers", besides the conferences above, is to organize joint events, and interact with the research projects they are involved in. Within this group there may also be software ho0uses that develop simulation tools for the industry (e.g., IPG CarMaker) which might also be a possible exploitation channel (we are going to attend one event organized by IPG).

Robotics community

We can divide the robotics community into scientific and industry-oriented groups as well. The main outcome of D4C for the robotics community may be related to the agent architecture (D2.1) that could potentially be extended to other domains and the simulation mechanism (D3.1) that could also be used to create robot abilities in other domains. The main conferences in this domain are IEEE International Conference on Robotics and Automation (ICRA) and the IEEE International Conference on Intelligent Robots and Systems. Potential users of Dreams4Cars findings may be industries in the robotics domain (this requires adaptation of the project output) as well as software house that develop virtual reality simulation tools (e.g., Unity). We will better focus on the robotics domain in the second half of the project life (our main focus in the first half was the primary Automotive application).

2.1.2 Dissemination activities as of M18

Dreams4Cars has done a wealth of dissemination (and some first things on communication) during the 1st 18 month of project lifetime. This Deliverable is the right place to provide a summary of all dissemination that took place so far. The project is maintaining a so-called Dissemination and Communication Inventory that provides a condensed overview about all actions that took place. This inventory refers, where appropriate, to the respective publications (weblinks, DOIs).

Annex 1 of this document provides the essentials of this Dissemination and Communication Inventory. Table 1 below shows the summary overview of dissemination activities per type of activity.

Type of activity		No. of activities
Conferences/Workshops/Events with Dreams4Cars contributions and participation		
	ITS/Automotive Community	12
	Robotics Community	3
	Others/Public	12
Subtotals		**27**
Papers		8
Other scientific articles / spin-off papers		7
Communication/Publicity		10
Dreams4Cars Workshops		2
Totals		**54**

Table 1: Summary overview of Dissemination activities

The above table does not include some applications for papers or conferences that have not been accepted, not included are also activities that are currently under preparation..

2.2 Liaison

Liaisons with related initiatives and projects offer the opportunity to facilitate collaborations between research and innovation community including industry and SME. Such liaisons allow a research project to participate in events, working groups or meetings and to organise joint workshops. This way the objectives, approaches and outcomes of Dreams4Cars can be highlighted. In addition, the project will get valuable feedback from stakeholders. Liaison can form the basis for future collaborations by identifying and exploiting synergies.

In the following the most projects and initiatives Dreams4Cars plans to liaise with are briefly described.

2.2.1 Related Projects

AdaptIVe project

The EU AdaptIVe project (http://www.adaptive-ip.eu) was a the last flagship IP on automated driving of the EU. Both CRF and UNITN were partners. The Dreams4Cars (CRF) vehicle and the Co-driver (version 7.8) are the benchmarks for the Dreams4Cars development (e.g., results are compared to these in D3.1). The AdaptIVe project ended in June 2017 and the final event was exploited as a first dissemination stage towards the industry sector (dissemination material was distributed). Contacts have been collected for further dissemination activities.

L3-Pilot project

The L3-pilot http://www.l3pilot.eu/ is a large-scale Field Operational Test (FOT)co- funded by the EU under H2020. The focus is the testing of selected automated functions in real conditions involving a fleet of 1000 cars. CRF is partner of the project. As the project is quite complementary to Dreams4Cars, contacts have been initiated for a possible future joint workshop or other joint initiatives.

Pegasus Project

Another candidate project that we are primarily considering for liaison is the German Funded "PEGASUS" project http://www.pegasusprojekt.de/en/. This large-scale research action aims at developing tools and methods to ensure that automated driver is mature enough (in particular safe enough) for market introduction. The project develops, test methods (including methods based on simulation). The PEGASUS project involves all German OEM, several suppliers, research centres etc.

A cooperation with Dreams4Cars looks potentially useful because Dreams4Cars focus methods to discover better driving behaviours by simulation. Since PEGASUS is focused on the industrial validation of automated driving, it may be an ideal link towards the market for Dreams4Cars.

Despite Dreams4Cars contacted PEGAUS several times (and HH attended one event) they are however not very responsive. Dreams4Cars aims to continue the efforts to establish a cooperation.

SAFE STRIP

SAFE STRIP (http://safestrip.eu) is a H2020 Action aimed at the development of smart infrastructures to monitor and support the road and the traffic. CRF and UNITN (different units than those involved in Dreams4Cars) are partners of the project. Within a SFES STRIP workshop Dreams4Cars presented the Co-driver concept. A very simple Co-driver, derived from Dreamns4Cars is going to be implemented in an infrastructure-based intersection support function of SAFE STRIP, One novelty is that this Co-driver is going to use the infrastructure sensors (sensible strips and roadside units) as partial replacement of the vehicular sensors. The actual implementation of this Co-driver is going to use the same agent architecture, albeit simplified for the target scenario. Cooperation is ongoing.

VDSD

VDSD is a local funded project (funded by the University of Trento with 158.000€) listed among the strategic initiatives of the University. The project deals with support actions for smart cities and in particular it is concerned with Digital Vehicle on Digital Roads (VDSD). Within this project we will carry out dissemination and, above all, the Dreams4Cars and OpenDS environment will be installed into an existing driving simulator to carry out experiment of human-vehicle interactions in Automated vehicles. One distinctive aspects of these experiments will be the fact that the interaction occurs with a realistic driving agent (whereas the entirety of other driving simulator experiments use programmed events that emulate the vehicle functions).

