

FLASHBACK  
2019

PAGES 2 TO 4

MASTER ERASMUS  
MUNDUS

Reviewing economic  
perspectives

Page 10

TERRITORIES

The Innovation Tour,  
1st edition meets  
with success

Page 16



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Donnons un sens à l'innovation

# Interactions

DOSSIER PAGE 5

## Machine Learning at UTC-Heudiasyc Lab

HEALTH-ORIENTED RESEARCH PAGE 14

### MICRO-ORGANS WITH LABS-ON-CHIPS

ÉRIC LECLERC, SENIOR CNRS RESEARCH  
DIRECTOR UTC- BMBI LAB

TRAINING PAGE 18

DESIGN HAS BEEN  
PRESENT EVER SINCE  
UTC WAS ESTABLISHED





**FROM THE  
PRESIDENT'S  
DESK**

**T**aking uncertainties into account lies at the heart of progress in experimental science. How can we estimate the most probable values of parameters when we have a sufficient number of measurements? In 1801, the Italian astronomer Giuseppe Piazzi discovered Ceres and observed its position 22 times before the asteroid was no longer visible due to its apparent proximity to the Sun. Many astronomers focused on determining its orbit and Gauss used his method of least squares to estimate the orbital parameters. His prediction, which took him 100 hours of computation, was different from that of other astronomers, but it was the only correct one. The least-squares method and its foundations were published in 1809 in "Theoria motus corporum coelestium in sectionibus conicus solem ambientium". The statistical linear estimation proved to be remarkably efficient in taking into account uncertainty factors. Thierry Denoeux presents modern conceptual and algorithmic advances in this area.

Three directions of research are active for today's estimation problems:

1. The volume of data and the dimension of the estimation problem. If the position of a satellite is a 3-D problem, the state variable of a weather prediction model is of the order of  $10^8 \sim 10^9$  dimension.
2. The non-linearity of the underlying dynamics for evolutionary problems as well as the non-linear relationship between model and observations.
3. The underlying probability distributions are not normal. Every engineer knows that a single mistake in measurements can negate the quality of any linear regression process.

Several UTC laboratories are conducting research on these subjects and in this issue we shall see examples of machine learning (ML) contributions to the emergence of efficient algorithms.

I should add that whilst engineers do not have to master all algorithms because they depend on the estimation problem, every engineer must fully master its mathematical and computational fundamentals.

**Philippe Courtier,  
President & Vice-Chancellor, UTC**

# Photographic



**PROSPECTIVE RESEARCH  
CONDUCTED AT UTC AND THE  
UNILASALLE INSTITUTE, BEAUVAIS  
IN THE FIELD OF METHANISATION**

In January 2019, UTC inaugurated a series of specialist press conferences (Interactions-Press) to present research activities and results by André Pauss (UTC-GP/TIMR) and Thierry Ribeiro (UniLaSalle) in regard to a dry phase methanisation process installed on UTC premises.

**FIRST UTC BIOMED  
RENDEZVOUS**

January 18, 2019, UTC organized its first rendezvous for designers, research scientists, engineers and undergraduates undertaking technology-intensive studies with health-care orientations to encourage exchanges conducive to biomedical innovation and the emergence of new models. The second edition, January 31, 2020 confirmed that the event is highly successful.



**AN AGREEMENT TO ENACT THE GROUPING OF  
THE NQSE'S MASTÈRE TRAINING MODULES WAS  
SIGNED**

February 1, 2019, UTC and the University of Abomey Calavi (Cotonou, Benin) signed an agreement in regard to regrouping two Mastère NQCE courses (Quality Management: Operational Strategy).



**LAUNCH CEREMONY FOR THE UTC  
INNOVATION FOUNDATION**

February 5, 2019, UTC-Paris hosted the launch ceremony for the UTC Innovation Foundation. The founder entities UTC, UTC-Alumni, Saint-Gobain Glass France and Sopra-Steria.

**RECENT PROGRESS IN BOTH BASIC  
AND CLINICAL RESEARCH INTO THE  
MUSCULO-SKELETON SYSTEM**

March 13, 2019, underscored the excellent 14 years of collaboration between UTC, the CNRS and the Mayo Clinic notably throwing light on research carried out by Sabine Bensamoun (UTC-BMBI/CNRS).



**LIGHT-UP COMPIEGNE**

March 2, 2019, students of the Association Light Up City organized a new lit-up night walk all over Compiègne "Light-up Compiègne".



# flashback 2019...



## THE IMAGINARIUM FESTIVAL

The 6th consecutive Imaginarium Festival took place at the Tigre de Margny-lès-Compiègne and welcomed over 15 000 festival-goers to this two-day event.



## PRESS & MEDIA INTERACTIONS- HOW TO DESIGN FOOD THAT COMBINES PLEASURE AND HEALTH ISSUES

The art of designing menus that combine pleasure and health issues. The spotlight was placed on this theme September 27, 2019 at UTC-Paris site– a special interest theme for Professor Claire Rossi and her research colleagues.



## UTC INAUGURAL LECTURES

In September 2019, this year's Inaugural lectures were assured by Luc Abbadie on "Biodiversity", by Francis Chateauraynaud on various "S&T Controversies" and by Anne-Virginie Salsac on "Blood flow biomechanics".



## CELEBRATING THE CNRS' 80TH BIRTHDAY AT UTC

In October, 2019, 4 of UTC's laboratories: BMBI, GEC, Heudiasyc and Roberval together celebrated the CNRS' 80th birthday, organising an exhibition recalling the past 40 years of scientific and technological research and previewing what the next 40 years may reveal.



## UNITED FOR THE TOWN

This year's "United for the Town" event took place September 5, 2019 in Compiègne and the neighbouring townships (as far as Noyon, > 20 km North). The core credo here is a societal and citizen commitment for the 1st year UTC students whereby strong and intergenerational bonds based on esteem and respect can be built, between the young students and the inhabitants.



## SORBONNE UNIVERSITÉ (SU) INAUGURATES SCAI AN HE CENTRE FOCUSING ON AI

September 2019, saw the creation of the Sorbonne Centre for Artificial Intelligence (SCAI) which support a major unified training centre entirely focused on AI at every level possible, ready to address various scientific challenges that will arise tomorrow.



## THE FIRST "AGGREGATE" RENDEZVOUS

October 1, 2019, UTC hosted a meeting of enterprise managers, lecturer-cum-research workers to discuss seven territory-intensive thematic aggregates specific to the Oise Department Metropolitan area: naturality, resilience, industry for the Future, health, aeronautics, energy and bioresources & water.

## CREATION OF AN AEROSPACE-CERTIFICATE

Autumn 2019, UTC created an "aeronautics and space certificate" in a partnership with Ariane Group, the French Space Agency (CNES), Safran-Zodiac and the Circle of Flying Machines (Margny-lès-Compiègne).







#### # UTC, RANKS 2ND POST-BAC 'EXCELLENCE' LEVEL ENGINEERING SCHOOL ACCORDING TO FIGARO ÉTUDIANT

UTC is ranked 2nd post-baccalaureate school in the "schools of excellence" category, which covers 21 French engineering schools targeted by students from "starred" preparatory classes 'CPGE' and the best high school students, in the first ranking of the Figaro newspaper (student edition). UTC also came 2nd in the category "industrial engineering - mechanical engineering" and 6th in the category "digital - computer science - mathematics". ■



#### # FIRST UTC / CRANFIELD UNIVERSITY (UK) RESEARCH SEMINAR ON SCIENTIFIC FORESIGHT

February 5-6, 2020, the UTC Daniel Thomas Innovation centre welcomed a delegation from Cranfield University (UK) for a first research seminar with the UTC for teachers. The aim of this event was to build new links between lecturer-research scientists and research workers to complement the already very close relationship at the training level, given the joint double degree programme which has trained more than 500 graduates. ■



#### # BÉRANGÈRE BIHAN-AVALLE (UTC-GEC) LAURÉATE OF THE EURASANTÉ 2019 INNOVATION & PRÉVENTION PRIZE

Professor Bérangère Bihan-Avalle, UTC-GEC laboratory, was awarded the Eurasanté Innovation & Prevention Prize, in the oncology category, for her ErADic project last December in Riaumont. ErADic aims to develop a predictive tool for the recurrence of chronic myeloid leukaemia patients after stopping conventional treatments using 1st or 2nd generation molecules. The prize rewards projects aimed at improving cancer screening techniques, promoting the proper use of drugs, and even preventing adverse effects. It includes financial support from the Denise and Norbert Ségard Foundation as well as support from Eurasanté for the promotion of the project and its results. ■

#### # THE FINAL ASSESSMENT ROUND FOR THE EUROPEAN "ESCAPE" PROJECT

Wednesday November 27, 2020, the UTC-Heudiasyc laboratory hosted the "ESCAPE Workshop" event which preceded the final review of the European "ESCAPE" project. This project uses and integrates the satellites of the new European Galileo network in the autonomous, self-drive, vehicles that Philippe Xu, teacher-researcher, has been developing for 3 years with the Renault group and partners from Spain (Ficosa, GMV), Italy (STMicro, LINKS) and France (IFSTTAR). ■



#### # 3 UTC STUDENT AWARDS 2019

Our congratulations go to Flavien Calvez (a student engineer in digital simulation), Héroïse Conte and Romain

Outters (respectively student engineers in mechatronics and project management)! All three being passionate fans for aeronautics and members of UTCiel, they took up the challenge to study the theme of the 2019 edition "The aeronautics defence sector industry faced with the return of protectionism in a multipolar world. From civil to military and vice versa, what are the possible industrial strategies?" ■

#### # A UTC UNDERGRAD MAJORING IN GI (COMPUTER SCIENCES & THEIR APPLICATIONS) WINS THE USINE NOUVELLE ENGINEER OF THE YEAR TROPHY FOR INNOVATION

Raphaël Jaurès, a computer engineering student, was awarded the Engineer's Trophy for Innovation last December at the Usine Nouvelle's 2019 Future Trophies ceremony for his project "Watsyn (a network of autonomous probes designed to monitor the composition of waterways)". In the same category, Mohamed Soliman, a UTC student (majoring in Mechanical Engineering,) was nominated for his project "Skater without borders": a creation of electric rollerblades that are animated by the skater's movements. Jérémy Pointel and his partner Arnaud Philippe, a recent IM-IDI (Industrial Design) graduate, were nominated in the category "Tech engineers for good" for their project "Swam": a siphon that can be screwed onto a conventional PVC sink outlet, allowing "grey" water to be diverted and collected in a watering can and reused for watering plants or flushing the toilets. ■ PS



# Photographic flashback 2019...

## DESIGNING MICRO-ORGANS USING LABS-ON-CHIPS

On October 23, 2019, Éric Leclerc, senior CNRS research director at the UTC-BMBI laboratory, presented his research work on the creation of microorganisms on biochip labs at LIMMS (CNRS/University of Tokyo), where he is collaborating with Franco-Japanese teams.



