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HANS LÖFGREN
November 13, 2020

WORKSHOP II

FORMULA INFINITY MEETS THE INDUSTRY

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BACKGROUND

On 5 December 2019, the interdisciplinary initiative Formula Infinity started through our first workshop. On site at Halmstad University, just over 20 participants from 11 universities and the Swedish Motorsport Association (SBF) gathered to discuss the vision of an educational car game. The game would strengthen Sweden as an engineering nation by increasing young people's interest in engineering sciences and technology, but also having applications for teaching at upper secondary and tertiary levels. A project idea 1.0 was then developed in collaboration between the higher education institutions and SBF. This was published together with the introduction of the initiative's website on April 18, 2020. It contained the plans for industrial involvement, for workshop II summarized in this report, and ideas for building a consortium with an associated financing plan.

Effots to involve the industry started in May 2020. Industry companies linked to Swedish vehicle manufacturing was contacted and talks were held via online meetings. In these conversations, each organization, in addition to an exclusive introduction about the initiative, also shared their thoughts, ideas and needs that they could link to the vision for Formula Infinity. Based on these conversations, the theme for workshop II was developed - The challenges of the automotive industry & the engineer of the future.

ONLINE
WORKSHOP II

Formula Infinity möter industrin för att förädla spelets vision och möjligheter.

NYA FÄRDIGHETER
Digitala samarbeten, AI och cyberteknologi

NY MOTIVATION
Att skapa en smart och hållbar värld

NYA UTMANINGAR
Elektrifiering, aktiv säkerhet och autonom körning

SAVE THE DATE
1 OKTOBER
09:00 - 12:00

FORMULA INFINITY
INGENJÖRSKONST
PEDAGOGIK
ESPORT
www.formulainfinity.se

The workshop invitational flyer, sent to companies, universities and other organisations.

INTRODUCTION

The workshop began with Petter and Barrett summarizing the project's situation. Project idea 1.0 was presented, and at the same time Petter presented that the idea gained clearer nuances in the discussions held with interested companies prior to the workshop. Three main points were highlighted:

CREATIVITY

It is important that the game acts as a creative playground for the players. Construction within the game must not be too arranged, for example with ready-made formats for vehicles and rigid systems with a low degree of changeability. In the same way as Minecraft and other creative games, we want to provide tools for creating, with loose frames.

INCLUSIVE

How do we make girls not only feel that it's ok for them to play Formula Infinity, but feel that the game is also aimed at them. One of the automotive industry's recruitment challenges is to attract more women.

SUSTAINABILITY

Both companies and academies agree that sustainability needs to be a recurring theme in the game and permeate the game design. There are several interesting approaches to this that will be part of the discussions during the design process.

In addition to the nuances, the participants were asked to broaden the concept during the workshop and brainstorm based on their own needs and challenges. How can we meet the need for specific skills in recruitment? How could we meet specific challenges such as a vehicle sharing economy through a game?

