

YOU HAVE THE FLORR

UTC benefits its first  
ERC grant with  
Anne-Virginie Salsac

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SPORT ÉLITE

First Jacques Vabre  
'Transat' Race  
for Tom Laperche


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UTC/UPMC

Virginie Simon, elected  
best French business  
woman in California

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NOVEMBER 2017 ### N° 45

 Interactions in French at <http://interactions.utc.fr>

Donnons un sens à l'innovation

# Interactions



## FROM THE PRESIDENT'S DESK



### Lending meaning to pedagogical innovation

**W**hen students matriculate at UTC, they must put together a university training project and start building a professional project. These steps represent a major break

with what they experienced at their lycée - where the thrust was clearly oriented to obtaining the baccalaureate, in a totally different posture from those who enroll for the Grande Ecoles' 'classes préparatoires' - to the extent that they do not have to prepare for a series of competitive examinations. It is up to them to choose their courses at UTC and the establishment itself can propose certain pedagogically adapted training modules. To make the undergraduates active, it proved sufficient to apply a pedagogy integrating a problem-solving approach, employed regularly at UTC in its project-intensive workshops, plus an interdisciplinary, international vista enrichment while allowing them to choose their personal courses throughout their 5 years at UTC. Add to this the long, yet monitored, placements abroad and in enterprise.

In this issue of Interactions, we propose to shed light on the evolution of this pedagogy in connection with the constraints of a globalized world in which our graduates will collaborate in the future with colleagues located in other countries. This hybrid form of learning calls for a binding of information content searches with informal field explorations or using problem-solving techniques and collaborative work but also career paths combining reverse pedagogy and distant learning schemes, gaming, role playing especially, group activities using collaborative digital tools perhaps even, one day, who knows, "reverse exams" here the question content would be the students themselves.

Policies like these would lend meaning to their UTC training on a day-to-day basis and, in parallel, would stimulate their acquired creativity, a skill which will prove useful throughout their professional career. ■

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



**Pedagogical Innovation :**  
*the UTC formulæ*  
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## The 2017 Roberval Prize ceremony

Nov.10, 2017 saw the ceremony for the awards in the annual Prix Roberval, an international venue that rewards literature, A/V productions or French language multimedia all oriented to explaining technologies for all.



GENERAL PUBLIC PRIZE 2017

**Agriculture connectée. Arnaque ou remède ?**

Vincent Tardieu • Paris (France)  
Éditions Belin



TÉLÉVISION PRIZE 2017

**L'odyssée Rosetta**

Jean-Christophe Ribot, Paris  
(France) • Look at Sciences • Vincent Gaullier



PRIX JEUNESSE 2017

**Déjoue les pièges de la science**

Pascale Hédelin et Benjamin Strickler • Nantes (France) • Gulf stream éditeur



JOURNALISM PRIZE 2017

**Toujours plus haut !  
Comment on construit une tour  
d'un kilomètre de haut ?**

Romain Raffegau • Montrouge  
(France) • Science & Vie Junior/Mondadori



THE MEDIA « LIKE » PRIZE

**Le mythe de la singularité.  
Faut-il craindre l'intelligence  
artificielle ?**

Jean-Gabriel Ganascia • Paris  
(France) • Éditions du Seuil



THE STUDENTS' « LIKE » PRIZE

**Nanorobots, voyage au  
cœur des tumeurs**

Daniel Carrière et Pier Gagné Montréal (Canada)  
• Radio-Canada - Découverte

The Robertval Prize Jury also awarded a special mention to Emmanuelle Sudre for a series of documentaries televised on Channel France 5.

To celebrate the 30th anniversary of the Roberval Prize, the winner of the category "Higher Education (HE)" will receive this HE Prize at a special ceremony, January 16, 2016 at the Academy of Science (France). ■

## 4th franco-chinois conference on industry of the future



November 14-15 2017, UTC hosted the 4th Franco-Chinese Conference on « Digital Factory and Smart Manufacturing », co-organized by GIS S-mart (coordinated by Director General Benoit Eynard (UTC) and Beihang University (BUAA, China). The event brought together French and Chinese research scientists to debate and analyse the digital

## RESEARCH

# Better retreatment processes for effluent waste water



Since 2014, the project MOCOPÉE (acronym in French for MOdelling, Control and Optimization of Processes used in Waste Water Treatment) has brought together the forces of SIAAP, UTC, IRSTÉA as well as numerous academic and industrial partners. This ambitious programme, with several research axes, aims at making measurements of pollutants more reliable, improving the waste water treatment process management, creating predictive tools to make maintenance of equipment easier and to value add to the by-products.