## 'SMART COMPOSITE MATERIALS AT THE UTC-ROBERVAL LABORATORY

On 12 November, Zoheir Aboura's research on intelligent composite materials that communicate their own operational status was highlighted to the specialist press at UTC-Paris.

## THE 'PRIX ROBERVAL' AWARDS CEREMONY

On November 16, 2019, Compiègne's Imperial Theatre was the venue for the 32nd edition of the Roberval Prize, which rewards literary, audio-visual or multimedia works devoted to the explanation of technology every year. This year, François Langevin, lecturer-cum-researcher at the UTC, received the "higher education" prize for his book "Architecture et ingénierie à l'hôpital", a real challenge for the future.



## THE UTC 2019 DIPLOMA AWARD CEREMONIES

The UTC graduation ceremony took place on November 23, 2019 with class God-Father Jean-Louis Chaussade, CEO of the Suez Group (major European water utility) and Chairman of the UTC Board. 800 graduates received their UTC diplomas on this memorable day applauded by the numerous guests.

All these 2019 events were videoed on You Tube UTC ; you can also keep up with our activities, live; on



# Machine Learning at the UTC-Heudiasyc lab

Professor Philippe Bonnifait, also Vice-Chairman of the scientific council of the University of Technology of Compiègne (UTC) former Director of a CNRS research group (GDR) in robotics between 2013 and 2017. Since January 2018, he has been Director of the UTC-Heudiasyc Laboratory, created in 1981. This state-of-the-art laboratory houses, in particular, the CID (Knowledge, Uncertainties, Data) team dedicated to research in artificial intelligence.

**UTC-Heudiasyc is a joint research unit (UMR) between UTC and the CNRS. It employs nearly 120 people – professors and lecturers, research-scientists, research engineers and technicians, doctoral students, post-docs, administrative staff, etc.** In addition, there are about twenty Master's level trainees per year. This makes it, after UTC-Roberval, the university's second largest laboratory.

*What are the major lines of research undertaken at UTC-Heudiasyc? There are four priority themes: computer science, artificial intelligence (AI), a key word that has been around for 20 years, when it was not yet fashionable, and finally automation and robotics*

"Heudiasyc's scientific scope has not changed much since its creation, but the themes have evolved. We focus on computer sciences in the broadest sense, with two main branches: the training of computer engineers and research Master students," explains Philippe Bonnifait. This specificity explains the very strong link between the lab and the UTC's

computer science department, since the majority of the lecturers involved in the training of computer engineers (but also in the framework of the research Master's degrees) report to UTC-Heudiasyc.

UTC-Heudiasyc is a cutting-edge laboratory that has seen "five of its research scientists seconded to the private sectors. Among them, two are at FAIR (Facebook AI Research), the firm's laboratory in Paris," he says. A laboratory whose lecturer-cum research scientists, with proven skills, provide quality training that is highly appreciated by students. The proof? "There are more than 700 matriculated computer engineering students. This is not insignificant. It is a highly valued generalist training that allows our students to easily adapt to the very rapid evolution of technologies in the sector. For Master's degree students, the training is more specialized, closer to what we do in research, in short. Currently, Heudiasyc has 55 PhD students, which proves the interest, in the eyes of the students, in the research themes tackled by the laboratory," he emphasises.

What are the major lines of research undertaken at UTC-Heudiasyc? "There are four priority themes: computer science, artificial intelligence (AI), a key word that has been around for 20 years, when it was not yet fashionable, and finally automation and robotics. All our teacher-researchers work in these disciplines," says Philippe Bonnifait.



PHILIPPE BONNIFAIT

Since the restructuring of the lab in January 2018, three teams have been working on these themes: the CID team (Knowledge, Uncertainties, Data), the SCOP team (Safety, Communication, Optimization) and, lastly, the SyRI team (Robotic Systems in Interaction). "The first team is dedicated to what we do in the foundation artificial intelligence studies, understanding that not all areas of artificial intelligence are addressed. We can mention machine learning, interactive learning, recommendation systems, etc." The second works in particular on the







problems of scheduling, networks but also - and this is a novelty in the laboratory - on safe systems, in other words, systems that are failsafe and secure. As systems communicate increasingly, data exchanges are therefore important. "Hence the major challenge of securing them against an attack by hackers, for example. Finally, the last theme addresses those questions that revolve around the autonomy of machines, in particular the articulation between robotics and artificial intelligence, the first being in the physical world while the second, computational, virtual, is located in the "cloud" or in computers. We now speak of artificial intelligence embodied by robots," he explains.

The choice made by Heudiasyc in the vast field of artificial intelligence applied to robotics? "We chose to focus our research on mobile robotics, particularly those dedicated to transport and mobility. Today, we are talking about intelligent ("smart") and autonomous vehicles. Vehicles designed to drive in shared environments. We were also one of the first labs to launch, in 1997, into UAVs," he explains.

A choice that allowed the lab to participate, as part of the Government Incentive Programme Investments for the Future (PIA), via Labex MS2T and EQUIPEX to Robotex and enabled Philippe Bonnifait to pilot everything related to land and

air mobile robotics in France. A project launched in 2011 and running until the end of 2021 which also had the support of the Hauts-de-France Region to the tune of 3.5 million euros in scientific equipment.

This policy choice that naturally led to a large number of industrial partnerships, particularly in the field of transport. "With Renault, for example, within the framework of Sivalab, a joint Renault/UTC/CNRS laboratory, or a ten-year project, launched in September 2019, with the IRT Railenium consortium related to the concept of autonomous trains," concludes Philippe Bonnifait. ■ MSD

# Modelling uncertainties in intelligent systems

Professor Thierry Denoeux has been a senior member of the Institut universitaire de France (IUF) since October 2019. Director of the Labex Maîtrise des Systèmes de Systèmes Technologiques (MS2T) within Heudiasyc, a joint UTC/CNRS unit, a researcher in the Knowledge, Uncertainties, Data (CID) team, he is also Editor-in-chief of two international journals: International Journal of Approximate Reasoning on uncertain reasoning and Array, a new open-access journal covering the entire field of computer science, launched in October 2018.



**A**s a graduate engineer from École des Ponts ParisTech (ENSP), Thierry Denoeux pursued a PhD thesis on "the reliability of rain forecasts by weather radar" in a laboratory dedicated to the environment at ENPC. He is interested, among other things, in computer science, pattern recognition and image processing. "The goal was to process radar images to analyse and extrapolate the movement of rain cells for quantitative forecasting in the very short term (one to two hours). These predictions were used to optimize the management of large sewer systems in order to limit flooding in the event of a storm," he explains.

An interest that naturally led him, after his PhD, to join the Laboratoire d'Informatique Avancée de Compiègne (LIAC), Lyonnaise des Eaux, which has since become Suez, as a research engineer. He stayed there for three years and worked on European projects with lecturer-

cum-research scientists working at UTC, in the early 1990s, when artificial intelligence (AI) was already arousing a lot of interest with the development of expert systems.

He joined UTC Compiègne in 1992 as a contract lecturer-cum-research singular scientist at Heudiasyc before being appointed as full professor in 1999. Several responsibilities followed suit: director of a joint laboratory with Suez, deputy director of Heudiasyc, vice-president of the scientific council of the UTC, scientific coordinator, before taking over as director in January 2019, of the Labex Maîtrise des Systèmes de Systèmes Technologiques (MS2T) - a ten-year project - which, as part of the Government Incentive Programme Investments for the Future (PIA), running until 2021. Also in January 2019, he took over the management of the SHIC<sup>1</sup> research federation, a CNRS structure initially grouping together the mixed Heudiasyc, BMBI and Roberval units, which were recently joined by the Costech unit. This federation provided impetus to a new dynamic for interdisciplinary technological research within the UTC.

*As biologists have been doing for a long time, computer scientists must now be concerned about the ethical implications of their work.*

At UTC-Heudiasyc, Thierry Denoeux is part of the CID team in charge of artificial intelligence, structured around two main research areas. The first concerns knowledge and data processing with themes such as knowledge modelling, machine learning and uncertainty management, a major challenge in both artificial intelligence and statistics. "Indeed, how can we model uncertainty, reason and make decisions knowing that we do not dispose of all the information needed?" he says. The second area of research is concerned with customized adaptive systems. In other words, everything that relates to the interaction between humans and systems with the idea of designing systems that can automatically and dynamically adapt to the user and the context of use.