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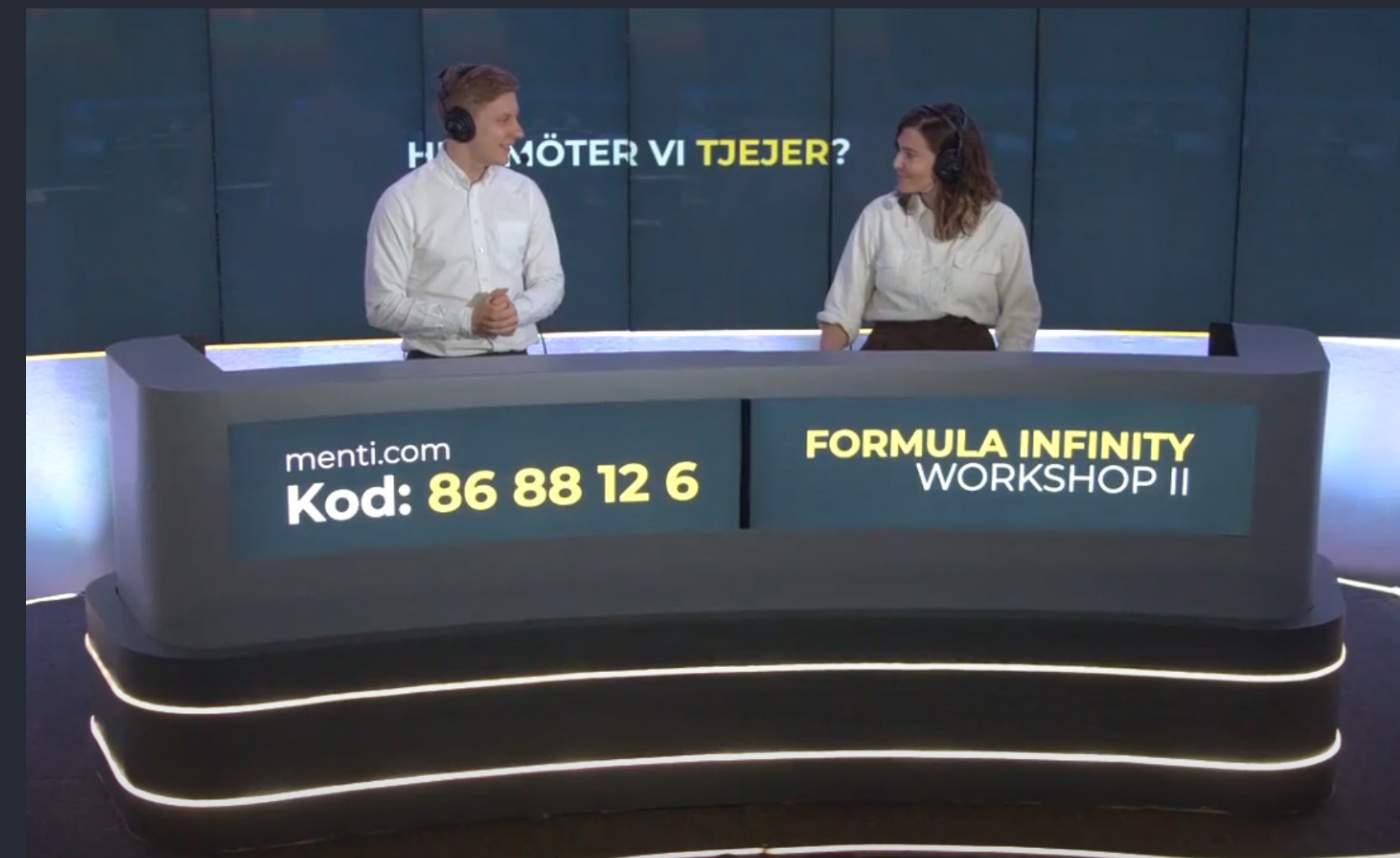
WHAT ARE THE CHALLENGES THAT THE INDUSTRY IS FACING?

Picture: tag cloud created live by the participants during the the workshop
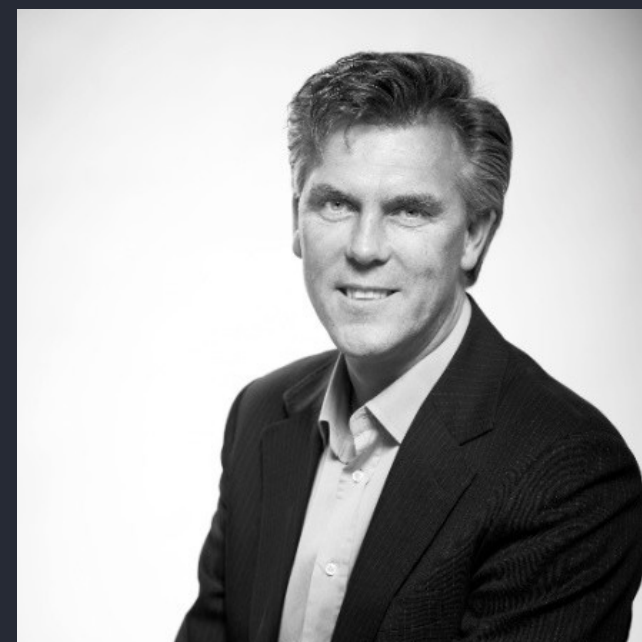
MATTIAS BERGMAN

CEO
Bil Sweden

OLA BENDERIUS

Associate Professor
Chalmers University

MARTIN ANDERSSON

Business Unit Manager
Future Mobility, ARFY

PANEL DISCUSSION ON FUTURE CHALLENGES

A paradigm shift towards electrification, autonomous driving and sharing economy that affects the entire automotive industry's ecosystem, including societal infrastructure, legislation and engineering education.

During the first of the workshop's two panel debates, the issue of the challenges facing the automotive industry was addressed. Mattias started by saying that the industry is currently talking about three megatrends;

- *to address the environmental and climate challenge facing the world, primarily through electrification,*
- *to work with autonomous driving systems to reduce accidents and fatalities in traffic,*
- *to move towards a sharing economy to reduce traffic and congestions.*

A megatrend that the industry does not understand will knock out the industry, he continues. Now we have three trends, and all three are connected, so this is a very exciting time for the industry.