2.2.2 Related Companies

Due to the specific tasks addressed in the project, some contacts have been established with companies outside of the Consortium on some specific tasks.

IPG-Automotive

IPG-Automotive, the developer of the software CarMaker, organises workshops around their newest developments. Dreams4Cars attended the event on 28 March 2017 and will make a presentation at the event Apply & Innovate, 11-12th September 2018. These workshops are dedicated to simulation scenarios for autonomous driving. They also provide the space and the opportunity to exchange experiences and ideas with other experts from the industry.

At the Open House on March 2017 a specific session was organised between some Dreams4Cars partners and some IPG people in order to introduce the project and analyse some specific points about the use of CarMaker simulation tool inside Dreams4Cars.

nVIDIA

nVIDIA is a leading company well known by their innovative GPUs. Meanwhile they are very active in areas such as Artificial Intelligence, Robotics and Automated driving. The latter activities comprise hardware and software that is specifically dedicated to advance the development of automated cars. They are closely cooperating with automotive industry, suppliers and the research community. Dreams4Cars has purchased a number of the Drive PX2 boards to be deployed in the experimental cars. Dreams4Cars is in close contact with nVIDIA: two meetings with nVIDIA staff took place. Dreams4Cars applied for a speech at their GPU-Tech Conference in October 2018 in Munich. Dreams4Cars raised interest of nVIDIA due to the innovative developments using Neural Networks in the trajectory planning part.

CRF took this opportunity also to organise some specific training from nVIDIA on the use of DRIVE PX2 board in June 2018.

2.2.3 Related initiatives and communities

SAFER

SAFER is a research centre at Chalmers University in Gothenborg, Sweden. SAFER's role is to be a thought leader in safe mobility, offering world-leading knowledge and project methodology. SAFER creates knowledge and value beyond what a single partner can achieve on its own. SAFER is also the open innovation arena where partners from the society, the academy and the industry can meet and share research and knowledge within safe mobility – a multi-disciplinary research hub that enables progress for its partners and for the society.

Dreams4Cars has established contacts with SAFER and has organised a joint workshop where researchers, students and representatives from Volvo Cars/Trucks attended. Dreams4Cars perceives SAFER as a gateway to the automotive industry.

Following the workshop technical materials (presentations and papers) have been distributed to attendees of the workshop. We had in particular (also recently) individual requests of details about our implementation from Volvo Trucks and Zenuity (the latter is a spinoff company from Chalmers and Volvo Cars that develops software solution for automated driving).

We plan a follow up which consists in promoting our OpenDS/Co-driver software as soon as we judge the whole system to be robust for general users.

VirginiaTech / InSight Database

Virginia Tech Transportation Institute VTTI is maintaining the SHRP2 database with about 35 million miles of naturalistic driving data collected from about 3500 cars during several years. These data also include about 1500 crashes and many more near crashes captured on videos, with detailed vehicle kinematic data logged from the vehicle network and additional sensors (e.g., speed, acceleration, pedals, radar data etc.).

A cooperation between Dreams4Cars and VTTI has been initiated. Access to a sample dataset (45GB of data) on predefined routes has been granted to UNITN. Further access to the whole dataset requires approval from the Ethical Committee of the partner accessing the data because (unlike the sample dataset) the full routes that may reveal personal information about the drivers (location of work and home) will be accessible.
The sample dataset has been examined and the conclusion is that the data can be exploited a source of situations that can be used to initiate dreams (any missing data will be filled in in the dreaming activity, just like existing parameters can be varied, for example as done for the UBER accident in D3.1 section 4.3). The dataset is thus a valuable to for extending the “wake state” situations beyond what can be gathered with Dreams4Cars vehicles (hence going beyond the demonstration of the technology TRL6 in this aspect).

On the other side, Dreams4Cars will make the OpenDS/Co-driver agent accessible to VTTI that will have the opportunity to experience advanced simulation mechanisms that go beyond the simple replay of accident mechanics.

Details of cooperation in the next phase of the project has to be defined.

Intelligent Transportation Systems Communities

A workshop in the Intelligent Vehicle symposium 2017 has been organized and many presentations have been carried out in the conferences (see the summary of activities tables).

Robotics Communities

The project was presented at the European Robotics Forum 2017 and at the EUCOG 2017 (see the summary of activities tables).

2.3 Standardisation

ADASIS

The ADASIS working group is defining the way map information describing the road in front of the vehicle is transmitted to the application. Currently, version 2 of ADASIS protocol is defined and used for Driver Assistance Systems, while version 3 is under definition to enable the use of HD Maps for Autonomous Driving.

This working group has been hosted by ERTICO under the name of ADASIS Forum and has recently moved to a specific association named ADASIS AISBL.

CRF, has research centre for FCA, is involved in this working group with two tasks related to Dreams4Cars. On one side, the goal is to influence the definition of the standard for v3 in order to fulfil the needs of the functions under development in Dreams4Cars; a comment has already been sent and considered from CRF to the ADASIS technical group working on the specifications.

On the other side, the basic concepts on the way the road and the lanes are described in ADASIS v3 have been used in the definition of the interfaces inside the Dreams4Cars systems (in the “scenario message”), so that the information needed to plan the automatic manoeuvre will be available from suppliers in a format that can be easily used.