Thierry Denoeux works mainly on the first priority theme. "I work essentially on the modelling of uncertainties in intelligent systems, a theme that lies at the interface between artificial intelligence and statistics. I am particularly interested in the theory of belief functions, a theory of uncertainty that allows us to reason and make decisions in the presence of uncertainties. It is a general theory, which encompasses probability theory, and has many applications because uncertainties are ubiquitous. Research in this area is multidisciplinary and involves economists, AI specialists, statisticians and others," he explains.

A field that led him, in 2010, to participate in the creation of a learned society Belief functions

and Applications society (BFAS), an association of which he is the President. The objective? In particular, to promote teaching, research, the advancement of knowledge in the field of belief functions and to explore the links with other theories of uncertainty. Hence the launch of international conferences held every two years - the next one will be convened in Shanghai in 2020 - and a thematic school for the training of PhD students, the latest edition of which was held in October 2019 in Siena (Italy).

However, Thierry Denoeux does not confine himself to the theoretical aspect of his research on belief functions, as he is also interested in the concrete applications that can derive from them. One example is automated postal address recognition, which was the subject of a CIFRE thesis in partnership with Solystic, one of the world leaders in the provision of automated sorting and distribution preparation solutions for parcels and mail. "This company sells machines with handwritten address recognition software. So when the address is not recognized, the envelope is rejected and processed manually. The challenge is to reject as few envelopes as possible while making as few errors as possible on those that are accepted. To meet these two criteria and improve machine performance, the idea was to integrate several software programs and combine the results of these systems using belief function theory," he explains.

Other applications include the work carried out with the French Institute of Transport, Planning and Network Science and Technology (IFSTTAR) and the SNCF on "Diagnosis of railway track circuits", and the ongoing collaboration with the Laboratory of Computer Science, Information Processing and Systems (LITIS) of the University of Rouen on "Segmentation of tumours in medical images and prognosis based on the evolution of patient data".



THIERRY DENOEU

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The theoretical corpus of belief functions is of course also of interest to the SyRI (Robotic Systems in Interaction) team, which is working in particular on intelligent vehicles (IV). "One of the problems in IV concerns perception. IVs are full of sensors and the challenge is to be able to process the information collected by these sensors to recognize objects on the road such as pedestrians, cyclists, etc. One of the problems in IVs is perception. We therefore need to combine the information from these different sensors. And here again, there is a lot of uncertainty, because each sensor provides partial and sometimes unreliable information about the environment," adds Thierry Denoeux.

Should we be afraid of AI? "Irrational fear is irrelevant. However, some applications of AI pose ethical problems, such as generalised video surveillance with, in particular, the development of facial recognition. As biologists have been doing for a long time, computer scientists must now be concerned about the ethical implications of their work," he concludes. ■ MSD

<sup>1</sup> Fédération de recherche Systèmes hétérogènes en interaction



#### UTC, AN ENGINEERING SCHOOL

#### WITH A STRONG INTERNATIONAL OUTREACH

Winner of the "1,000 Talents" program launched by the Shanghai City Hall to encourage the arrival of international experts in universities, Thierry Denoeux has been a "joint" professor at the UTseuS since 2019.

UTSEUS is a Sino-French Institute in Engineering, jointly run by the Universities of Technology (UTBM in Belfort-Montbéliard, UTC in Compiègne, UTT in Troyes) and the University of Shanghai. With 250 Chinese students in Compiègne in 2018, the UTC will consolidate its status as a top-ranking engineering school with an international outlook. Today, the UTs but also the Shanghai University (SHU) have decided to step up their efforts, particularly in the field of research. Hence the recruitment of young Chinese permanent lecturer-cum-research scientists attached to UTseuS, but also the appointment of "joint" professors - professors from the UTs who will spend part of their time on the UTseuS campus in Shanghai. There are currently two of these: Renaud Bachelot, who works in the field of nano-optics at UTT-Troyes, and Thierry Denoeux from UTC-Compiègne. A working group led by Thierry Denoeux has defined a research theme that has been approved by the UTC's scientific council: cyberphysical systems (systems composed of different physical entities connected by the Internet, for example: transport systems or the Factories of the Future) and data science, with three main applications: intelligent mobility, intelligent manufacturing systems and intelligent functional materials. ■ MSD





# Virtual reality serving the cause of training

Senior lecturer, Domitile Lourdeaux is also a member of the Knowledge, Uncertainties, Data (CID) team at UTC-Heudiasyc, a joint UTC/CNRS unit. Her research focuses on customized adaptive systems, more specifically on everything related to virtual reality and training.



DOMITILE LOURDEAUX

**A** field that she has been working on since her PhD thesis at the École des Mines de Paris: a CIFRE thesis funded by the SNCF on "Virtual Reality and Training of TGV Drivers", conducted between 1998 and 2001. She pays particular attention to the pedagogical objectives or "how," she says, "virtual reality could either improve existing training or complement it".

Initially trained as a computer scientist, she immediately refused to address this question solely from a technical point of view. "I started working with ergonomists, education specialists and also end-users," she explains. Once her PhD was completed, she stayed for four years at the École des Mines as an associate research officer, joined UTC-Compiègne in 2005 as a lecturer and continued her research based on concrete needs, always in conjunction with industrialists.

Her first project resulted from a meeting with researchers from the National Institute for Industrial Environment and Risks (Ineris). The objective? "To ensure the training of

subcontracted operators who work on high-risk sites. This was all the more topical because of the explosion at the AZF plant in Toulouse, a tragedy that happened only a short time earlier. Explosion due to human errors in subcontracting," says Domitile Lourdeaux. A project that mobilized three PhD theses and obtained significant funding from the National Research Agency (ANR) but also from the Region. "Usually, virtual reality is used to train in a technical gesture or procedure. But I wanted to distance myself from this schema. Since we are in high-risk areas, I wanted the learner to be able to make, possibly make mistakes and see the consequences of his mistakes," she adds.

Since then, Domitile Lourdeaux has been working on a series of new projects. This is illustrated by one on "training aeronautical operators in aircraft assembly" in partnership with STELIA Aerospace (Méaulte). Another innovative project? VICTEAMS (2014-2019) conducted in partnership with LIMSI in Orsay, specialists in cognitive ergonomics, the Val-de-Grâce military medical school and the Paris City Fire Brigade. Project that will surely be pursued.

What is the particularity of the STELIA and VICTEAMS projects? The answer is the level of integration of artificial intelligence (AI). "Since we couldn't afford to put dozens of developers, like video game manufacturers for example, we came up with the idea of integrating AI to create scenarios," she points out.

"Prior to the STELIA project, the trainer selected the level of the learner and then gave him/her the learning objectives, for example, to work on a particular safety rule. The scripting system then generated learning situations based on these objectives. In the aeronautics project, we wanted to create a dynamic learner profile, i.e., to ensure that the system was able to detect the learner's skills in order to propose interesting situations. We therefore start from beliefs about his ability to manage, or not, the situations he/she is confronted with. This is called the "proximal zone" of development. In other words, that one has skills and is capable of acquiring new skills, close to one's own skills. To do this, genetic algorithms and belief functions have been used to gradually extend this proximal zone," she explains.

With VICTEAMS (see box), Domitile Lourdeaux goes further. "I wanted to emphasize collaborative work by creating virtual teams. The involvement of different players and their interaction requires an even finer degree of scripting. This is notably the case for training medical leaders in the management of a massive influx of injured people," she explains. ■ MSD

## TRAINING MEDICAL LEADERS

**Dr Stéphane Dubourdieu was Scientific Affairs Manager of VICTEAMS for the Paris Fire Brigade (BSPP). A project conducted in partnership with Heudiasyc (UTC) and the Val-de-Grâce military medical school.**



### Can you tell us about the objectives of VICTEAMS?

Firstly, the aim was to use a tool like VICTEAMS to train military medical leaders in the management of a large influx of wounded soldiers from combat situations, while the fire brigade intervenes in a civilian setting. However, it soon became clear that there are many similarities in the skills sought in leaders. Indeed, if one can deal with different types of injuries, the *modus operandi* is comparable.

### The advantages of VICTEAMS?

The training of medical leaders mobilizes a large number of people. This is restrictive and above all costly, both financially and in terms of human resources. VICTEAMS is, in my opinion, very innovative. Its first advantage? It reproduces a virtual environment with virtual team members involved in the care of several victims. This mobilizes few human resources. The other advantage is that it allows us to simulate different scenarios on the experience, behaviour or stress of the operators and first responders, for example, and to integrate them into the training of leaders.

### And a word about leaders?

It is mainly non-technical skills that make a good leader. Essential qualities include leadership or the ability to manage teams, to have a good vision of the situation, to communicate correctly or to make the right decisions. ■ MSD







# Is artificial intelligence a new form of magic?

Professor, Sylvain Lagrue was appointed to UTC-Compiègne in September 2018. In his capacity as research scientist in the Knowledge, Uncertainties, Data (CID) team at Heudiasyc, a joint UTC/CNRS unit, he is working on the logical representation of knowledge and reasoning, the management of uncertainty in artificial intelligence, and decision making and games.

**A**fter his DEA (currently the Master 2 diploma) in Artificial Intelligence (AI), Sylvain Lagrue has been working on a European project on "Taking uncertainties into account for preference modelling in geographic information systems". After completing his thesis, he joined the University of Artois in 2004 as a lecturer before joining the UTC as a full professor.

His role within the CID team? "My cross-disciplinary profile allows me to work with the different researchers in the team. Both in the field of "the uncertain" and that of "knowledge representation", for example," he says.

And how does AI fit concretely into all this? "For the public at large, AI is magic made by the computer. And the more magical it is, the more AI. In other words, seeing actions made by computers that we thought were impossible," he says.