The universities also need to follow the industry's major changes, says Ola. This year, we have actually shut down our entire automotive masters program to create a new program teaching the right competencies. The traditional product cycle for car manufacturing, i.e. where you have produced a product, handed it over to the customer and then switched to producing the next model, is now outdated and moves to a model where you continue to collect and analyze data from the car during use. This of course requires connected vehicles, data management and very robust analysis tools, in addition to more sophisticated software systems in the cars themselves. So the competence has totally changed compared to what it was 5-10 years ago, and this must also be reflected in education.

To meet the new trend, engineers need to work with the combination of hardware and software. Data management in cars is becoming increasingly complicated and places higher demands on engineers, who must build these components and integrate them into the car. This requires much more planning and integration skills that companies must acquire in order to meet the market. In my opinion, they have lived a lot on old merits and taken very small steps - but now it is about very big steps and then you also have to change the organizations, Ola concludes.

From being a supplier of a system, you suddenly have to build something that should be integrated in a larger context, Martin confirms. You go from centralized development of an object to becoming just a component in a large web where you work in a seamless integrated world, all the way from rail traffic down to vehicles such as cars and bicycles. I see this as the big challenge for a car manufacturer today, to see that you are part of a larger ecosystem. We at AFRY have also been a product of our traditional background, but we need to make a number of changes and connect our different competencies within the company, such as infrastructure, the energy side and the industrial side. Autonomous vehicles are a fantastic system, not only technologically, but as a business model, which means that you now have to tackle completely different types of challenges, not just pure technical product issues.

Strategic vehicle research has now evolved from the traditional product and component level, says Mattias. We can not just produce an electric truck if there is no charging infrastructure, or an autonomous vehicle unless the legislation supports such a thing. We now have to have discussions with many who are outside our member companies. Everything becomes more complex and more risky. The automotive industry is now in a humble awakening where they are looking for partners and need to attract new skills, and that is also why we are interested in this project. The industry now has a dualistic need for both broad competence with a holistic and system understanding, as well as expert competence with cutting-edge expertise in each individual area, Mattias concludes with the support of Martin.

At the end of the panel discussion, Petter curiously asks Ola a question; will we ever have autonomous driving systems that mean we have no injuries or accidents? When can we get there? Ola replies that it is of course a very difficult question, but that he can say that so far it does not look so good. Humans are very good at driving. A computer is good as long as everything goes as planned. We have a lot left there and also in attaining society's acceptance. Everything must be built up gradually and test beds must be created. You also have to get a lot of data over a long period of time, for when components degenerate and traffic changes. This is not a holy grail but it is an inevitable development where there is a lot of exciting work to do!
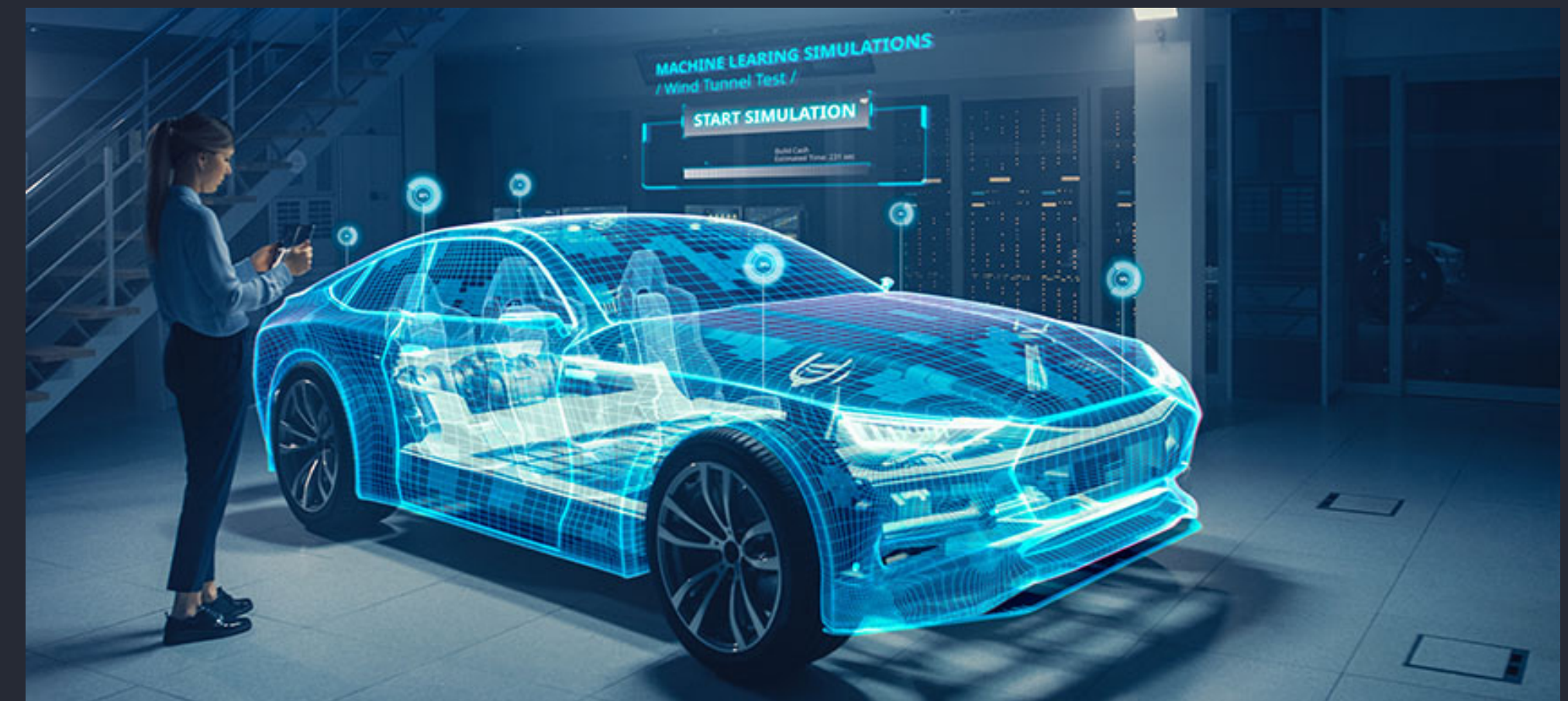
GROUP DISCUSSION