**E**ffluent waste treatment station operators and associate industrialists must comply with increasingly stringent and more numerous standard requirements, hence the need to increase the accuracy and frequency of physico-chemical inspections. Moreover, the other objective to reduce costs and improve on the efficiency of the depollution protocols raises new scientific and technological challenges. Inasmuch as MOCOPÉE enhances and enriches the exchanges among local authorities, research laboratories and industrialists, it was created to accelerate the emergence of new, innovative solutions. The SIAAP (acronym in French for interdepartmental agency for the Paris Basin treatment), a major player in effluent waste water management, with 8.5 M inhabitants in the Greater Paris (Île-de-France Region) area, UTC and IRSTÉA were desirous to set up an association in this framework, for the purpose of benefitting mutually from return on experience

(ROE) and the skills of the other actors. "Through our collaboration with the operator of the largest treatment plant in Europe (Achères near Conflans-Sainte-Honorine), we have access to a vast experimental station", explains Prof. André Pauss, Head of the UTC-TIMR Laboratory (Integrated Transformations of Renewable Matter). From the standpoint of the industrial partners, that fact that a multitude of certified data from the Greater Paris SIAAP sites can be accessed has enabled the scientists and engineers involved to develop new products and to test them, full scale, on the experimental station site. Alternative analytical methods launched by the companies Watchfrog and Envoleure derive from this collaboration.

## Attaining operational solutions via research

There some unavoidable topics for both operators





and industrialists here that have not as yet been given much attention in scientific documentation are at the heart of TIMR research carried out during the first four years of MOCOPÉE. The design, for example, of a tool to measure nitrites has now been embodied as a standardized process. UTC-TIMR and research scientists at Ecole Polytechnique worked together to assemble and bench-test this high precision device. “We were polyvalent in our work, but UTC focus was especially on sensors and associate algorithms while the Polytechnique scientists looked at command/control functions”, adds André Paus. This particular innovation is now in its pre-industrial phase and will be made rapidly available for the professionals of the sector. One of the major axes being investigated relates to gaining a better understanding of the physico-chemical phenomena at play in the treatment reactors. One of the eight theses defended (or in the course of finalization) in the framework of MOCOPÉE, examines the production of foam in the reactor vessels. Manel Larachiche,

a young UTC PhD student is working currently on the characterization and prediction of this as yet largely unknown feature. The ultimate aim is to reduce systematic reliance on anti-foam admixtures and to anticipate the occurrence of foaming, so as to be able to control expenses and decrease pollution. Another PhD student is working on digital modelling of a complete treatment plant. “Some models do exist but only at the scale of a single reactor, a single network or a single station outflow; what we are looking at is the possibility to reproduce the entire plant operation from input to outflow”, details the Head of TIMR. As of 2018, MOCOPÉE moves into its phase II. Optimizing the maintenance of treatment installations and plant will be part of the next 5-year research programme. Participation of the UTC-GM (Mechanical Engineering) Laboratory will enable fine-scale investigations of corrosion in concrete and steel structures. New tools, allowing us to assess the state of filter membranes, will be on the research agenda. Lastly, a new thesis will look at

a methanisation process using treatment station sludge or horse manure, in a collaborative project with the Institut Polytechnique UniLaSalle and SIAAP. ■

[www.mocopee.com](http://www.mocopee.com)



## RESEARCH

# Carnot Smiles\* serving the cause for improvement, via mathematics, of entrepreneurial competitiveness

By setting up a link between applied mathematics laboratories and industrialists, Tremplin Carnot Smiles\* encourages and enhances the emergence of research contracts that see mathematical modelling and digital computation serving the cause of entrepreneurial development and innovation in general.

**The Carnot Smiles Institute is a public research entity supported by the Sorbonne Universities Cluster (of which UTC is a member) alongside the CNRS and UPD (University of Paris 7 (Diderot)), specialized in mathematical modelling, digital modelling, optimization and data sciences, with a focus on conducting research with partners in enterprise.**

Carnot Smiles brings together pluridisciplinary research teams (structure and fluid mechanics, acoustics, biology, chemistry, electronics,

physics...) that have mathematics as tools in common, for the purpose of providing global solutions to enterprise's complex technology-intensive challenges.