Test catalogue for Autonomous Driving

In the discussions between car makers and suppliers, during events and workshops, it is clear that it would be very useful to define a test catalogue for standard scenarios and evaluation metrics for autonomous driving. At this moment, a similar world-wide initiative is not known; the definition of scenarios and metrics inside Dreams4Cars can contribute to this topic, also referring to the understanding of how many kilometres of testing should be done in real roads and how many can be done in simulated environment.

Hence, one important contribution here is the definition of standard simulation tests and procedures (short bits extracted from the discovered situations) that will become/contribute to a database that can be used to automatize the testing of vehicle software, similarly to what the EURO ENCAP tests are for real vehicles.

Further contributions could be hardware and software requirements (for neural computation), recommended dreaming mechanisms and recommended agent architecture.

3 Dreams4Cars exploitable results

At this stage, the products indicated here below can be specified.

Product 1: Artificial Driver

This is the runtime part of the final agent, as evolved at end of phase 2. It will be released as a module for OpenDS together with the OpenDS framework. This system will allow people to veryfy a set of example situations as well as research their own and compare the agent to their own (if any) agents for driving. The main purpose of this product is scientific dissemination (including supporting the data management plan) for the ITS community, as well as a promotional tool for the Automotive community. Preliminary versions of this system might be given to selected third parties (for example VTTI o SAFER).

One goal is also that the OpenDS/Co-driver framework is adopted for development of ITS functions. The framework might also be used within driving simulators (just like UNITN use in the VDSD project), thus opening the ground for human-robot interaction studies based on realistic co-driving agents. Finally, the framework might also have educational applications.

On the other hand, one commercial system that is today used for ITS development is CarMaker, by IPG. We will consider carefully whether and under which conditions to offer IPG a Co-driver module for their environments with the same goals above (since CarMaker is already used for the design of vehicles and Advanced Driver Assistant Systems, the Dreams4Cars agent will bring the artificial humanlike agent in these environments ready for evaluation, research, and comparison with the vehicle applications that the CarMaker users are internally developing).

Product 2: Artificial Driver for design of Driver Assistance Systems

This is a possible application of the Dreams4Cars system (produced as extension of product 1) aimed at the design of Advanced Driver Assistance Systems in the short-term (i.e., a version of specifically tailored to the Automotive community and with a license that allows reusing the agent or parts in real applications). The goal is to provide optimisation tools operating on a multi-body virtual prototyping environment largely used for the design of vehicle system.

In particular (see CRF exploitation intentions here below), it is important to note that not only the all Artificial Driver can be considered as a product, but also some parts of it; in that sense, some modules can be applied to Driver Assistance Systems.

Product 3: Dreams4Cars Developer Kit

This is the complete Dreams4Cars system (i.e. the runtime agent and the simulation system), which can be used to design Driver Assistance Systems of various complexities (even before full automation will be on the market). It may be engineered in various forms and will be typically hosted in virtual prototyping environments such as OpenDS. Compared to products 1 and 2 the training tools described in D3.1 will be available together with a Co-driver “template” or a pre-trained one. User will be available of train the agent to operate in different vehicles (e.g., learning the vehicle models and synthetizing control) as well as training the agent to use different sensor sets. Licensing conditions and costs will be defined later depending on the success of dissemination, requests and performance of the various modules developed in WP2 and WP3.

Product 4: Dreams4Cars system

This is the complete system, made of the runtime agents and a cloud-based service. Several business models may be envisaged: e.g. company private services, public services. This is the longest term goal and details will be developed later.

Product 5: Know-how

Dreams4Cars is already creating significant know how: for example, the implementations of the agent loops described in D2.1 and the many methods for imagery and training described in D3.1. In a scientific perspective these will produce publications and possible reuse in other initiatives. However, for industrial users, a fast transfer of know-how may be desirable. Hence potential (commercial) uses of these findings (if they want

personalized solutions instead of the above products) may ask direct transfer of knowledge in the form of a combination of disclosing the software source code, teaching the development methods and theories and training companies personnel.

4 Exploitation intentions per partner

The sustainability of the projects results will be supported not only through intense dissemination and liaison activities. This part of the project work should result in a targeted exploitation of products, services and knowledge both in commercial and non-commercial sense.

By nature, different types of organisations have different intentions. Research organisations are usually more interested in using the knowledge, whilst commercial companies should have an interest to market the products and generate turnover.

All partners in Dreams4Cars have a strong interest in exploiting the results of the project in line with their strategic goals. The exploitation intentions described below are the starting point to develop the exploitation plan.

4.1 UNITN

Description and strategy

UNITN has significantly contributed to the development of the Co-driver Agent (D2.1) and to many methods for the simulation system (D3.1), including the library for quality assurance tests (WP1.4).

The exploitation strategy is geared towards both commercial exploitations (via licensing/agreements/training of practitioners) and towards academic exploitation (via reuse of the research and publications).

Exploitation intentions

Concerning possible commercial exploitations, UNITN would like to define agreements with CRF for the exploitation (and co-development) of project findings in the development of the automated driving functions that FCA is carrying out. All forms of cooperation (according to the GSA agreements) are possible ranging for providing the existing software frameworks and components to cooperation in developments, developing jointly patents and training CRF people. Further commercial exploitation is possible via licensing of knowledge to third parties (either jointly with other partners of the project of individually as far as this is allowed by the GA).

Concerning academic exploitation, UNITN aims at high-level scientific publications on one side and to the reuse of findings for further research. In particular, for the latter case, there already exist one project funded internally by the University of Trento (VDSD, budget 158 k€) that will re-use the Co-driver into a driving simulator such as to create an environment for safe testing of the automated driving functions and, above all, for testing human-robot interactions that go beyond the SAE automation levels (for example the rider-horse metaphor).