" COOPERATION

"It is important that the game can meet both generalists and specialists - and the interaction between them. This is to be able to meet the needs of a wider group of players, but also to build on classic role-playing elements and game design ".

"The game should include a database or marketplace where developed components can be shared with others."

"It is possible to design challenges so that collaboration is required to move forward."

"Formula Infinity can become a team game to practice the integration of diverse disciplines. Here, the Swedish model with collaboration shines through. Together, we can solve everything from legal challenges to the integration of different systems. "

" RAISING INTEREST

"The game should provide quick feedback on how a choice affects different characteristics of the car / product."

"A game like formula Infinity, which starts at a simple level, can get young people (and others) interested in learning more. An interest in improving oneself in mathematics in order to understand technology can be better than learning mathematics first and then looking for applications".

"Traditional engineering skills are still super important, but it is difficult to attract young engineers to these subjects. A game that is based on modern "hyped" concepts eventually lands in the traditional subjects and attracts competence to the right place. "

"It should be easy to learn more about a topic / component by clicking on a help / information box."

"One should engage role models in the various areas, ie influencers, especially engineers and designers, who can be involved and inspire to explore the area further."

Interdisciplinary cooperation is one of the key issues around the challenges the industry is now facing. From having developed individual products, companies, organizations and teams now work in symbiosis with each other to create larger intertwined systems. The most played games today are all collaborative games where there are role distributions that are either built into the game, or that have arisen through the development of the gaming community. Which division of roles and which forms of cooperation will most benefit Formula infinity players and the game itself?

Education within traditional automotive technology is being abolished and provides space for new areas of competence. At the same time, the way we learn is being modernized and new approaches are being sought to get young people interested in science and engineering professions. A major problem has long been to consolidate all theory into reality and create a broader understanding of formulas and models and their place in a larger system. Formula Infinity can take a "top down approach", where you start from the whole and then dive into details.

" FINDING COMPETENCE

"Companies can recruit skilled users with the help of various development steps within this simulator. For example the development of the engine, sustainability aspects in car development, etc. "

"You can link games and reality by using the game as recruitment to, for example, internships or other activities where you get to try it out in reality."

"You can connect companies to different skills in the game. It should be identifiable which players are good at which things to connect the right people to the right company. "

"You can unlock new levels at companies or schools when you visit them physically."

" SYSTEMS UNDERSTANDING

"Integrate long-term sustainability, a time axis where it is possible to see how a built vehicle changes the environment - society - attitudes, in the long term."

"Sweden has a great opportunity to take a position on mobility as we, among other things. have a leading gaming industry, an automotive industry and a culture and tradition of cooperation and societal development."

"A "The SIMS"or "Transport tycoon"-like game where the "player" is responsible for the city's climate impact and can build transport networks and plan routes, energy efficiency, etc. Here you can help create the transport network of the future together."

"Imagine a game where you can construct an 'eternity machine' in a modular economy where local engineering constitutes the smallest components; as a classic Ford factory firmly distributed and flattened across many industries. Cool and inclusive. Minecraft meets Mad Max!"