The key difference between Carnot Smiles and other, classic public research laboratories lies in the fact that it benefits from a new set of human resources that enables the unit to respond in a more professional and more reactive manner to the challenges now facing the entrepreneurial world, as follows:

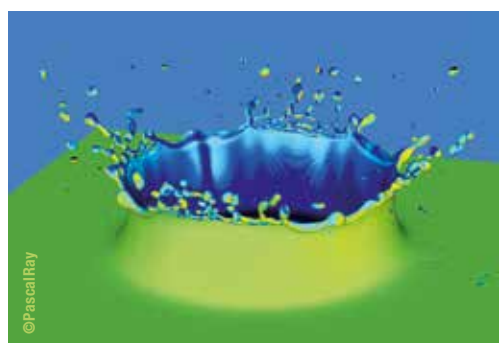
- acting as a facilitator between the academic and industrial worlds, probing and assessing the R&D needs of companies and identifying 'in-house' those research scientists with the skills needed to handle the issue;
- providing Carnot certified engineers, with PhDs in mathematics, who can train the project-teams alongside the institute's scientists when collaborative contracts are signed with enterprise, focusing their efforts on: creating and developing mathematical models, likewise for algorithms and drafting of assessment reports for the industrial partners. Carnot certified engineers form a bridge between two time scales: on one hand, the enterprise time-scale and on the other, the

academic time-scale. They ensure a constant link with their counterparts in enterprise, both in terms of project management and also in the proposal of technical solutions, while the research scientists' expertise is brought to bear when dealing with the more critical phases of a project;.

The UTC-LMAC Lab (applied mathematics lab, Compiègne) is part of the circle of participants in the Carnot Smiles Institute and already has conducted several collaborative projects, on issues like sustainable energy management and new algorithms based on complicity reduction and high-level computational protocols. Other topics will be explored and developed, on data sciences as well as making good use of new skills that have recently come to UTC-LMAC. ■

**Visit the UTC-LMAC Lab. at: <http://webtv.utc.fr>  
> Nos séries > Les laboratoires de recherche**

\* In the framework of the Carnot Round #3 call for projects, a new category, the “Carnot springboards” - addressing laboratories wishing to increase their knowledge-base and skills in building contract relationships with entrepreneurial world but who lack practical front-line experience in this area - was created with the support of the French General Investment Agency (CGI).



revolution ongoing in manufacturing industrial sectors.

The research themes discussed were collaborative design integrated digital chains, industry of the future, advanced manufacturing processes, manufacturing robotics, cyber-physical production systems, product-service systems, "smart" connected factories, etc.

The occasion also saw the signing of a partnership agreement between the School of Mechanical Engineering and Automation, Beihang University, China and the GIS S-mart to develop and implement training modules and further research topics in the area of industry of the future. ■

<http://webtv.utc.fr>

## The James Dyson Awards 2017



Sept.7, 2017 saw the ceremony for the James Dyson Award. Two UTC undergraduates, Jordy Manière and Romain Radreaux, had been declared

finalists, i.e., were in the "Top 5" line up for the James Dyson 2017 Awards, with their project 'Liftup'. LIFTUP is an invention designed to improve autonomy and comfort for persons experiencing difficulty both in sitting down and/or rising to their feet. The system supports the rear of the body and does not need an electric power feed. LIFTUP can be adapted to any wheel-chair and consists of two adjustable hydraulic pistons, providing between 50 and 70% of the force needed to either stand up or sit down - operational speed is progressive and under the person's control at all times. ■

## CNRS Crystal Medal award ceremony for Bernadette Tse Sum Bui



Bernadette Tse Sum Bui, who works at the Enzyme and Cellular Engineering Lab (UTC-GEC) has been awarded the CNRS Crystal Medal

that goes to collaborators of research scientists who have contributed to the advancement of our knowledge base and to the overall excellence of French research. Bernadette Tse Sum Bui is studying molecular imprinted polymers (MIPs) that can be used as active ingredients in body deodorants, inasmuch as these MIPs can capture the molecules that initiate BO (body odor). This work is conducted in a collaboration agreement with L'Oreal. ■

<http://webtv.utc.fr>

## RESEARCH

# Electrifying transport vectors



For a quarter of a century now, the UTC-LEC Lab (Electromechanical engineering, Compiègne) has been engaged in research that contributes to all-electric transport systems progress. A special conference was organised Nov.7, 2017 to mark the 25th anniversary. LEC Director, Prof. Guy Friedrich sums up the work carried out over these academic years rich in innovative projects and outlines the prospects for the coming years.