One example among others? "Let's consider games. When IBM's Deep Blue defeated world chess champion Kasparov in 1997, the general public thought that AI was going to take everything in its path, and then it calmed down. The reason? It was noticed, after analysis, that what won in 1997 was the computer's computing capacity. For the general public, this is no longer magic. So it's no longer AI," he explains.

But then what is AI in his mind? "It's about making a machine reason when you don't expect it to be able to do it. So there's a whole aspect of logic, but also of decision making. In a word, making it reason and make intelligent choices," he describes.

This is reflected in its three areas of research. The logical representation of knowledge and reasoning? "Logic has always - since ancient times - been a way to formalize reasoning based on a certain number of hypotheses allowing us to

*It's about making a machine reason when you don't expect it to be able to do it. So there's a whole aspect of logic, but also of decision making. In a word, making it reason and make intelligent choices*



draw conclusions that are valid. Our objective is to see this type of advanced reasoning done by a machine. This can be achieved efficiently thanks to resolution and deduction algorithms which, based on the hypotheses, ultimately allow a machine to make decisions", stresses Sylvain Lagrue.

A skill that has led him to work on a European project aimed at "safeguarding intangible heritage in South-East Asia and in particular the Water Puppets of Vietnam, whose playlets represent the country's history, legends, scenes from daily life, etc. "All this is accompanied by music, songs and recitations. In terms of richness, they can be compared to opera in Europe. So we had to represent a lot of complex knowledge," he says.

Managing uncertainty with AI? "If you roll a die, you don't know which side it's going to fall on. However, in this case, we do have probabilities. In other cases, we don't even have probabilities. In the formalisms that I use, the challenge is to model a sequence of "we think that such and such an action leads to this but in the opposite case rather to that". In short, a much more ordinal modelling," he says.

Finally, is there an interest in AI games? "The advantage of gaming? It allows us to have a controlled universe. You know what environment you're in, with its precise rules, whose effects you know, and you don't have to worry about the physical aspects. It allows us to test a large number of algorithms," he explains.

An interest that led him to co-direct a thesis on "general game playing", or how to make a computer play any game. "Deep Blue could only play chess, for example. In order to develop a program capable of playing all games, we had to represent all games with complete information thanks to the Game Description Language (GDL). Which brings us back again to the representation of knowledge", concludes Sylvain Lagrue. ■ **MSD**



INTERNATIONAL

# The SHU-UTseuS Master's degree in Mechatronics, coming shortly

UTseuS is the Franco-Chinese engineering training program, a strong partnership that has been forged over the ten past years. Created by the network of French Universities of Technology (UTs) and the University of Shanghai (SHU), this partnership is equally pioneering and unique in the fields of training and research. Most recent is the creation of a Master's degree in "mechatronics".

**T**he Sino-European Technology University (UTseuS) of the Shanghai University (SHU) trains more than 1,200 Chinese, French and European students each year in an international and multicultural setting. At the end of October 2018, Donghan Jin, President of Shanghai University in China, came to UTC-Compiegne to participate in the launching of a new Master's degree program recognized in China and France. This was an opportunity to strengthen UTseuS cooperation initiated in 2005. Indeed, UTseuS allows, thanks to the many possibilities of mobility, to train Chinese engineers to meet the

needs of French companies exporting to China and to train French engineers to become competent on the Chinese labour market, while acquiring new working methods and adding a strong international dimension to their careers. "Last July, we signed an Agreement between Shanghai University (SHU) and the three Universities of Technology (UTBM, UTC, UTT), enabling the creation of a new Master's degree at UTseuS. The first class of students for this Master's degree should be welcomed at the start of the September 2021 academic year. We are expecting 100 students per class, 25 French students from the three UTs and 75 Chinese", announces Marc Bondiou, French director of the UTseuS.

## Living 1 ½ years in Shanghai

The proposed new Master's degree in "Mechatronics" also corresponds to the creation, in 2019, of a research axis in data science for cyber-physical systems.

Once the pedagogical model and the

associated economic model had been validated, all that was missing was the official accreditation granted by the Chinese Ministry of Education, which has just been communicated to us in March 2020. The next

step will be the visit to Shanghai of the French equivalent Commission for Engineering Titles (CTI), which will endorse the admission of this training by the French State, allowing its holders to bear the title of engineer. The chosen field - mechatronics - corresponds to a discipline on the borderline between mechanics and electronics, with a large part of signal and information processing. For French students, it will be a real immersion in a city of international dimension. "Shanghai and its 25 million inhabitants attract some of the world's largest companies, including Suez, Engie, Safran, PSA, Dassault Systèmes, Valeo and many others. Students will have access to Mandarin classes and will be very well received," emphasizes Marc Bondiou. "For everyone, French and Chinese alike, this is an opportunity to start great careers with leading Chinese or French companies, not to mention simply discovering the other". ■ KD



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MARC BONDIU

## A NEW UTC COURSE EPOG+



DAVID FLACHER

## Reviewing economic perspectives

In September 2020, the UTC will offer an Erasmus Mundus Master's degree in "Economic Policies for the Global transition". It joins the other three European Master's Degree of Excellence in Economics. This new all-English course includes a first year abroad, semester 3 in Paris and semester 4 at one of the 40 associate partners around the world.

**T**he Erasmus Mundus EPOG+ (Economic Policies for the Global transition) Master's Degree is a project funded by the European Commission under the Erasmus+ programme. It is an integrated international Master's programme leading to joint and multiple degrees with the project partners (in and outside Europe). A project coordinated by the UTC-Compiegne, initially

framed in a Parisian university in 2012, some time after the financial crisis. The Master's degree is now based at the UTC, thanks to renewed support from the European Commission. "Thirty people will be selected from among a thousand candidates from more than a hundred countries to follow this Master's degree on economic policies for ecological, economic, social and

digital transitions," says David Flacher, head of the Department, who, on arriving at the UTC in 2017, decided to see which players were ready to follow the adventure. The result two years later: students will be able to benefit from an integrated network of eight prestigious partner universities in five countries that will offer recognized, high-level Master's courses. But also some forty associated



partners, including eight non-academic partners, notably major international organizations, who will be able to host students on internships, and more than twenty academic institutions around the world in all areas of the programme to welcome and supervise students during their final semester.



### Generous and selective grants

More than 4 Meuros have been released to support the Master's degree programme run by UTC, Sorbonne University being one of the partners. The first academic year will start next September. Each year, 22 very selective scholarships will be awarded by the European Commission, each with 1,000 € per month plus installation and/or travel expenses. "This is not negligible," comments David Flacher, professor-researcher in economics. The call for applications was launched last October and closed

on January 30. "In March, the shortlisted students will be auditioned by videoconference to retain only around 5% of the initial candidates. The students will be divided into one of the three majors, taught in English. The first will focus on the issues of digital transition, the knowledge economy and innovation, the second on macroeconomics and finance and the last on development models for a sustainable world. The EPOG+ Master's degree thus becomes the first international Master's degree in economics to integrate these three fundamental dimensions for the future of the planet and our societies." ■ KD

## INNOVATION

# Jazz and Innovation : quite a programme!

UTC has been working for several months on the 'Jazz and Innovation' research program. A project that is more than inspiring since it is already leading to the implementation of a new way of accompanying companies in order to reveal and develop their own potential for innovation.

**O**n the evening of November 5, 2019, in the SACEM auditorium, the first public illustration of the link between musical improvisation and innovation processes took place. The 'Lobsterjazz Quartet', composed of singer and psychologist Sabrina Yactine, bassist Peter Giron, beatboxer William Bayakimissa and pianist and consultant José Pendje, accompanied by Pascal Alberti, Director of Innovation and Territorial Development (DIDT) at UTC,

demonstrated - through a musical discourse and debate - that the process of improvisation unleashes the innovative potential of companies by mobilising a community of original action. "We seek to highlight the inspirational power of the art of musical improvisation - as a process of instantaneous collective composition - to unleash the innovative potential of businesses. For the company, jazz is a model of team cohesion, a clever mix of rigour and creativity," explains José Pendje, musician and industrial design engineer, a UTC graduate. He also holds a post-grad. degree in human sciences and technology dedicated to the management of complex systems, supervised by Prof. Bernard Stiegler.



PASCAL ALBERTI

### JOIN A WORLD OF INSPIRATION



The conference-lecture-concert is hosted by singer Sabrina Yactine and pianist José Pendje, co-founders of the musical project Lobsterjazz and respectively psychologist and consultant, and by Pascal Alberti (UTC-Compiègne). The Lobsterjazz Beatbox Quartet illustrates live some of the concepts on which this approach to innovation is based. Musical improvisation and debates thus give us the opportunity "to feel" in order to better think about and implement these new concepts that are potentially conducive to sustainable and responsible value creation within companies and organisations. ■ KD

### Exploring the source of inspiration for the art of improvisation

Pascal Alberti was interested very early on in these possible parallels between improvisation in jazz and innovation in business: "While working on my own thesis, I came across José Pendje's DEA work, 'Le Sens du Projet', which contains a section on 'Music'. In particular, it teaches that improvisation in the world of jazz transcends simple musical interpretation guided by a conductor. It refers to the individual perception and production of emotions at the very heart of a collective work. » Indeed, when we decipher a jazz concert, we observe the notion of a group with interactions, collective values and shared knowledge. Not forgetting the attraction for this or that interpretation of the work. "All this is also true in the business world between a technological link and a sharing of values. So why not reach out to SMEs, which are often in the urgency of everyday life, in the immediacy of work. To do this, we

*We plan to mobilise the major 'captains of industry' who love jazz in order to present their suppliers with a new way of supporting their potential for innovation.*

imagine mobilising the big bosses who love jazz in order to present their suppliers with a new way of supporting their potential for innovation," explains Pascal Alberti, who has not neglected the notion of pleasure in music, which is not contrary to the credo of the economic world. ■ KD



## LEAVING SOME DAY



**IN 2018, AT THE AGE OF 22, CONSTANCE, JUST GRADUATED, LEFT TO LIVE AN "AMERICAN DREAM". SHE CHOSE TO DO INTERNATIONAL VOLUNTEER WORK IN A COMPANY IN THE UNITED STATES. BETWEEN MACHINE MAINTENANCE AND CRAYFISH TASTING, LET'S DIVE INTO HER FUNNY DAILY LIFE.**

### Can you tell us about your background?

I graduated from UTC in February 2018, I majored in Mechanical Engineering with the Integrated Production and Logistics optional specialty. After two internships in logistics and maintenance, I wanted to discover another country. At first, I wanted to go to Canada and finally, in September 2018, I had the opportunity to do an international corporate volunteer placement in the United States. I now live and work in Atlanta.