A major challenge for the industry is to reach out to all the new competence needed and find a large enough base for recruitment to maintain high quality. In addition to opening the eyes to the automotive industry to many young people, Formula Infinity can also be a direct point of contact for interested and knowledgeable young people.

In the same way that the automotive industry is now undergoing a total restructuring, Formula Infinity needs to address the same structural issues. What type of ecosystem is being built now? How can we engage young people with an interest in such and develop their systematic thinking through the game?

WHAT SKILLS DO FUTURE ENGINEERS NEED?

humaniora

cyberfysiska system

kommunikationsförmåga

simulering vs verklighet

computeraidedengineering

bred förståelse

snabblärda

kreativitet

anpassningsbara

tvärvetenskap

beräkning

disciplinkompetens

tvärvetenskaplighet

etik

ingenjörsprocesser

kommunikation

filosofi

fjämja handligsförmåga

digital

modellering

integration

leverera funktion

öppenhet

estetik

hållbarhet

bedöma

lagspelare

PANEL DISCUSSION ON SKILL SETS

SOFIA ORE
CAE Director
CEVT

PATRIK LILJA
Senior lecturer in pedagogics
Halmstad University

SARA HERMANSSON
Talent Attraction Manager
Northvolt

The engineer of the future has a broad and deep basic education, has a curiosity and will to think outside the box, learn new things as well as has the ability to collaborate.

What I mainly look for when I recruit is, in addition to knowledge in what the engineer will work with, to have a curiosity and willingness to learn new things, says Sofia Ore. As an engineer, you can become anything and must become anything because everything develops so fast now. In the past, engineers could be trained for a profession that looked the same for a long time, but now the professional roles change much faster. We need curious engineers who have both breadth and depth. The standard phrase to be able to think outside the box is both a good and important characteristic of an engineer, says Sofia.

To solve the future need for engineers, it is not enough to just train new ones with the right skills, says Sara Hermansson. We must also develop the skills of already active engineers who have knowledge that may not be needed to the same extent in the future. The important thing is not what technology you have learned in school, we also focus on personality, drive and passion for thinking new. It's a plus if the engineer also has experience from different industries and has been involved in having failed. Failing, you often learn more than if everything just works, Sara emphasizes.

We will always have vehicles to get around with, but the climate cannot cope with the type of cars we have had, says Sofia. This means that we must think about sustainability, in which electrification is an important part. Batteries must also be able to be manufactured sustainably. Much of the new knowledge we need in the automotive industry is linked to this electrification. We need to start thinking about what our society will look like in ten, twenty and thirty years' time. An understanding of basic physics and mathematical formulas will be required, as well as an ability to explain to people who will then make the decisions, Sofia predicts. Mathematics, chemistry and mechanics are the basis for us to finally get to the sustainable society we want. In addition, we need a curiosity for the broad context as well as knowledge and ability to collaborate. We are quite good at talking about the soft skills nowadays, but we must remember that the hard skills are also needed, Sofia emphasizes. If we do not have the technology in place, we will not move forward.

Formula Infinity needs to fit into an educational context, says Patrik Lilja. The technology in vehicles and its connection to society involves different professional categories. To meet such challenges, so-called interprofessional learning that fosters an interdisciplinary mindset is needed. Here, communication and the ability to understand a problem from several points of view becomes central. A kind of problem-based learning. For this to work, the game also needs to be linked to the schools' curricula and there are good opportunities for that, says Patrik. If we want to get FI into the education system, the education system will probably also have to be developed. We must create pedagogical contexts where we can meet different approaches and techniques and provide conditions for testing and playing with technology. This also places demands on teachers, but digital environments such as Formula Infinity will help.

A good thing about the game idea Formula Infinity is that with it we can attract those who do not have access to this technology in their vicinity or who do not have parents or acquaintances who work as engineers. To be able to open their eyes and show them that technology is fun and that they get to feel that this is something they can become good at and something that might become a future career. The engineering profession is probably seen as a rather boring profession, Sofia laughs. But we will change that.

GROUP DISCUSSION

During the second group discussion, the participants continued to discuss the topic of the engineer of the future. Three clear trends could then be discerned; creativity and curiosity, communication and collaboration as well as knowledge and education. These categories are in a way interdependent. No human is an island and we learn and are influenced by each other. They also have in common that they are trainable qualities.

" CREATIVITY AND CURIOSITY

"Foster curiosity and playfulness throughout the education system. Do not look at specialists and generalists as opposites."

"Today we do not have all the answers. Leave enough open for imaginative play for the younger players, but the older ones may need to test their skills more."