## Does the UTC LEC unit occupy a special position in academic research?

Our small (20 persons) research and teaching team brings together three skills that are normally separate in other similarly sized laboratories: energy conversion technologies, design and modelling of electric machinery. Multiphysical modelling (electric, thermic, acoustic) of the propulsion chain is one of our lab specialties.

Ten years after LEC was created in 1973, we rapidly became interested in electric powered transportation systems. Privately owned cars also rapidly took front stage of our investigations and today too is our prime area for applications.

## How and to what extent has the context of all-electric vehicles evolved since 1992?

25 years ago, there were no mass-produced electric vehicles, only prototypes. Technical progress in this field has been quite striking even if we cannot, as such, pinpoint any technological breakthroughs. These technologies are now mature. For equivalent performance levels, the cost of an electric motor is now lower than that of an internal combustion engine. With batteries of equivalent weight, these electric vehicles can now cover ten times the range previously attained. However, several problems still remain if we want to see the number of potential customers increase. For example, the time to recharge the batteries is still too long for certain trips. Batteries represent one third the price of the electric car while offering a life expectancy less than the vehicle itself (15 years approx.). UTC-LEC is currently working on all these points and issues.

## What are the main areas where UTC-LEC contributed to progress in this field?

UTC-LEC is active in 4 research areas: motor improvements (noise, space needed, performance levels), battery monitoring and management (costs, performance, operational time, safety), power electronics and control systems. Thanks to our partnerships with the main automobile

manufacturers, our scientific achievements have applications in concrete industrial uses. No less than 7 these have been devoted to the starter-alternator unit. This research contributed to Valeo launching its Stop & Start® system. Our work on acoustic noise levels generated by electric propulsion motors also served in the design phase of the all-electric car Zoe by Renault. On average,

ten years separate the moment a laboratory publishes its results and their integration in a commercial product.

## What are your forthcoming projects?

We have a partnership agreement currently underway with VALEO and PSA to develop a low-cost hybrid vehicle for the European markets. Designing very cheap electric vehicles for developing countries will probably require new innovations. Moreover, we are closely studying the acoustics for Renault's new engines. Diversification of applications is definitely the 'name of the game'. Our innovations in

electric motor propulsion units can be adapted to a variety of transport modes, viz., boats, planes, trains, urban trams ... Aeronautics offers us a new area for experimentation with specific demands in terms of performance, light structures and increased safety factors. In this sector, electric motor actuators have gradually replaced hydraulic flight surface controls. The next stage will be electricity-powered small aircraft (10-20 crew and passengers). LEC is collaborating with Zodiac Aerospace in regard to batteries installed in airliners as an emergency backup should the main hydraulic circuits fail. We have a PhD thesis under way to assemble and certify a diagnosis system that verifies the continuous availability of this emergency backup power supply. ■



UTC-LEC Lab : <http://webtv.utc.fr>

# Pedagogical Innovation : *the UTC formulæ*

The key guidelines for pedagogical innovation implemented by UTC aim at ensuring the students become the actors of their personal learning process. This calls for collaborative work on real, scale-one problems, also for reverse educational lectures and serious games. The aim is not only to better arm our student-engineers to face their future professional career but also to adapt the university to comply with the specifics features that characterize a new generation of undergraduates.

**A**ctive pedagogical methods have become increasing present at HE institutions. In France, UTC was one of the pioneering universities to go down this road, framing its training policy round a key principle: understand in order to do things well, but do things well too, so as to better understand them.