Extensions of the “brain” architecture of the Co-driver to other robotics applications is also within the scope of exploitations.

4.2 HIS

Description and strategy

HIS has a long history of research on the so-called simulation hypothesis/theory of cognition and human-machine interaction and this project significantly contributes to this research. HIS has significantly contributed to the development of the simulation system (D3.1) and the exploitation strategy is mainly focused on this part with an emphasis towards academic exploitation (via reuse of the research and publications, as well as future collaboration with current partners).

Exploitation intentions

Concerning academic exploitation, HIS, similar to UNITN, aims at high-level scientific publications on one side and to the reuse of findings for further research. HIS have a static immersive driving simulator consisting of a complete real vehicle (a Volvo S80) and projector screens covering the driver's field of view in which research on traffic safety and interaction with intelligent driving systems have been performed previously. HIS will be able to exploit the results from the project (OpenDS development and co-driver development) to update the simulator environment at HIS to enable new research on human interaction with autonomous driving systems.

The results of the project will also lead to the continuation of the previous cognitive science research at HIS on the simulation hypothesis and computational models of the simulation theory. There are several possibilities for further collaboration with all of the academic partners with respect to the advancement of the simulation theory and the development of new computational models that can further our understanding of the role of embodied and episodic simulations (see D3.1).

4.3 MU

Description and strategy

MU, in developing the logical reasoning (LR) system and defining the underlying subsumption architecture of Dreams4Cares (cf. especially deliverables D2.1), has made a substantial contribution to the run time system (for which it assumes ultimate responsibility as the WP2 lead). This integration of symbolic and sub-symbolic reasoning is of high relevance to the driving domain in which strong rule-priors exist alongside real-world stochastic complexity (as well as having potentially wider application). MU will therefore participate in exploitation (and co-development) agreements in relation to project findings associated with the automated driving functionality as a whole (such as those with CRF), and also to future software licensing arrangements.

Exploitation intentions

MU is actively preparing research proposals involving perception-action human-in-the-loop learning ideas that are derived from Dreams4Cars, for example in the area of office automation. The exploration mechanism MU has contributed to (cf. D3.1), utilising a strategy of top-down parameter instantiation is also being actively considered in terms of its cross-fertilisation into other areas of machine learning and efficient PA modelling of human actions.

As its primary mode of academic exploitation, MU will continue to published papers in high quality peer-reviewed outlets. The ideas underpinning the action parallelism within the run-time architecture have additionally had fruitful spinoffs (represented by peer-review outputs) into wider fields of endeavour, such as ensemble machine learning and quantum computing.

4.4 USFD

Description and strategy

USFD is focusing on two distinct areas in this project: action selection/discovery (WP2) and forward modelling (WP3). The action discovery work based on deep reinforcement learning from training in a simulation environment represents a paradigm shift for training AI agents (as a key barrier to deep learning is generating many training examples). The forward modelling is also key to predicting consequences of action in control schemes.

The exploitation strategy of USFD is focused on academic exploitation, via re-use of research and publications, as well as exploring potential commercial exploitations via future research.

Exploitation intentions

For academic exploitation, USFD intends to produce high-level scientific papers and also re-use outputs in future research projects. The novel ideas generated in Dreams4Cars, particularly in action discovery with deep reinforcement learning based on simulations, can be exploited in other domains such as robotics. Future research projects will potentially move towards commercial exploitation with new industry partners. For instance, Innovate UK funding can provide follow-up funding with industry partners – in such projects USFD would seek to

generalise and demonstrate methods for action selection/discovery, and also develop forward modelling for other vehicle-types.

4.5 DFKI

Description and strategy

Dreams4Cars is a very important project for DFKI. The whole approach of learning from synthetic data, which was first applied in Dreams4Cars, is now being extended in a number of follow-up / parallel projects. The automotive industry has also accepted that simply collecting real data for training and validating AI modules for autonomous vehicles will not be enough. Therefore, Dreams4Cars can be considered as a crucial base project of a totally new research line. With respect to our exploitation plan, we would like to highlight the Genesis initiative, which already generated great interest in industry and the public in the first half of 2018. Genesis will be an open platform for the continuous validation of AI modules for autonomous vehicles. OpenDS, our open source driving simulation developed in Dreams4Cars, also plays an important role in Genesis. The exploitation of Dreams4Cars and learning from synthetic data in general can already be considered extremely successful in terms of visibility, invited talks, invitations to participate in project proposals, industrial research contracts, and so forth. In the remainder of the project we plan to continue this course of success.

Exploitation intentions

A major task of DFKI in Dreams4Cars is the development of the cloud-based simulation environment which is based on DFKI's open-source driving simulation software OpenDS. One of the project's goals is advancing the development of this software concerning a more realistic vehicle dynamics simulation, an automatized road generation process, support of the OpenDRIVE format and the ability to connect the simulated vehicle to the Dreams4Cars co-driver software. Making these extensions available to the scientific community will increase the attractiveness and acceptance of the product OpenDS and will boost its application in industry and research.