"A leadership issue to attract and retain competent staff is to create an open climate that allows people to think outside the box and dare to fail. The game needs to invite reflection. "

"Competitions and rules for how to win will be able to develop over time through participation and 'wisdom of the crowd'."

Creativity and curiosity are sensitive qualities that we are all born with but that our education system may not always have the ability to stimulate. Playfulness and courage to fail are probably among the most important contributions that the gaming medium can make. Who knows, maybe gameification as a phenomenon can also inspire new ways of working.

" COMMUNICATION AND COOPERATION

"Communication rust is the worst thing that can happen. You need to understand the concepts. "

"Technical competence in at least one discipline and understanding of other competencies and how to communicate between each other."

"Cooperation between different personalities and areas. In school you can "nerd in" and there is a perfect solution. In industry, there is often no perfect solution, which means that you have to be able to compromise and be able to discuss with others. "

"How do we make sure we are understood between organizations? Here lies the responsibility of everyone. Can we bring this in as a competitive element? "

Communication and collaboration are partly cultural in that routine ways of doing something can get rooted in the company. At the same time, "walls" can be moved or opened up in favor of a more informed and unified approach. As a teammate or colleague, communication and the ability for smooth collaborations become a decisive factor for the joint performance. Perhaps these abilities need to be constantly practiced so as not to be tarnished by rust or, in the worst case, regenerated. Here, the digital gaming world can hopefully become an exciting training arena for both communication and collaboration strategies.

" KNOWLEDGE AND EDUCATION

"Dissolve different levels of knowledge within a system and prevent people from getting stuck in their favorite area or organization."

"The engineer's ability to filter, validate and manage information without simultaneously shutting out new opportunities will be crucial."

Get things that can be measured in the game. For example: How many toxic substances are emitted when you choose this component and what will be the imprint when you choose this solution? "

"Dynamic education vs. Instrumental bureaucratic ditto. "

"Insights into programming. What should and can be automated? "

Knowledge is not just the product of education. It can also be acquired dynamically through work, colleagues or through leisure activities. Knowledge is a fresh product, it changes or risks being forgotten. However, knowledge can be preserved in books or in the technology itself. For an engineer, however, knowledge is not enough, the engineer needs to understand to be able to solve problems and create new innovations. How do you then cultivate knowledge for understanding within a professional group or organization? We think these summaries are trying to answer that.

UNITY 3D FOR ENTERPRISE
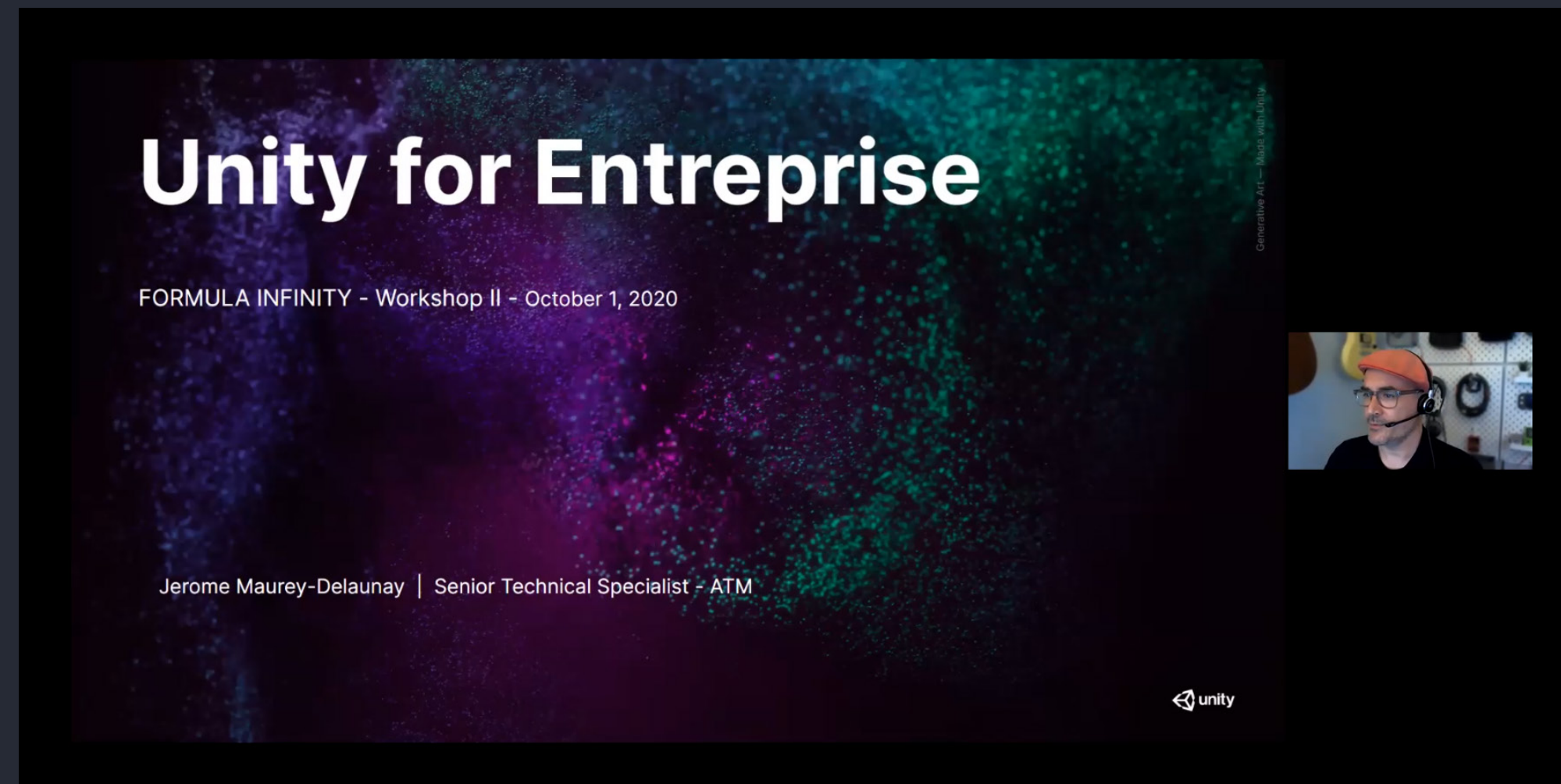
Jerome Maurey-Delauny
Senior Technical Specialist - ATM