### What are your daily missions?

I'm on a Volunteer programme with Sidel Inc., a company specialized in industrial packaging. I work as a maintenance engineer. Concretely, I carry out missions for some of the company's customers. I analyse machine downtime, I propose solutions and best practices to improve processes, etc. My day-to-day business is great and every day I have to deal with different, unique issues and situations.

### Why did you choose to do a VIE (International Enterprise Volunteers) Programme?

I find that the advantage of VIE is its duration. A year and a half is long enough to gain a good professional experience but at the same time on the scale of a career it is relatively short. I knew I wanted to work abroad, but I was reassured by the fact that this experience had an end date.

### What do you like most about your day-to-day work?

What I like most about my daily life, I reckon, are the people I work with. They are all very demanding from a professional point of view, but we work in a very good atmosphere. Afterwards, it's true that I see some cultural differences, especially in the way projects are managed. But that's also what makes the VIE experience enriching.

### Weren't you afraid of going abroad alone for so long?

No, not at all! In everyday life, I think I'm a pretty easy person to live with. I like it everywhere and I love meeting new people and learning more about how they live. So you could say that with this VIE in everyday life I get full satisfaction! One of my best memories is the "crawfish boil" parties organized by some friends during the crayfish season. They have a typical Louisiana recipe that they cook and we all eat together while drinking beer... Paradise!

### Do you think you'll stay in the United States at the end of your VIE?

To be honest with you, leaving for a year and a half has been a great experience, but I don't see myself spending my whole life here. I miss a lot of things in France. My family, my friends, and public transportation! Here everyone drives in their car and I spend hours in traffic jams! But before going back to France, I want to do a little detour through Canada. Either in the Canadian branch of my company, or in another company. I hope that will come to be!

### What advice would you have for young graduates who would like to do a VIE?

First of all, you have to bear in mind that leaving is always logistically complicated. There will always be a last-minute glitch, so you have to hang in there. You shouldn't be afraid of facing up to the unexpected either.

I didn't have a job description when I joined the company and my missions have evolved as I've proved my personal skills. So you really have to take advantage of this once-in-a-lifetime experience. ■ GO



## THE UTC CREATHON

# Ensuring innovative projects emerge

October 2019, UTC's Innovation and Territorial Development Department organised the first edition of a "Creathon". The objective? To introduce students to entrepreneurship and the creation of start-ups.



**Two days to bring out innovative projects and find start-up ideas. This is the ambitious project that some fifty students from UTC and UniLaSalle (Beauvais) took on last October.**

Gathered at the UTC's Daniel Thomas Innovation Centre for the University's very first Creathon, they worked in teams on the emergence of new projects. "What I really liked about the Creathon is that the organizers really taught us how to innovate," says Florent Meyer, a computer engineering student. They taught us a lot of concepts and methods to find a project and above all to be creative in the proposed solutions. "Concepts such as ideation, design thinking and value proposition were presented to the students. These are not disciplines that we are used to studying in class," says Martin de Beaulieu, a final year student. "So it was really interesting to be able to discover them during this weekend. »

Among the projects proposed by the students: a connected muffler, an application to share food or a collective, connected composter. It was the latter project that aroused the enthusiasm of the jury. "The project is simple, it's a composter installed in buildings that allows residents to work with a local farmer," explains Martin de Beaulieu, a member of the winning team. Before their pitch, the team went through many steps. "Once we had the draft of our project on paper, we went out into the streets to meet potential users and get their opinions. We realized that there were a lot of things wrong with our project," he says. So the team worked over and over again to perfect his project and prototype. All under the watchful eye of coaches from the

entrepreneurial community. "It was really precious to have professionals to help us. They gave us a different perspective on our project," says Martin. "For example, at a time when we were stuck on the solution to our problem, they asked us to think about a solution that would amplify the problem, just the opposite of what we wanted! And thinking backwards allowed us to come up with new ideas for our real prototype."

Virginie Lamarche who initiated the idea of a Creathon, had noted - as an innovation engineer at UTC: "For the past 10 years, we have been organizing a competition for innovative projects at the school to enable students to set up their start-up. I noticed that many students were attracted by innovation and entrepreneurship but didn't have a clue about it" have she explains. "So I got this idea to organise a UTC Creathon to help them sort out their ideas, and this, before the competition for innovative projects." And for Virginie, this first edition was a great success. "We had students, coaches and facilitators involved and very happy to have spent a weekend at the Daniel Thomas Innovation centre". Want a proof? The end-of-weekend cocktail party (often deserted in the events) remained full until the Innovation Centre closed.

*"What I really liked about the creathon is that the organizers really taught us to innovate. They taught us a lot of concepts and methods to find a project and above all to be creative in the proposed solutions. »*

For Martin de Beaulieu and his composter team, the wager is a success in any case. "We really liked working on this project, we will continue to work on it in the coming months to eventually set up a start-up. And if it's not for this project, in any case now I know that I want to set up my start-up! "A second edition of the Creathon is to be expected in 2020. ■ GO





## TELL ME ABOUT YOUR PROJECT

# How I designed a reusable cardboard container

Freshly graduated from UTC, Romane Jager successfully implemented an ambitious project during her final internship: designing a reusable cardboard container. This is how she did it.

**H**er journey through Latin America was already perfectly planned. It must be said that at 24 year old Romane Jager is an organization wizard. On a six-month break to discover the salt desert of Bolivia, explore the great beaches of Brazil and then travel the plains of Argentina. All the logistical details were taken care of. Accommodation with friends for some destinations, work in 'wwoofing' or in ecovillages for other cities. All that was left to do was to book the plane tickets.

But at the last minute, on the very day she was surfing between the different booking sites, the young woman came across an internship advertisement. The title? 'Design of a new line of bulk containers at Vrac'n Roll'. "The subject of the internship immediately appealed to me," the young woman explains. "I had planned to take a six-month break in South America before my final internship, but I was still looking at the job offers so as not to miss something really good." And this ad has everything to please the young student. First of all for the content of the internship itself. Product design is Romane's preferred specialty: "I fell in love with this discipline during my third year at UTC,"

she explains. "Originally I wanted to specialize in biology, then in biomechanics, and finally a design course made me want to get into this area".

But beyond the missions, it is the framework of the internship itself that she liked. Vrac'n Roll is a small start-up specialising in delivering organic products all over France. Founded in 2016 by Sarah Benosman (a former UTC graduate), the company employs four people. "The current immediately passed with Sarah and the teams," continues Romane. "So in February 2019 I started my internship at the end of my studies". And her missions are evolving rapidly. "When I arrived, I was immediately told that my subject had changed. They had told me that I was to work on the manufacture of containers for bulk foodstuffs, but in the end they had already found what they needed. So I was assigned to a project to create an innovative package."

The problem before Romane was very complex: how to send products all over France without generating thousands of tons of cardboard waste every year? So, for several weeks, she tried to solve this difficult equation. With her tutor Sarah, she carries out a thorough investigation, going the rounds to meet the teams in order to create a product suitable for the order operative who fill the container, the

logisticians who will move it and the final customers who receive it.

After several months of work, she developed and patented the Vrac 'n parcel: a returnable cardboard box that can be reused at least fifty times. "We did a lot of prototyping with our suppliers to find the perfect package. The most difficult part was to find materials strong enough to make the package," says Romane.

Today, the parcel designed partly by Romane circulates everywhere in France to transport bulk products. A source of pride for the young woman, but a project that has above all led to a permanent contract within the same company. "Since September, I have been appointed project manager for innovation and logistics," she confides with a smile. "I'm responsible for developing new products as well as improving the various production processes." A golden job for the now UTC graduate who wanted to lend meaning to her daily professional life. "I needed a company that shared the same values as me: sustainable development and ecology. Before joining Vrac'n Roll, I was already a fan of bulk and organic products. Today there is a coherence between my personal and professional lives and I am so proud of this". ■ GO



## MY SECOND YEAR AT UTC - EPISODE 5

In the last issue of Interactions, we left Pierre Gibertini just after he started his second year at UTC. How did the new semester go? Did he adopt new working methods? The answer is below!

**T**his fall semester has gone by at breakneck speed... A bit like me on the slopes last week.

I just came back from 'ski'UT', the big trip to the mountains organized by the UTC students. It's my second year taking part in this and I still find it great to be able to go skiing with other students for a reasonable cost. But before being able to enjoy the slopes, I had to 'slalom' through some other obstacles: the end of semester exams. And to tell the truth, things have gone much better than before for me in terms of work. I feel like I've acquired new methods and I'm much better revising. Well, of course, I always tend to do everything at the last minute, but let's just say it's "less worse" than before! But at least this semester I haven't failed any exams and I've validated all my courses. I have to say that I have been lucky enough to be able to

choose courses that really interest me. I decided that I wanted to join the Mechanical Engineering major to go on to the Design elective specialty later on, so I was able to take courses in mechanical manufacturing or strain/stress transmission calculations. These are courses that are quite dreaded by the students, but honestly I enjoyed studying them very much.