4.6 HC

Description and strategy

Heich Consult GmbH has a long track record in assisting and advising research organisations and commercial partners in getting access to international funding sources, preferably EU-Research funding. Heich Consult stimulates the R&D activities within the client organisation ensuring that R&D activities become part of the company's overall strategy and that research feeds the innovation process in the optimal way. In this context Heich Consult sees international research projects as steppingstone towards innovation and towards new products and markets

Exploitation intentions

The cooperation in Dreams4Cars will enrich Heich Consult's knowledge and competence in the areas of robotics, transport and cooperative ITS significantly. This will put Heich Consult in the position to demonstrate to potential customers the benefits of the Dreams4Cars modelling approach, especially by means of product 1, to players who are active in the robotics and transport field. This way Heich Consult is widening its network and will be in the position to generate new consulting contracts as well as national and international projects combining research, industry and SME.

4.7 CRF

Description and strategy

CRF, as research organisation inside FCA group, is deeply involved in supporting the development of autonomous driving functions for cars, that is part of the industrial plan for FCA. So, the main interest of CRF is to

evaluate the performances of the Driver Agent developed in Dreams4Cars in order to understand in which form concepts and modules developed in the project can be integrated in the product development.

In particular, the expected capability of the Driver Agent to cope with complex situations and learn from "dreamed" scenarios is very interesting for product development. Also, the tools and concepts used to generate simulated situations to test the autonomous driving system are very interesting for the validation process.

Exploitation intentions

The evaluation of performances of the Driver Agent developed in Dreams4Cars will generate objective data to compare this approach with internal developments, mainly with respect to trajectory planning in complex situations and application of learning mechanisms. From this evaluation, a plan will be derived about which concepts and modules can be integrated in the industrial development.

In particular, since for safety reasons it will be necessary to generate different trajectory plans from parallel processing modules, it is possible that the concepts developed and tested in Dreams4Cars bring to the implementation of one planner module running in parallel with others inside the autonomous driving system.

Annex 1

Dissemination and communication inventory

This Dissemination and Communication Inventory is part of Deliverable 6.1 (Dissemination and Communication Plan). It will be regularly updated to keep track of all dissemination, communication and liaison activities as they are part of WP6.

The document comprises of the following tables:

Tables 1.1 – 1.3: Conferences/Workshops/Events with Dreams4Cars contributions

- Table 1.1 - ITS / Automotive Community
- Table 1.2 - Robotics Community
- Table 1.3 - Others/General public

Table 2: Papers

Table 3: Scientific Articles

Table 4: Communication / Publicity

Table 5: Workshops organised by Dreams4Cars

Table 1.1: Conferences/Workshops/Events with Dreams4Cars contributions/participation

Conference/event	Dates	Location	Dream4Cars contribution Short description such as paper, presentation etc. Title, if available	Dreams4Cars responsible	Remarks
ITS/Automotive Community					
GPU Technology Conference (http://www.gputech-conf.com)	May 7-11, 2017	San Josè, CA, USA	Attended the Automotive application thread	UNITN M. Da Lio A. Mazzalai	
IEEE Intelligent Vehicle Symposium IV2017 (http://iv2017.org)	June 11-14 2017	Redondo Beach, CA, USA	Presentations within the workshop "Cognitively Inspired Intelligent Vehicles" organized by Dreams4Cars (see also table 5).	UNITN MU USFD HIS	About 20-25 attendees
Automation for Commercial Vehicles 2017 https://autonomous-commercial-vehicles.iqpc.de	September 12 – 14 2017	Stuttgart, Germany	Presentation: A look at future (co)-driving agents - From human-robot interactions to learning by dream-like simulation mechanisms	UNITN Mauro Da Lio	About 20 attendees. The presentation raised interest and generated a contact with Virginia Tech, that owns naturalistic driving data and accident data. Cooperation is being defined.
1ST PAN-EUROPEAN SAFE STRIP WORKSHOP Organized by H2020 Safe Strip project http://safestrip.eu/ https://ec.europa.eu/inea/en/horizon-2020/projects/H2020-Transport/Safety/SAFE-STRIP	September 27, 2017	Thessaloniki, Greece	Presented the Dreams4Cars concept with particular emphasis to Digital Infrastructure support (which is the topic of the SafeStrip H2020 project)	UNITN Mauro Da Lio Francesco Biral	Attended by about 25 expert and policy makers. Cooperation with SAFE STRIP project established.
EOSC Pilot / OpenAIRE-DE joint workshop: "Future Open Science services for scientific communities"	October 3-4, 2017	Berlin, Germany	Attended the workshop and working groups on ZENODOO and OpenAIRE	HC Hermann Heich	Approx. 45 attendees

IEEE International Conference on Intelligent Transportation System http://www.itsc2017.org)	October 16-19 2017	Yokohama, Japan	Position Paper: Exploiting Dream-Like Simulation Mechanisms to Develop Safer Agents for Automated Driving (see also table 4)	UNITN Mauro Da Lio	Attended the conference (about 40 attendees, expert). Presentation was followed by 45 minutes of questions from several industry attendees.
Workshop "Autonomous driving, real driving emission and simulation: the challenge and the solutions" Politechnico di Torino	October26, 2017	Torino, Italy	Round Table / Presentation:	CRF (Andrea Saroldi)	About 50 persons attended (Scientists, Students, Automotive Industry) Brief report avaiable
Pegasus Project mid-term event and symposium "how safe is sage enough"	October 8/9th 2017	Aachen, Germany	Attended	HC Hermann Heich	Established contacts to establish cooperation, feedback to project partners
- CRF Workshop on Vehicle Control - Project presentation to FCA autonomous driving team	March 12, 2018	Torino, Italy	Presentation: "Dream-like simulation abilities for automated cars - Lateral control implementation"	UNITN Mauro Da Lio R. Donà G. Rosati	About 10 people between UNITN and CRF participated to workshop on vehicle control. About 30 people between UNITN, CRF, and FCA attended the project presentation.