“Ever since UTC was established in 1972, the university has adopted a very novel training model, integrating two 6 month internships with an enterprise into the curriculum”, recalls Étienne Arnoult, UTC’s Director for Training and Pedagogy. “We also introduced and developed project-based learning where students working in small groups tackle subjects proposed by industrial partners or by any other economic actors”

UTC has deployed, since its early days, this project-oriented pedagogy to enable our future engineers to confront the realities of their professional world. In addition, nowadays, we must also prepare them to face the demands resulting from global markets and often this requires them to collaborate and network with colleagues based in other countries, people with different cultural backgrounds who do not necessarily think and act the way they do here. There are also the specific features tied to a knowledge-based economy focusing on innovation, where creativity both in individual and collective terms, i.e., the ability to interact with other cultures and other specialties are fast becoming key skills for our future graduates. Consequently, the number of collaborative

projects with enterprises and universities continues to grow.

Likewise for the pluridisciplinary projects which bring together student-engineers doing different majors and often students matriculated at other HE institutions – in particular the University of Paris 6 (Pierre & Marie Curie) and University of Paris 4 (Paris-Sorbonne), both of which are members of the Sorbonne Universities Cluster as is UTC-Compiègne. “In the coming years, our aim is that each of our students lives through at least one experience that forces him/he to look outside their chosen specialty and be open to an interdisciplinary exchange during their time at UTC”, underlines Étienne Arnoult.

Our academics and lecturers at UTC are also experimenting other forms of active pedagogy, e.g., serious games where simulations are run based on concrete situations that are not easy to teaching in a classroom context or in a traditional seminal group formation? Or again, using what are called “reverse lectures” (where the students study the contents, as best they can, before attending the class) and even ‘flipped’ classes that the students

organize themselves.

This diversified approach of approaches is stimulation for the students, inasmuch as taken individually students do not all learn in the same way. But more importantly is that we must adapt our teaching to the new generation of students for whom a plethora of knowledge is just “one click away”, so to say. Have them do things, have them learn how to learn, teach them how to sort information and stay critical with regard to the sources they access so easily... This is a new deal of cards, and implies that making the students key actors of their own learning process has become an increasingly necessary step. ■







## Increasingly intercultural project- based workshops

Since 2002, the Dept. of Urban System Engineering (UTC-GSU) has implemented project-based workshops that bring the students into close contact with the realities of their future profession and career. The concept proves efficient and will be an integral component of the future “3I” Engineer (Industry – Innovation – Intercultural) that will be tested and assessed as of 2018.

**E**very year, UTC-GSU organizes some six project-based workshops, each lasting for a complete semester.

There are 15-20 students in each workshop, who in a manner similar to a design office accept and answer an order from a local authority or an enterprise related to some specific urban problem: planning, transportation, energy, environmental hazard and risks... The students spend one day per week on the project, with precise objectives and schedules, plus a progress report at the half-way mark and a final presentation and report. “These project-oriented are highly appreciated by the companies and local authorities who pass the orders”, notes Gilles Morel, Director of the UTC-GSU Dept. “For the students, it is a way to experiment real working conditions via the project, a way to enrich their knowledge of a specialty field - something that is not taught per se at UTC, given the sheer scope of sustainable urban problems – and to acquire transverse skills: being able to work in teams, to manage a project, to make use of collaborative tools.”

### An interdisciplinary, international dimension

Also to an increasing extent, these workshops integrate an intercultural dimension. These urban-intensive complex projects have an international or interdisciplinary vista that is a result of the global economy; hence they bring in several professions and trades simultaneously. In 2016, for example, one of our workshops brought together students from two majors, urban system engineering and computer sciences and their applications to tackle an order from a company Sopra Steria related to ‘smart’ buildings (cf. following article intra).

Also in 2016, UTC organized a first international workshop in a collaboration with the Federal University of Rio de Janeiro (UFRJ), a partner with whom UTC has developed student exchanges and scientific co-operation since 2011. This workshop, financially supported by the Sorbonne Universities Cluster, for the purpose of facilitating access to the UFRJ campus and local on-site travel. Two Franco-Brazilian teams, one from UTC, one from UFRJ, collaborate over the Atlantic, linking northern to southern hemispheres, notably via videoconference facility, with some input from a third team based at University Paris-Sorbonne. Despite the distance here and the cultural gap, the assessment is positive: the students proposed some excellent scenarios, combining various transportation modes (classic, ‘green’, innovative...) to improve short, medium and long term mobility. In March 2017, in the framework of an Erasmus programme, where UTC-GSU is an active partner (CityLab), a new international project-based workshop was launched, in a partnership with the Port Authorities, Lima, Peru. The objective assigned to this workshop is to provide some answers and solutions to problems faced by this key South American port where the port facilities development runs counter to Lima’s forward-looking urban plans as the capital city of Peru, where traffic congestion is a major issue and where, clearly, there is a lack of land to install storage warehouses.