And then I also started to study Italian, and that's great. I have Italian origins through my Father, but neither he nor I speak it. So I decided that I'm going to get into it and I'm really glad that UTC offers so many languages!

On the associative side, I took part in the bathtub race in the Oise this year... and with my crew, we sank! The concept is to build floating boats to put in the Oise, but let's just say that we wanted to be a little

too innovative in the materials used, which weren't very good in terms of buoyancy. But it's really been a great experience. And then, as I said in the previous issue of Interactions, I took the plunge and joined the decoration team at the Imaginarium Festival. We're going to take care of creating the whole visual atmosphere of the festival, which will take place on May 30-31. Concretely, for the moment we're starting to budget a little bit for our projects and in a few weeks we're going to take action.

This first semester of my second year at UTC went really well. I found the perfect balance between courses and associative projects, I was able to choose courses that corresponded perfectly with what I want to do later. In short, I think it's really a very fulfilling start to the year... Stay tuned, more later! ■ GO



## HEALTH RESEARCH

# Micro-organisms on a bio-chip



Éric Leclerc, CNRS Research Director at the joint UTC BioMechanics and BioEngineering Laboratory (BMBI) and CNRS between 2003 and 2015, is collaborating, within the LIMMS (Laboratory of Integrated Micro Mechatronic Systems), in the framework of a joint international unit (CNRS/University of Tokyo), with Franco-Japanese teams.



target organs to understand the effect of a given molecule on the liver itself and subsequently on the organism. A drug that will be degraded in the liver before reaching its target will therefore be of no interest. The same applies to a drug that is toxic to the liver itself," he insists. Research that he is gradually extending to bioreactors in the kidney and intestines, in particular. The goal was to make them work together to study the physiological responses to multi-organ problems," he says.

In 2015, he's off again to Tokyo at LIMMS and Professor Sakai's laboratory. This time, the research will continue as part of a collaboration between the laboratories of Professor Fujii and Professor Sakai, who will be joined by Professor Minami from the Supramolecular Materials Design Laboratory. The goal? To extend organ-on-a-chip technologies to induced pluripotent stem cell (iPSC) technologies. The interest of these iPSCs? "They can be reprogrammed and, in a sense, controlled. In short, we can control cell differentiation and direct it towards the production of specific organ cells. Thus, with Professor Fujii, we developed functional microenvironments with oxygen sensors to verify oxygenation in these tissues; with Professor Sakai, we worked on the protocol for transforming these cells; and finally, with Professor Minami, we explored other sensors, such as glucose, for example, to have a continuous analysis of cell metabolism," explains Éric Leclerc.

The idea behind this research? "The idea is to have models that reproduce human physiology using human cells. We can cite, for example, human models for studying liver regeneration, models of human pathologies on which we could test molecules of interest (drugs) without going through the animal testing phase or avoid non-physiological models," he explains. ■ MSD

**A**fter presenting his thesis at the CEA in Grenoble on "steam explosions, a possible accidental occurrence in nuclear power plants", Éric Leclerc, who has solid skills in fluid mechanics, could have found himself "in Norway with Total working on oil extraction processes or at EDF modelling the hydraulic circuits of nuclear power plant cores", but it was Japan and research that won the day. "The reason? I was much more interested in the proposal from CNRS and the University of Tokyo to work on a new generation of micro bioreactors for biological applications. In particular, the creation of micro-organisms on biochips to study the mechanisms of normal or pathological liver function under conditions close to physiological reality," he points out.

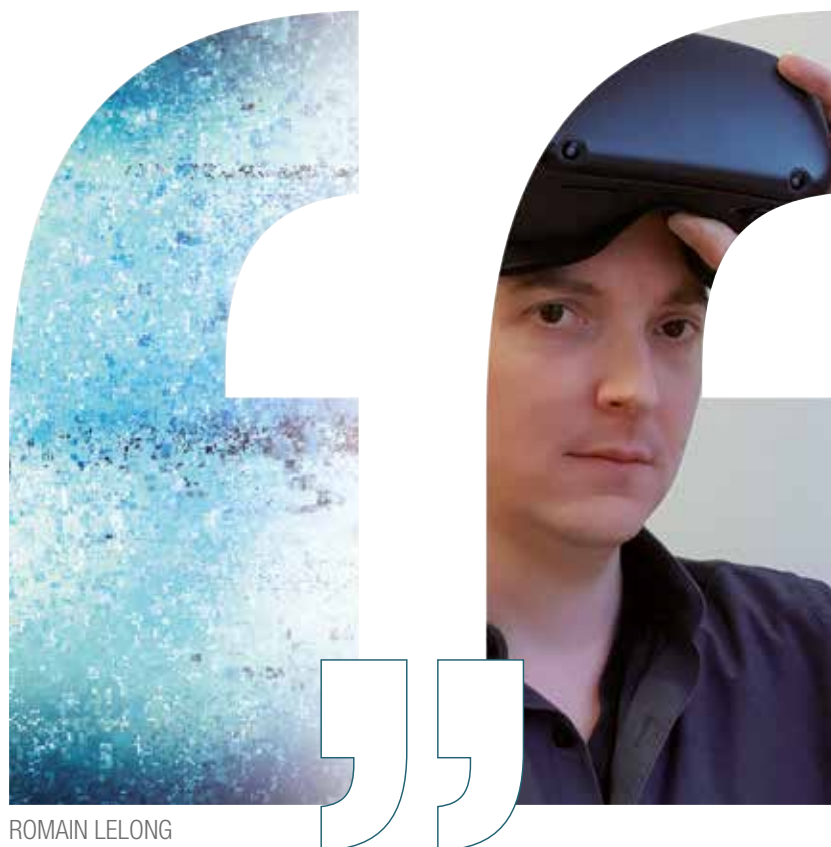
Thus, during his post-doctorate at LIMMS and in the laboratory of Professor Fujii (Applied Microfluidic Systems Lab) at the Institute of Industrial Sciences of the University of Tokyo, Éric Leclerc began to develop, in partnership with Professor Sakai (Organs and biosystems engineering Lab), organ-on-chip models. This research work lasted three years. "The aim was to create micro-environments, micro-bioreactors to cultivate, in this case, liver cells while reproducing

*It's all about having models that replicate human physiology using human cells. Examples include human models for studying liver regeneration, models of human pathologies on which molecules of interest could be tested without going through the animal testing phase.*

human physiology. This allows us to test the effects of new drugs or given pollutants, for example, and to be able to extrapolate the model to humans as quickly and accurately as possible," he explains.

In 2003, he returned to France. For ten years, he continued his research on the liver within the joint research unit (CNRS/UTC). The choice of liver? "It is a central organ in the body because any compound - food or medicine, for example - that enters the body, either orally or through the skin, will pass into the bloodstream and then into the liver to be transformed and detoxified. It is quite naturally that it becomes one of the first





ROMAIN LE LONG

Romain Lelong takes a new look at

## virtual reality (VR) serving the needs of industrialists

Based in Compiègne, the innovative company Reviatch develops training tools using virtual reality (VR) and augmented reality (AR). Romain Lelong, a UTC graduate and his research teams offer a complete range of 3D software solutions dedicated to design, communication and training in companies.

**3D tools for training through virtual reality (VR) for training purposes, enough to perfectly meet the needs of many companies in all sectors: industry, health, administration, energy...** This is the promise kept since the creation of Reviatch in 2008. Based in the technology park of Venette in the Oise region, it develops training tools using virtual reality (VR) and augmented reality (AR), which reduce learning time while at the same time improving productivity and quality. "In recent years, we have become experts on issues of employee safety in industry. When, at the beginning, we proposed five or six scenarios per project, today we are developing nearly forty. This shows the growing importance of our work, which consists of designing educational situations that are as close as possible to the reality of the company," explains Romain Lelong, Managing Director and co-founder of Reviatch, who also graduated from UTC-Compiègne. The company is made up of engineers and researchers in computer science largely recruited from UTC, specialized in 2D and 3D computer graphics, in computer studies and engineering in 3D simulation, virtual reality and augmented reality, but also in

pedagogical engineering and technical studies on industrial systems and processes.

### Virtual reality a real added value

Virtual reality, with its state-of-the-art headsets, including the Oculus Quest®, is no longer just an educational or marketing gadget. "Indeed, virtual reality has succeeded in helping engineers in design, from the test phase to development. It is also a very good solution for awareness and learning through immersion and interaction. In terms of collaboration, virtual reality facilitates understanding and exchanges between collaborators and thus accelerates decision making. These virtual reality collaborations also make it possible to eliminate distances, thus contributing to the grouping of employees from distant sites around the same project", explains Romain Lelong. Augmented reality, meanwhile, makes it possible to assist a user remotely by putting him in the presence of an expert who will guide him as if he were at his side.