At Unity we believe the world is a better place with more creators in it

It means that we want to empower content creators to reach their audiences across medium and discipline.
To do so we reach over 20 platforms, officially support 20 platforms including most XR and mobile and desktop. We have about 1.5 monthly active creators using the unity platform to create everything from games to car configurators to machine learning simulations. We have a mobile leadership which sets us to 53% of the top 1000 games on mobile are made with unity.

Unity is the world's leading platform for creating and operating interactive, real-time 3D (RT3D) content

The world is evolving, and things are changing. Static content now becomes interactive.

What is currently driving this disruption? There is a demographic shift, aging workforce is retiring, and the incoming new workforce are digital native, they expect a superior user experience and more mature or flexible tooling than has been traditionally been used in the industry. Sustainability is also a huge driver for adoption of 3D being more efficient, more ethical and allowing for new regulation. Technology is also a big driver while people are using Unity because we are in sync with all the major platforms from Apple to Nvidia. We work with those technology platform hardware or software owner to ensure that Unity creators are able to deploy content seamlessly and tap into the latest and greatest things like IoT, 5G etc. Finally, Covid 19 has definitely been a huge accelerator or catalyst for digital transformation in enterprise. People realize now that the workplace is disrupted. People are working from home and they need to connect in immersive spaces for example to do design reviews or to make decisions. There is also disruption in supply chains and also in the way we manufacture products.

Real-time technology is transforming how products are being designed, engineered, made, sold, serviced and maintained.

WHAT IS UNITY?

Most people know us as a game engine. It is a content development platform that includes the Unity editor. This comes in two flavors. We have basically two technical tracks that we maintain in parallel. One of those is what we call the long-term support. Currently, the long-term support version of Unity that is recommended for doing production and actually shipping products with is Unity 2019 LTS. Because our environment is never static, we support 20 platforms including all the major AR, VR, mobile and desktop. We always need to evolve the tech so we can't stay static, we have to keep with our environment and keep developing and innovating. For this we also have what we call the tech stream. This is currently in version 2020.2 which is the second release for the year is already in beta and will be coming out of beta in the next few months. That will be the last tech stream for this cycle and then we would move to 2020 LTS which will be the long-term support. In 2020 we are focusing on improved quality of life, making sure that the creator experience is good and better in every release. That we have robust AR support for example and have robust deployment to all the major platforms and that we can take in more data and have better performance when it comes to working with complex projects. This is important to us. Obviously, we need best-in-class artist tools and visuals. For this we have been working on what we call our scriptable render pipeline. Unity is really meant to be customized. We do not tell people how to development their content and that includes also how to render. We don't have one pipeline; we have a pipeline that has multiple profiles out of the gates that we provide to our community. One is called the universal render pipeline, which is focused on working across all the platforms that we support, from high-end desktop all the way down to embedded devices for example in the car. Then we have the high definition pipeline, which is focused on cinematic qualities including real-time ray tracing. Finally, a big focus of the Unity 2020 release cycle is to support Next-Gen platforms, that includes the Next-Gen consoles, but this has very little relevance to the industry. It also includes working with Apple, Google, Qualcomm and Nvidia on making that Unity supports all of their upcoming hardware and software layers so that developers now can benefit from all the innovations in the space.