GPU Technology Conference (http://www.gputech-conf.com)	March 26-29, 2018	San Josè, CA, USA	Proposed presentation "Beyond end-to-end: biological layered control architecture for adaptive behaviour and dream-like learning"	UNITN	Presentation not accepted
Branchentag Automotive - Automotive goes Future https://www.ac-bb.de/veranstaltungen/artikel-ansicht/article/branchentag-automotive/	21.6.2018	Klettwitz Germany	Attendance, demonstration of DFKI test vehicle and promotion of Dreams4Cars	DFKI Elmar Berghöfer	
IPG user conference – Apply & Innovate 2018 IPG-Automotive (Carmaker) https://ipg-automotive.com/de/veranstaltungen/apply-innovate/	September 11-12, 2018	Karlsruhe, Germany	Presentation: "Test Environments for Artificial Co-driver in Dreams4Cars - Fast steps from MIL to vehicle."	UNITN Riccardo Donà CRF Andreas Saroldi	Accepted
GPU Technology Conference 2018 https://www.nvidia.com/en-eu/gtc/?ncid=pa-pai-m8-36310#cid=Paid_GTC_DE_20180416_GTCEU2018_GoogleSearch_na	October 9-11, 2018	Munich, Germany	Proposed presentation: "A networked co-driver architecture for online adaptive sensorimotor control and offline dreamlike learning"	UNITN Mauro Da Lio	Presentation proposed, pending

Table 1.2: Conferences/Workshops/Events with Dreams4Cars contributions/participation

Conference/event	Dates	Location	Dream4Cars contribution Short description such as paper, presentation etc. Title, if available	Dreams4Cars responsible	Remarks
Robotics Community					
Workshop on Exploitation of Neuromorphic Computing Technologies. DG Connect (in conjunction with the Human Brain Project)	February 3, 2017	Brussels, BE	Attended workshop, established connections.	UNITN (Paolo Bosetti)	Report available
ERF 2017 (European Robotics Forum) http://www.erf2017.eu)	March 22-24 2017	Edinburgh, UK	Invitation to present the Dreams4Cars project (poster and presentation)	HIS (Serge Thill) UNITN	Presentation
EUCOG 2017 EUCognition Meeting "Learning: Beyond Deep Neural Networks" http://eucognition.org/index.php?page=2017-zurich-general-info)	November, 23-24 2017	Zurich, Switzerland	"A Hybrid Multi-Layer Architecture for Autonomous Vehicles Utilising a Hierarchical Perception-Action Dream Simulation Mechanism,". A paper has been accepted (see table 4).	All partners MU UNITN	Presentation and proceedings available
IROS 2018 International Conference on Intelligent Robots	October 1-5 2018	Madrid	Workshop proposal: "Cognitive control for autonomous vehicles"	Sean Anderson Serge Thill	Not accepted

Table 1.3: Conferences/Workshops/Events with Dreams4Cars contributions/participation

Conference/event	Dates	Location	Dream4Cars contribution Short description such as paper, presentation etc. Title, if available	Dreams4Cars responsible	Remarks
Others/General Public					
APRE Round Table (Italian National Contact Point)	January 23 2017	Rome, Italy	Invitation to present the Dreamns4Cars project and to participate in a round table.	UNITN (Mauro Da Lio)	
AdaptIVe Project Final Event (https://www.adaptive-ip.eu)	June 28-29 2017	Aachen, Germany	Attending final event, establishing connections.	UNITN, CRF, HC	Dreams4Cars brochure disseminate First contacts to PEGASUS Project established
Smart Mobility World – 2017 (http://www.lingottofiere.it/event/it-790/smart-mobility-world)	October 11, 2017	Turin, Italy	Round table / Presentation: "Driving Agents: from human-robot interactions to learning by dream-like simulation mechanisms"	UNITN Francesco Biral	General public and experts (about 30-40 people).
European Researchers night Skoevde https://forskarfredag.se/researchers-night/	September 29, 2017	Skövde, Sweden	Dreams4Cars poster and PowerPoint presentation.	HIS Henrik Svensson	General public (50 persons). This generate positive curiosity. Report available.
Bologna Moto Show 2017 December 2-10, 2017 https://motorshow.it/it/	December 4, 2017	Bologna	Dreams4Cars presentation at "Digital LAB Autoliv", "A look at future (co)-driving agents from human-robot interactions to learning by dream-like simulation mechanisms"	UNITN (Mauro da Lio)	Both general public and people working in the supply chain (20 people). Presentation available

High School “De Gasperi”	December 5, 2017	Borgo Valsugana, TN (Italy)	A look at future (co)-driving agents from human-robot interactions to learning by dream-like simulation mechanisms.	UNITN (Mauro da Lio)	Two classes at last year (40 people and two teachers) Presentation available
High School “Chilesotti”	February 2, 2018	Thiene, VI , Italy	A look at future (co)-driving agents from human-robot interactions to learning by dream-like simulation mechanisms.	UNITN (Mauro da Lio)	Two classes at last year (40 people and two teachers) Presentation available
High School “Rossi”	January 24, 2018	Vicenza (Italy)	A look at future (co)-driving agents from human-robot interactions to learning by dream-like simulation mechanisms.	UNITN (Mauro da Lio)	Several classes at last year (200 people and several teachers teachers) Presentation available
UNITN Prospective Students	April 27, 2018	Trento	Artificial Cognitive System Architectures for long-term reliable automated driving.	UNITN (Mauro da Lio)	Approximately 200 students of the first bachelor year.
Liaisons Modena- Trento PAT Workshop to explore collaborations on IT/ITS	February 8, 2018	Trento	Presentation Dreams4Cars: IV/ITS research at the Dept. of Industrial Engineering (2003-2018). Separate presentation to the FCA management of Dreams4Cars.	UNITN (Mauro da Lio)	Presentation available. Scientist from UNITN, UNIMORE, FBK CREATE-NET, Regional bodies, Automotive industry FCA