### Cutting edge R&D

In 2020, Reviatch is also banking on research projects. It has just completed two of them, including the KIVA project financed by the Hauts-de-France Region. Knowledge and Informed Virtual environment for gesture cApitalization is a collaborative research project between the UTC, the LINAMAR group (Montupet company) and Reviatch the aim of which is to create, using VR, a new training environment for technical gesture for the aluminium casting professions. A second collaborative research project, VICTEAMS, funded by the ANR, led to the design of a virtual reality training course for medical leaders in the rescue of the injured, focusing on non-technical skills (communication between medical teams, management and organisation). The application uses AI protocols to drive the virtual characters and an innovative communication system to target the learning of non-technical skills. ■ KD





### 3 QUESTIONS FOR...



**SOPHIE POUILLART,**  
HEAD OF THE ALTYTUD  
CLUSTER

**Why did you accept to participate in the Innovation Tour?**

The first Innovation Tour in the industrial territories made a stop-over on September 10 in Albert-Méaulte. An event organized by the UTC. Pascal Alberti, Director of Innovation and Territorial Development of UTC. Pascal Alberti, Chantal Carton of the Pays du Coquelicot Area and myself led the discussion workshop. The objective was to identify the needs of industrial companies in order to innovate and develop. During this debate, Charles Lestoquoy, director of Ascodero Productique, testified about his experience of innovation within his company. The company with 17 employees, located in Bray-sur-Somme, manufactures specialized machines. Innovation is at the heart of its daily activity. It is truly his job to innovate.

#### What do you learn from this?

Many local business leaders came to the workshop-debate that day and we could see that they sometimes innovated without realizing it. So I found the initiative of the Innovation Tour most relevant, if only to demystify innovation through practical and direct feedback. It is also very interesting and useful to encourage industrialists to project themselves further into innovation projects with the support of the economic actors of the territory. This workshop allowed many exchanges. I would like to take this opportunity to underline the support of UTC-Compiègne in these matters. This engineering school's expertise in research and development provides many skills that meet the needs of all the players in the aeronautics industry in order to capture new markets and attract talent to dynamic manufacturers..

#### What is the vocation of the Altytud cluster?

Altytud is an aeronautics cluster and member of GIFAS (Groupement des Industries Françaises Aéronautiques et Spatiales). It brings together industrial players positioned in this sector of activity on a regional scale. Altytud's mission is to contribute to the influence of the regional aeronautics industry, to increase the market prospects of companies and to promote their skills development. The combination of order givers/supply chain players is at the heart of its operational implementation. Altytud has 62 members, with 52 manufacturers. ■ KD

### TERRITORY

# The Innovation tour, a successful first edition

The first innovation tour in the industrial zones, running from June to October 2019 and in which UTC participated, was a success. Its assigned objective was to identify the needs of SME-SMIs in terms of innovation and international skills.

**A**mong the forty stopover cities of the first edition of the innovation tour in the industrial territories, four are in Hauts-de-France, including Albert-Méaulte and Saint-Quentin. Last September, in the town of Albert, the event was organised by UTC-Compiègne. A workshop-debate co-hosted by Pascal Alberti, Director of Innovation and Territorial Development of UTC, with the ALTYTUD cluster and the community of townships of the Pays du Coquelicot ("Poppy-land"). The themes addressed related to the place of innovation and international development in the current activity of the SME-SMIs of this territory, their expectations in terms of skills but also the synergies between companies, territory, universities and higher education establishments. Several business leaders were able to express themselves on many points. Typical questions raised: How do we innovate? With whom do we innovate? How do we attract young talent? What synergies? What skills are in demand? Then, on October 7, the tour ended at the Aisne Departmental Chamber of Commerce and Industry. Around thirty higher education establishments, including the UTC, were mobilised to support this initiative of the InnovENT-E Institute. The latter has just renewed the approach initiated in 2012, which was to meet and interview SME-SMIs in order to better understand their expectations in terms of human resources and to develop a skills-intensive bank. The institute wanted to be part of the dynamics of the industrial territories launched by the

Prime Minister last autumn to meet their economic players in a more extensive and structured format. And this will benefit from the support at the national level of the

interministerial delegation for industrial territories, the BPI France, the Ministry of Higher Education, Research and Innovation, the CPME, the Pink Innov' association, the MMA business foundation of Entrepreneurs of the Future, the APEC and several players in the economic and social development of each territory visited.

#### The strength of a territorial network

The InnovENT-E Institute is a partnership foundation created in 2018 with the aim of "promoting the development of innovation and international skills among SMEs and SMIs". It will perpetuate the actions of IDEFI (Initiative D'Excellence en Formations Innovantes) launched in 2011 as part of the Government Incentive Programme of Investments for the Future (PIA). The institute promotes the grouping of economic and academic actors, structured in a network of territorial networks. It aims at contributing to the development of employment and business competitiveness through the co-construction of a training offer around the themes of innovation, creativity and entrepreneurship (ICE) labelled and adapted to the specificities of SME-SMIs. This foundation also promotes SME-SMIs among students and apprentices. The Regions of Normandy, Brittany, Centre-Val de Loire, Hauts-de-France, Grand Est and Pays de la Loire have supported IDEFI InnovENT-E's approach, some of them as early as 2011 and, in particular, the association that was the forerunner of the partnership foundation. "This national tour will result in a status document that we will submit to the Ministry of the Economy during the first semester of 2020. A very useful tool for companies and for all of us, actors of the territory, in order to stick to the needs of the field via a reference frame of competences", explains Pascal Alberti. Because more than ten thousand questionnaires have also been sent out to SMEs without forgetting the thousand companies mobilized on this large-scale action. "It should be remembered that only one in twenty companies export when they are not innovating while one in two export when innovation is present". ■ KD





MADE IN OISE

# A Cornilleau Billiard Table



Cornilleau, European leader, manufacturing leisure table tennis equipment, is located in Bonneuil-les-Eaux in the Oise region. The company has been interested for a long time now in innovation in all its forms and has an in-house design engineer who graduated from UTC-Compiègne.



After three years' design work, the R&D workshops of Cornilleau brought out last summer a brand new product, the result of a real challenge for the Picardy-based company's teams. It is the first outdoor billiard table called Hyphen, a link between elegance and leisure, design and conviviality. A former UTC student from the Mechanical Engineering major, and the elective speciality Industrial Design engineering course joined the adventure and took part in the design of this billiard table. Romain Radreaux, 26 years old, was recruited in June 2018 by Cornilleau for his know-how combining aesthetics, mechanical engineering and use. "Thinking about design today means putting oneself in the place of the user, thinking about the mechanical constraints without forgetting the great importance of aesthetics in all this. For me, that's what design

is all about and Cornilleau has understood that," confides the engineer who is part of the R&D team, comprising prototypists, engineers and project managers and headed by Nicolas Havard. Innovation-related functions account for 10% of the 90-strong company's workforce, which is still the European leader in its sector.

## Tables, bats and balls "Made in Oise"

The brand provides tables for events organised by the French Table Tennis federation, in particular the French championships. It is distributed in more than 80 countries, designs and manufactures all its tables in France and places innovation at the heart of its development for more than 80,000 tables manufactured per year. Cornilleau reported a turnover of 27.5 Meuros in 2019 and a remarkably high level of international development. "We export to 85 countries, including the United States, where we opened a subsidiary in 2019. The American market is very strategic for us," assures François Robert, the company's sales director, who has continued – ever since the creation of the company in 1946 by Émile Cornilleau – to develop business by creating technological breakthroughs. One of the most notable dates back to 1988 and the creation of the outdoor table with a solid laminate top. In 1995, more ergonomics were introduced with the

compact table; in 2005, Cornilleau launched the outdoor composite bats "Made in France".

## Always innovate

"Among the innovations that we are proud to have developed are the Park table, a durable, all-weather model dedicated to open-air playgrounds, and ultra-durable outdoor rackets with indestructible surfaces such as the Tacteo and its eco-designed cousin, the Softbat. We are also innovating in the field of competition; for example, we have created a competition racquet surface, Target Pro GT, in collaboration with Michelin. For us, the culture of design at the service of innovation is a way of sublimating every technological advance. It allows us to develop a top-of-the-range brand image and also, of course, to differentiate ourselves from the competition," explains Nicolas Havard. R&D is a real asset for the company, as is "Made in France". Exports are affected, representing 55% of turnover. Cornilleau is a good example of how companies can combine the ingredients for success. The search for quality, the drive to gain a competitive edge, digital transition and the circular economy. Indeed, two years ago Cornilleau also launched the first outdoor bat made from recycled materials. Called SoftBat, the model is the fruit of this circular industry. Armor Lux supplies used clothing to a company that is able to recover the material and recompose it. The plastic used by the leader in table tennis equipment came from reprocessed used textiles. More recently, on November 5 last, Cornilleau was awarded the Set d'Or de l'innovation 2019 at the Salon des Equipements et Techniques du Tourisme for its weather and shock-proof billiard table which converts very easily into a garden table. ■ KD

*Cornilleau is a fine example that brings together the ingredients of successful companies. The search for quality, the drive for competitiveness, digital transition and the circular economy.*





TRAINING

# Design engineering present at UTC since it was established

For almost 50 years now, UTC has been training around 30 design engineers every year. Yoghurt pots, household appliances, drones... Nothing can resist their pencil and pen art! A closer look at this atypical specialty elective course in the landscape of French engineering schools.

**I**n 2023, like UTC, it will blow out its 50 candles. Created by renowned designer Danielle Quarante, the IDI program "convinced UTC founder Guy Daniélou of the importance of training engineers in design thinking, to put the user at the heart of the design process," explains Emmanuel Corbasson, head of the program. Today, the course remains an exception in France, because, apart from UTBM (Belfort-Montbéliard) and other specialised Masters degrees such as the D-School hosted by the Ecole des Ponts ParisTech, there are no other engineering schools that integrate "design thinking" into their initial core training.

But what is the difference between a "classical" engineer and a design engineer? "The design

*Objects, whatever they are,  
always transmit emotions  
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EMMANUEL CORBASSON

## "4P7S", THE DOCTRINE OF THE IDI CHANNEL



**Place** : a single, well-identified place for the sector within UTC. Students are at home there. They can come and work there alone or in groups, or ask a teacher for help.