DIGITAL TWINS

Jerome then discussed a few use cases and started with Digital Twin where the virtual and physical worlds are emerging. For this we have a solution called Perspective, which is a software development kit on top of the unity editor. It lets you import CAD data directly. Unity has a robot library in order to quickly add standard robot to your simulation. It is important to be able to simulate production lines even before you have hardware PLC's in order to design systems.

TRAINING

Training is also a very big use case for unity, specifically immersive training using VR and AR. We have a tool kit called Interact to allow this kind of process simulation or stepped assembly using a visual editor, so no code is required. It also bundles a very precise industrial physics engine that can do intricate collision detection, measure force and can even be used to do ergonomic studies for processes. It supports multi-user collaboration in an industrial space.

HUMAN-MACHINE INTERFACE

Another use case that is very relevant for automotive is HMI. We are actively working with OEM's to get Unity into the vehicle. Traditionally it has been used as an accelerator for prototyping. We have good support for mobile, so you are able to deploy to mobile hardware, for example running Android. We want to introduce an end-to-end workflow without the traditional break in between prototyping and then having create a lengthy design document for this prototype to be rebuilt using another system. Jerome also showed how this technology could be used in a in-car entertainment system.

AI, ML & SIMULATION

Another use case is AI, machine learning and simulation. For this we have quite a bit of tool kits and frameworks available. Most of those are open source actually, like our Perception toolkit, AI planner, feature detection, the ML agent which is one of the most popular GitHub repositories. We also have a couple of products that we are going to release soon. One of those is the SimVis SDK that allows you to quickly set up simulation and visualization scenarios within the Unity editor, but also a sensor framework which allows you to create custom sensors that are going to be put into your vehicle. We will soon also include standard industry sensors to get started with a simulation inside Unity.

UNITY FORMA

We are also working on the end-to-end marketing solution, developing a SDK called Forma. This product makes it faster to implement colors and materials in a real-time 3D experience.

UNITY MARS

Finally, Unity MARS is an accelerator to create AR experiences, i.e. a specialized authoring environment for creating intelligent AR experiences. The idea of MARS is to try to simulate as much as possible inside Unity editor without having to go to the device. So, if you are creating AR experiences often you have to go to the mobile device or the HoloLens. MARS allows you to not have to deploy as much to the device and also set up fuzzy logic in order to handle various environments.

At the end of the presentation Jerome played a video that was recently released in collaboration with Volvo Cars that is the embodiment of what Unity means for a car manufacturer. In it we saw how Volvo was using Unity in the design process and in the simulation of different driving situations.

CONCLUDING REMARKS

ANDERS NELSON

Deputy Vice Chancelor
Halmstad University

Last but not least, the word was handed over to Deputy Vice Chancelor Anders Nelson at Halmstad University, with special responsibility for collaboration, innovation and internationalization.

Anders began by describing how the University came into contact with people who were involved in e-sports a year and a half ago. We then realized that something is happening around the world heavily envolving young people in gaming, in e-sports, in different platforms where you both play and socialize. This was completely new to us as a university. The university has since tried to get to know these phenomena and the people, both at the grassroots level and those who work with this professionally. We have realized that we do not usually communicate in the way and in the contexts and places where these young people are and socialize. Many of them are of course our future students and we need to start understanding what is happening in their lives, how they define themselves and what they are interested in. For some time now, we have been quite active in building relationships with these groups to somehow make these worlds grow together. People in these groups may not have been the ones we saw as future students, but to a large extent we believe we must meet them.

The Formula Infinity project is one of several examples of how we can approach young people. This is super exciting! I think we need to understand that people learn in everyday life in completely different ways than how the educational system traditionally organizes their educations. Education is usually very linear in its nature. You take part in different pieces of wholes, while learning in everyday life is often holistic, based on interest, strong motivation and a strong driving force to master and understand the world you live in. This differs from how courses and education plans are designed. This is not the first time a project has tried to bridge the difference between a playful approach and a traditional education, but here in this project I think it is taken seriously. We at Halmstad University support this and believe that this is one of many projects that will make us much more prepared for how we will meet our future students and understand how we will develop our educations in the future. Thank you for this workshop and I look forward to the continuation.

Afterwards, Petter and Barrett ended the workshop by asking the leading question:

- How will we face the future so that Sweden remains a leading innovative country?