Automotive Tech AD 2018 March 4-6, 2018 https://autonomous-driving-berlin.com/	March 2018	Berlin	Presentation of Dreams4Cars & Moderation of two sessions on the role of simulation for autonomous driving	CRF Andrea Saroldi	Presentation and material from sessions available
UNITN PhD students	June 11, 2018	Trento	"Reti neurali e guida autonoma"	Alice Plebe, Mauro Da Lio	Attended by PhD students of two departments and people from CRF Trento branch (about 25 people)

Table 2: Papers

Papers	**Target audience**	**Dream4Cars contribution** Short description/title of the paper	**Dreams4Cars responsible**	**Remarks**
IEEE Transactions on Intelligent Transportation Systems	ITS Research community	Paper: "Biologically Guided Driver Modeling: The Stop Behavior of Human Car Drivers," IEEE Transactions on Intelligent Transportation Systems, DOI 10.1109/TITS.2017.2751526	M. Da Lio, A. Mazzalai, K. Gurney, A. Saroldi,	Published Open Access http://ieeexplore.ieee.org/document/8057588/
ITS-World Congress 2018 Copenhagen	ITS Research community	Position Paper: "A System for Human-like Driving Learning"	UNITN Mauro Da Lio Alice Plebe, Daniele Bortoluzzi, Gastone Pietro Rosati Papini, Riccardo Donà	Accepted
IEEE Transactions on Intelligent Transportation Systems	ITS Research Community	Paper: "Hierarchical Adaptive Real-Time Path Planning for Automated Driving in Roads Networks Structured with Lanes! Mauro Da Lio, Member, IEEE and Alessandro Mazzalai.	Mauro Da Lio, Alice Plebe, Riccardo Donà, Gastone Pietro Rosati Papini	Under preparation Paper is about D2.1 section 2.1.1)
IEEE Transactions on Intelligent Transportation Systems	ITS Research Community	Position Paper: "Some Fundamental Issues Concerning the Sensorimotor Architecture and Abilities of Agents for Automated Driving"	All partners	Under preparation (It is a general position paper presenting the overall philosophy of Dreams4Cars and the Agent Architecture).
IEEE Transactions on Intelligent Transportation Systems	ITS Research Community	Paper: "On Reliable Neural Network Sensorimotor Control in Autonomous Vehicles"	Mauro Da Lio, Member, IEEE, Alice Plebe; Daniele Bortoluzzi.	Submitted, under review (paper is about D2.1 section 2.1.2)

IEEE Transactions on Intelligent Transportation Systems	ITS Research Community	Paper: "Robust Learning of Vehicle Dynamics Forward Models Using Cerebellar-like Neural Networks"	UNITN Mauro Da Lio, Alice Plebe, Riccardo Donà, Gastone Pietro Rosati Papini USFD Sean Anderson	Under preparation (paper is about D3.1 section 6)
VEHITS 2018 4th International Conference on Vehicle Technology and Intelligent Transport Systems March 16-18 2018, Madeira	ITS Research Community	Position Paper: "Autonomous Vehicle Architecture Inspired by the Neurocognition of Human Driving"	Mauro Da Lio, Alice Plebe, Daniele Bortoluzzi, Gastone Pietro Rosati Papini, Riccardo Don`	Published Open Access https://iris.unitn.it/handle/11572/208762?mode=simple.298#.Wwz_OoouBaQ
IEEE – ITSC 2017 20th International Conference on Intelligent Transportation Systems Yokohama, JAPAN. October 16 - 19, 2017	ITS Research Community	Position Paper: "Exploiting Dream-Like Simulation Mechanisms to Develop Safer Agents for Automated Driving"	All partners	Published (green OA on UNITN IRIS website)
IEEE-ITS 2018 The 21st IEEE International Conference on Intelligent Transportation Systems November 4-7, 2018 Maui, Hawaii, USA	ITS Research Community	Position Paper: "Towards an Automated Driving Agent using Dream-Like Simulation"	All Partners	Submitted (acceptance to be known on July 2)
IEEE-ITS 2018 The 21st IEEE International Conference on Intelligent Transportation Systems November 4-7, 2018 Maui, Hawaii, USA	ITS Research Community	Paper: "Optimal Lateral Dynamics Control of Automated Vehicles" Mauro Da Lio, Member, IEEE, Riccardo Don`a, Francesco Biral, Luca Zaccarian, Fellow, IEEE, Gastone Pietro Rosati Papini and Alice Plebe	Mauro Da Lio, Riccardo Dona, Francesco Biral, Luca Zaccarian, Fellow, IEEE, Gastone Pietro Rosati Papini, Alice Plebe	Submitted (acceptance to be known on July 2)

United Kingdom Automatic Control Council 2018 UKACC 2018	ITS Research Community	Paper: "Linear System Identification of Longitudinal Vehicle Dynamics Versus Nonlinear Physical Modelling"	Sebastian James, Sean Anderson	Submitted