**Process** : students have access to the workshop, with many machines and to the advice and help of the workshop manager and staff. They also have access to design books, drawing materials, graphic tablets, in self-service. It's a system based on trust, and we have never had any problem yet !

**People** : students and teachers are part of the same team. Trust is the key word. Teachers are available outside of class hours and students can ask for them for all their projects. They can rely on the skills of the different teachers. The eyes of the other is essential when working creatively.

**Projects** : some projects are proposed by Uteam, some by industrialists such as Decathlon, Johnson & Johnson, Vrac'n Roll...

**7S** : everything mentioned above must be able to be done in 7 seconds!

engineer takes the user into account in the design process. It can be a problem of use, service, recycling, etc., to which he can provide a solution. The aim of the IDI programme is to teach the designer that there is a user, and that it is the user's problems that need to be solved. "To train these engineers, the course offers courses in communication design, introduction to industrial design, product design, etc.

More recently, two CCs, Packaging Design and Sound Design, have been set up in response to a strong demand from the industrial sector. Another novelty is the increasing use of computer tools in design. "Students have to learn to master the graphics tablet, for example, even if the practice of drawing and sketching remains fundamental!" adds Emmanuel.

The lessons are given in project mode (apart from the introductory lectures). The students are therefore closely monitored and accompanied by the teaching team. "Objects, whatever they are, always transmit emotions to humans. Work and projects must therefore be confronted with the other's eyes," says Emmanuel. And, in order to design, draw and conceive, people must feel confident."

## Design, a revelation for Emmanuel Corbasson

"Originally, I trained as an engineer in fluid mechanics applied to the biomedical field at INSA Lyon. During an engineering internship at Whirlpool Amiens, I drew a caricature of the

department in which my superiors appeared. This led me to change departments and to be assigned to the Design department "since I had talent as a draughtsman". A real revelation! I had no idea at the time how inseparable form and content were and what design could add to a product, even a mass market product. I had found my way, I just had to find the right training to get there. Being already an engineer, I chose the DESS in design at UTC, led by the dynamic Danielle Quarante at the time. I specialized in consumer products, everyday products, at Ronéo, Media6 and then Pierre Henri SA. I had always kept in touch with UTC and the IDI sector. In 2008, when the UTC asked me to come and teach in the IDI department, I did not hesitate, the opportunity for me to pass on this revelation, to act at the source... I took over as Head of the IDI course shortly afterwards. ■ MB





## SUCCESS STORIES

# The Dyson Award, a cutting-edge competition perfectly suited to the skills and talents of UTC undergraduates

Every year, numerous design competitions open to students are organised. Competitions that allow students to express their creativity, but also to acquire new skills, and even launch their own start-ups.

**P**articipation in competitions for UTC-IDI students is not compulsory, although one might think otherwise, given the number of students awarded prizes each year.

It depends on the willingness of the students. "We took part with Victor Cheung for the challenge it represented and because we already had a few ideas in mind before the competition," confirms Vincent Bihler, a graduate of the IDI programme in 2014.

"Students who wish to take part in a competition ask us to open a Research Project course," explains Emmanuel Corbasson, head of the Industrial Design Engineering (IDI) department.

Once participation in the competition has been validated, students and teachers meet for one hour each week to follow the progress of the project. But beware," adds Emmanuel, "we only advise them! It is they, and they alone, who have to define their problem and the means they envisage to solve it." To make their models, they can also use the machines in our workshop and the Daniel Thomas Innovation Centre and benefit from the advice of all the workshop managers.

"However, not all competitions give the right to a CC. It must leave the intellectual property of the project to the students," explains Emmanuel Corbasson. "In addition to the James Dyson Award, these competitions include the Parrot

competition, the Braun Prize and the Verralia Design Awards."

Even for those who do not pursue the development of their project in the midterm range, participation in these competitions remains a strong and very enriching experience. "The competition personally got me my first job, first as a trainee, then on a permanent contract with Parrot, where I was able to develop some of the products that are now on the market," confirms Vincent. "It was also a very good creative exercise where the concept's viability becomes extremely demanding. I now apply these same methodologies on a daily basis at the -entreaute design studio." ■ MB

## ZOOM ON SOME UTC STUDENT PROJECTS LAUREATES OF DYSON PRIZES

### THE EVE BRACELET

by Mathilde Blondel and Romaric Delahaie



1<sup>st</sup> in the  
James Dyson  
Award 2019

In the event of an attack, the "EVE" bracelet, quickly activated manually or by voice command, emits a deterrent noise and warns the authorities by transmitting the precise location of the bracelet as well as the audio recordings of the attack. EVE can be used for any type of attack and benefits from the latest communication technologies, and is protected from cyber-attacks, in order to protect the users' personal data.

THE  
JAMES  
DYSON  
AWARD

### FREEWHEELCHAIR

by Colin Gallois and Xavier Garcia



1<sup>st</sup> in the  
James Dyson  
Award 2016

Freewheelchair is a device that can be attached to any type of wheelchair and which allows braking by 'back-pedalling' with the hand (a slight tilt of the wheel backwards), to avoid friction and effort. Collin Gallois continues the development of the project with another UTC graduate, Lancelot Durand. After a patent application, and a first contact with the world's leading manufacturer of armchairs, the two partners plan to sell the first devices in 2021.

### INHALE

by Vincent Bihler and Victor Cheung



1<sup>st</sup> in the  
James Dyson  
Award 2013

INHALE is a protective mask consisting of a transparent, watertight shell with a removable and reusable filter on the side. Its design allows the user's face, especially the mouth, to be seen completely. Communication between people wearing a protective mask (patients or healthcare personnel, for example) is therefore facilitated and the stress associated with the sight of these masks for patients is reduced. Vincent and Victor had been approached by industrialists to pursue the development of the concept internally, but declined, as they both already have good professional opportunities.



SARAH BENOSMAN

## With a strong UTC entrepreneurial fibre

Sarah Benosman, who graduated from UTC in 2009, although starting her career as an eco-design consultant, founded the start-up Vrac'n Roll in 2016, the first organic and zero waste online shop. Here is a portrait of a young woman with clear ideas, determination and a strong entrepreneurial spirit.

**D**oes Sarah have clear ideas? Yes indeed and she demonstrated this when, as a young 5th year high school student at Perpignan, she wanted to choose an education path that would allow her to "reconcile," she says, "her taste for science and for all that is artistic and creative". "I have always loved science but also the arts. I used to draw a lot, do music – I spent two years at the Conservatory -, doing theatre training, etc." Still thinking clearly? "It was a friend's uncle working in the design department at PSA (Peugeot automobile Co) who told me that the UTC was offering training courses for design engineers - I didn't even know that existed," she admits. That's when she made her choice. It was going to be UTC-Compiègne. "In 2004, my final high school year, I was invited for dossier based interviews UTC. And give that I obtained my "Bacc" cum laudae, I was admitted to UTC," explains Sarah Benosman.

She definitely does not regret her choice here, even if she admits receiving a "slap" in the first semester. "I was far from my parents. I thought it was great to have my own apartment, to see my friends whenever I wanted. I also appreciated the very free spirit of an engineering school where you could choose your subjects, where you didn't feel the pressure of grades and so on. As a result, I didn't work a lot. The result was not long in coming: I failed half of my subjects. It was bad news for me. My pride took a bashing. For me, who graduated from high school "with honours" without too much effort, it was a hard fall," she says. But her determination remained intact. "I realized that I ran the risk of being expelled from an establishment that I hadn't chosen at random. Luckily, the work placement gave me a chance to recover. At the end of this internship, which went very well, I admitted to the jury that I could only blame myself, and I promised to be more rigorous, more regular in my work. Although they doubted my ability to continue along this path, I managed to convince them. They trusted me - a quality that cannot be denied at school. It's a trust that I've respected, since I haven't failed a single subject in the rest of my UTC years," she adds.

However, her passage through Carlton University, Ottawa, Canada in her third year made her doubt her choice. "We were learning a lot about drawing and materials. But that's when I realized there was one thing I didn't like: the client choosing which concepts to pursue, not the designer. I, for one, was putting too much emotion into the proposed concepts and the fact that my favourites were not chosen did not please me at all. In short, I realized that I love to work more in participatory innovation, helping people find ideas, participating in the creativity phase, leading work groups, looking for new materials, etc. I also love to work with people in the design process. Emmanuel Corbasson, head of the UTC design Department, and other teachers from the UTC helped me in this increased awareness process through various exciting projects. The design course has continued to support me in my various professional experiences, in particular by training new students that I have been able to take on internships and now on permanent contracts," she emphasizes.

Convinced by and attracted to the business world during her various internships, Sarah joined Evea, an eco-design consulting firm (founded by Jean-Baptiste Puyou, himself a UTC graduate engineer) as soon as she completed her studies in 2009. She stayed with Evea for seven years, but the desire to become an entrepreneur was the stronger. It is quite naturally that she responds to a call for projects from the ADEME (French Environment and Energy Management Agency) for eco-innovations, with the result that she receives substantial funding over three years. Vrac'n Roll, an e-commerce company, was born. With one leitmotiv: 0 waste.

"We started with a drive and home delivery in Lyon and the surrounding region. Since October 2019, we have been delivering all over France via Relais Colis de France points - groceries, hygiene goods, zero waste accessories (e.g., reusable stainless steel drinking straws), etc. - in returnable boxes made of light and resistant plastic. Boxes that are shipped and returned in a patented, reusable package," summarises Sarah Benosman. ■ MSD

### BIO EXPRESS

**2009** : graduated as design engineer and began her career as an eco-design consultant  
**2016** : Vrac'n Roll was created, initially serving Lyon and its vicinity  
**2019** : national development of Vrac'n Roll, thanks to a ten-strong team



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