### A trail-blazing label

2018 will mark a new stage with both an interdisciplinary and international workshop, associating UTC and two Brazilian partners: the Federal University of Paraná (UTFPR) and the Renault car assembly site at Curitiba. The core thematic has not yet been finalized

but will be sufficiently broad-based to attract and involve students from various specialties: urban engineering, computer sciences and their applications, mechanical engineering... But the innovation does not stop here, inasmuch as this workshop entertains a much more ambitious initiative: to create a new label “Engineer 3I” – with I’s as in Industry, Innovation and ‘Interculturality’. “Major industrial groups such as Renault automobiles experience a growing need for young engineers with the capacity to work on innovation-intensive projects in multidisciplinary, international teams”, explains Gilles Morel. “To meet this new demand, UTFPR and UTC want to inaugurate a specific course that will lead to the award of this “3I” label, coming in addition to the engineering diploma itself. The outline course contents and profiling are under preparation now, but as of Semester 1, 2018, we shall be in position to field-test several modules, with support from the Sorbonne Universities Cluster”. In February 2018, some 6 UTC and 6 UTFPR undergraduates will get together at Curitiba for a ten-day seminar the purpose of which is to prepare them to take part in multicultural team work and to detail the objectives assigned to the workshop project. During the semester, each group will follow intensive language learning (Portuguese for the French and French for the Brazilians) and at least one project management credit course (CC). Over the next few years, the students will continue their “engineer 3I” training, which will include a two-semester internship abroad: one semester with a partner university of technology, the other with a business company (or a start-up). In the long term, our aim is to build up an international network of universities of technology that will all be able to award the “engineer 3I” label. ■

# A corporate view

Sopra Steria, who have signed a pedagogical partnership with UTC, involves our students on a regular basis in various projects. This proves to be a mutually enriching form of collaboration.

**L**ong-standing strategic partners in research activities, Sopra Steria and UTC have decided to widen the scope of their collaboration, taking in pedagogical research. To this end, they signed an agreement in December, 2016. In this cooperation institutional framework, students are invited to take part in projects that have a close connection with those of Sopra Steria groups who rank among world leaders in finding digital solutions – with some 40 000 staff round the world. The ‘software editing units’ of the multinational group are strongly involved in these mutually beneficial exchanges. Three units focusing on the bank sectors, manpower resources and the building sector, indeed, were very interested by the capacity for innovative and pluridisciplinary thinking of UTC undergraduates. The excellence displayed in computer sciences and their applications, in data processing and analysis and in urban system engineering were found highly attractive by the professional solution experts. “In essence, we mobilize their technical talents and skills to help them progress, and at the same time we are keen to benefit from an external vision from their generation, which has specific digital uses”, notes Thierry Fournel, a Sopra Steria expert in building

sector software packages. A workshop project and several CC lab.sessions (TXs) and projects (PRs) have already been set up via the partnership. To the extent that Sopra Steria is very happy so far with the results, the group now wishes to project towards a follow-on programme over several years. The group wishes to set up this unique relationship with an engineering school on a lasting basis.

## Interdisciplinarity, an important added value

The principle that underscores the modules is that we are able to propose real, concrete cases as met by professionals in the sectors, without being too ‘directive’ i.e., so as not to stifle the more innovative solutions the students can have. There are regular meetings between the students and Sopra Steria staff bringing everyone up to date as to project progress, in a constructive dialogue that enhances mutual benefits. “The idea here is not to simply accept the students’ work at its turn-key face-value but rather to be engaged in a pedagogical approach where what we have to say serves to enrich the students’ experience in a logic of co-construction based on concrete hands-on