Table 3: Other Scientific Articles / Spin-off papers

Name of scientific event / Media	**Target audience**	**Dream4Cars contribution** Short description/title of the paper	**Dreams4Cars responsible**	**Follow up**
Swedish Cognitive Science Society (SweCog) conference 2017	Robotics community	E. Lagerstedt, H. Svensson, "A drive through the world of functional tones, simulations and cars," paper accepted	HIS (H. Svensson)	Paper accepted.
International Symposium on Quantum Interaction	Robotics community	D. Windridge, Rajagopal Nagarajan, Quantum Bootstrap Aggregation" In. de Barros J., Coecke B, Pothos E. (eds) Quantum Interaction. QI 2016. Lecture Notes in Computer Science, vol. 10106. Springer, Cahm	MU (David Windrigde)	Online available https://link.springer.com/chapter/10.1007/978-3-319-52289-0_9
Journal Neurocomputing, Volume 286	Robotics community	Iain A.D.GunnaÁlvarArnaiz-GonzálezbLudmila I.Kunchevaa "A taxonomic look at instance-based stream classifiers"	MU (Iian Gunn)	Online available https://www.sciencedirect.com/science/article/pii/S092523121830095X?via%3Dihub
Journal Frontiers in Robotics and AI	Robotics community	David Windrige Emergent Intentionality in Perception-Action Subsumption Hierarchies	MU (David Windrigde)	Online available https://www.frontiersin.org/articles/10.3389/frobt.2017.00038/full
Journal Machine Vision and Applications, Volume 28	Robotics community	Santosh Tirunagari, Norman Poh, Kevin Wells, Miroslaw Bober, Isky Gorden, David Windridg "Movement correction in DCE-MRI through windowed and reconstruction dynamic mode decomposition"	MU (David Windirge)	Online available https://link.springer.com/article/10.1007%2Fs00138-017-0835-5
Frontiers in Robotics and AI	Robotics Research community	D. Windridge, "Emergent Intentionality in Perception-Action Subsumption Hierarchies", Frontiers in Robotics and AI, vol. 4, 8, 2017.	MU (D. Windridge)	Online available: https://www.frontiersin.org/articles/10.3389/frobt.2017.00038/full
Machine Vision and Application	Robotics Research community	"Movement correction in DCE-MRU through windowed and reconstruction dynamic mode decomposition", Machine Vision and Application (2017) 28:393-407; DOI 10.1007(s00138-017-0835-5	MU David Windrigde)	Online available: https://link.springer.com/search?query=DOI+10.1007%28s00138-017-0835-5

Table 4: Communication / Publicity

Name of media	Target audience	Dream4Cars contribution Short description/title of the paper	Dreams4Cars responsible	Follow up
On-line magazine VVOX www.vvox.it	General public	Article/Interview with Mauo da Lio on Dreams4cars	UNITN (Mauro Da Lio)	Article online available https://www.vvox.it/2017/12/07/automobili-autonome-blade-runner-al-motorshow/
SIENNA Project http://www.sienna-project.eu/		The project deals with Stakeholder-Informed Ethics for New technologies with high socio-ecoNomic and human rights impAct) will develop ethical protocols and codes for human genomics, human enhancement and AI & robotics. Dreams4Cars has been interview as stakeholder for AI&robotics	UNITN Mauro Da Lio HC Hermann Heich	Transcription of interview available.
Human Factors Liaisons	Richard Roewe	Meeting between the partners and Richard Roewe at USFD	Kevin Gurney	Discussed possible application of Dreams4Cars to human behavioural studies in Richard's driving simulators
Meeting with Tom Westendorp (NVIDIA)	Tom Westendorp	General discussion on NVIDIA solutions for Dreams4Cars	Mauro Da Lio	
Neuromorphic Computing Liaisons /Spinnaker)	Stephen Furber, Simon Davidson	Exchange of information concerning the two projects as side meeting at the London meeting (April 28 2018)	Mauro Da Lio	
UNITN Prospective Students 3rd March 2018	Students, Trento	Artificial Cognitive System Architectures for long-term reliable automated driving	UNITN	Presentations available
Dreams4Cars Video 1	General public	Introduction to Dreams4Cars	HC	Video available
Dreams4Cars Video 2	General public	Car approaching traffic light & pedestrians	HC	Video available
Dreams4Cars Video 3	General public	The Brain Concept	HC	Under preparations

Table 5: Workshops organised by Dreams4Cars

Workshop	Target audience	Dream4Cars contribution	Dreams4Cars responsible	Follow up
Workshop at "Intelligent Vehicle Symposium (IV), organised by Dreams4Cars Redondo Beach CA, USA, 11-14.6.2017	ITS Community	Cognitively Inspired Intelligent Vehicles (See also Table 1.1)	Mauro Da Lio Serge Thill	About 20-25 attendees (Expert).
Workshop in cooperation with SAFER - Vehicle and Traffic Safety Centre at Chalmers Gothenborg, Chalmers University 26.1.2018	Scientific community, students and Automotive Industry	<u>Presentations:</u> -Artificial Cognitive System Architectures for long-term reliable automated driving (Mauro Da Lio) - Active discovery of threatening situations by dream-like simulations (Henrik Svenson) - Behavior optimization and generation of training examples with offline Optimal Control (Francesco Biral) - OpenDS environment for simulations and dreaming (Rafael Math)	Mauro Da Lio Francesco Biral Raffael Math Hermann Heich	About 30 attendees. (Scientists, students and automotive industry/Volvo Cars)