examples”, explains Thierry Fournel. The field of what we now call ‘smart buildings’ – where there is a high demand for studies by certain Sopra Steria clients – is one of the areas touched on by the students and their lecturer, research scientist mentors. It is a highly transverse theme and has allowed students majoring in computer sciences and their applications and in urban engineering to learn how to work together, producing and proposing joint solutions. “Over and above the technical aspects, interdisciplinarity is a high added value for the companies here”, insists Thierry Fournel. Digital transformation of buildings was also used to mobilize the young UTC undergraduates. Consolidating information related to consumption, uses and residents’ behaviours using data from connected objects was one of the themes proposed. Another workshop proposed that the students imagine a set of expectations of a flat owner/occupant in 20 years’ time. For this exercise, the students put together a questionnaire they circulated over the social networks to their friends and relatives. This ingenious use made of new media is a good example, of UTC students’ levels of creativity, beyond their specific majors and this also is an important asset when they want to enter the job markets. ■

## Two weeks to solve a ‘transverse’ problem

Over the past twelve years, interdisciplinary problem-solving workshops have enabled students from different background and majors to concretely experiment the advantages inherent in collaborative work modes. The next workshop will bring together student-engineers from UTC with university students from Pierre & Marie Curie (Paris 6) and Paris Sorbonne (Paris 4).

**T**he principle underscoring the workshop is to see some 30 students from various UTC majors: (mechanical engineering (UTC-GM), urban systems engineering (UTC-GSU), computer sciences and their applications (UTC-GI)...) with other students for a two-week session of intense work on a “real” problem, in a close collaboration with the companies and local authorities involved: this is the principle underscoring so-called interdisciplinary problem-solving workshops (‘AIRPs’), inaugurated as early as 2005. During the first week, the students are invited to carry out field observations of the situation and to meet the parties involved (staff of the company, experts in the subject-matter...), to analyse the problems

to be solved and to come up with innovative suggestions and solutions. They then make a presentation of their diagnosis and their proposals to a jury combining professionals and academics. During the second week, they develop the solutions deemed satisfactory and validated them with demonstrator set-ups, before submitting their final presentation of work to the jury.

## Health and safety factors on work sites

“Over and above the possibility offered here to implement class-room theory, the protocol also

serves as a novel way to learn to the extent that the lecturers on hand are not there to dictate what is expected of the students, but act as manpower resources to answer their questions and advise them as to solutions”, underlines Pierre-Henri Dejean, a lecturer research scientist working at the UTC-Mech. Eng Dept., who initiated the AIRP programme. The programmes also offer a concrete way to measure the extent to which interdisciplinarity is conducive to creativity and innovation. The first workshops provided this demonstration amply. In the Framework of a partnership with the French national institute, INRS (research and safety factors), these workshops focused on design of work areas that took into account a need for workers’ in situ



comfort and prevention of professional illnesses and accidents. From the outset, students from architectural colleges and student-engineers from UTC worked together. “To the extent that architects and engineers do not speak with the same terms or manner, dialogue between these professions is often difficult”, explains Pierre-Henri Dejean. “The aim here was to have the student become aware of the need to attain optimal solutions. It was a wager that succeeded all the better because they were immersed for the two weeks in an external environment and under the obligation to find solutions in a very tight work schedule”. As a follow-on the cultural mix went beyond simple interdisciplinarity, since several European workshops were organized, with student-engineers and architecture students from France, Rumania and Sweden.

### Adaptation to population ageing

For the past few years, the AIRPs have addressed a new theme – population ageing. Two years ago, to illustrate this, a workshop was devoted to adapting the ‘social’ housing for ‘Picardie Habitat’ to meet the new needs created by this

ageing phenomenon. Students were invited to imagine solutions to make home displacements for seniors safer, contributing also to their physical and psychic well-being, and to making the job for helpers easier... a two-room flat that integrates their proposals is being furnished and equipped. The next AIRP, planned for January-February 2018, will extend this theme from ageing to urban planning and to the problems specific to city-hospital relationships. “The objective here is to ensure that senior citizens experiencing gradual loss of autonomy can remain as long as possible in their own homes. They must be able to easily access all the care and services needed”, explains Pierre-Henri Dejean. “This constitutes an objective that raises numerous questions: what remote medical services should be developed; how are we to optimize the home-hospital transport, where exactly is it relevant to install “adapted” housing in our cities, how do we ensure that senior citizens can use pavements safely, etc.?” This workshop, conducted in a partnership with a hospital and a local authority, combines unusually diverse skills, with student-engineers

from UTC, students in ergotherapy, in kinesiotherapy and in robotics from University of Paris 6 (Pierre & Marie Curie) and students reading geography and philosophy at University of Paris 4 (Paris-Sorbonne). Indeed this is one of the projects earmarked as laureate in the latest call for proposals for innovative, pedagogical initiatives launched by the Sorbonne Universities Cluster. ■

## Projects and creativity as priorities for future designers

The specialty course in Industrial Design in the Mech.Eng. Dept. of UTC has chosen to operate just like a design agency, where project learning and creativity enhancement approaches are key to the pedagogy deployed.

**S**tudents who register for this Industrial Design specialty can be seen as collaborators of a design agency or indeed as independent designers, faced as they are with the same professional reality: constant competition in terms of calls to tender. The course lecturers encourage their students to participate in various design competitions that are open to students. And of course they accompany them in these ventures. “We instate a one-semester

project CC for each student or group of students who apply for a competition”, explains Emmanuel Corbasson, who heads the course and is also an independent designer. “This implies that we have a two-hour weekly session to check project progress and ‘deliverables’ and we train them as to how they should tender for the competition, how they should present the project to a jury...” This coaching has proved rewarding. In just 7 years, students in UTC-GM-DI have won a dozen or so

prizes. The latest successes came in 2017: a team won a Parrot Award for a surveillance drone to be deployed over an industrial site providing images and awaiting the arrival of the fire-fighters – this enables their action to be better adapted to the situation as observed. Another team came second in the James Dyson Awards (France), proposing a system to assist persons with mobility/motricity problems to sit down on (and get out of) a wheel-chair. “These competitions demand a high level





of investment both from the students and their lecturer mentors, but the approach is definitely ‘win-win’”, notes Emmanuel Corbasson: “when we have laureates at these competitions, they find a first appointment or add-on internships much more easily and at the same time, their success adds to UTC’s notoriety”.

## The ‘4P’ method

In this most original specialty (indeed very few engineering schools teach industrial design to their student-engineers), pedagogical innovation goes further still. “We operate practically as a design agency, stresses Emmanuel Corbasson, “using an approach we call the “4P” method”. P for ‘projects’, inasmuch as learning by project is the key feature underpinning the specialty ; running from taking part in competitions to personal design contributions and industrial product design for industrial clients. P for ‘place’, where the students work, equipped in such a way as to encourage and enhance ideas and creativity. Lecturer-mentors to hand,

design areas, model-making and prototyping, not forgetting the coffee vending machine – all these resource are within 7 seconds!

P for ‘process’, given that ‘creatives’ must have all the tools needed for their projects : CAD, 3D printers, laser cutting machines... and the latest addition – nomadic virtual reality solutions to certify and design and ergonomic options before actually building a physical mock-up or prototype.

Lastly, a P for ‘people’: viz., the academics and the students, all seen as “full” members of the industrial design engineering team. “The classic system of the lecturer handing down knowledge is not conducive to enhancing students’ creative potential”, explains Emmanuel Corbasson. “Our objective is to be close to our students and always to show a benevolent attitude in regard to their proposals, thereby encouraging them to fully express their potentialities” ■



# Rebuilding two legendary aircraft

Now, this is a credit course (CC) that many students would just love to have to take again! The aim and challenge is to ‘revive’ two mythical aircraft, one of which is a Latécoère that will be one of the key attractions of the exhibition 2018, to celebrate a century of air travel.

**In a partnership with the ‘Cercle des machines volantes’, a Compiègne-based ‘1901’ association, UTC is taking part in the reconstruction of a Caudron Rafale C430, a two-seater, single wing racer that made its maiden flight in 1934 and a Latécoère 28, the same as the model flown by Jean Mermoz for the first ever South Atlantic crossing in 1930.**

Both planes – where the reconstruction work makes use of modern technologies such as CAD and/or computational modelling techniques...) must comply with today’s airworthiness standards in order to be allowed to fly, while remaining as close as possible to the original aircraft specifications.

The operation – which started years ago – counts a permanent staff of between 5 to 7 lecturer research scientists each monitoring the work of 2 to 4 student-engineers who are assigned specific tasks (worth one CC- one semester), e.g., linen fabric properties for wing/fuselage covers, CAD engine re-design... and once their CC has been certified satisfactory, the students hand over their work on to class of students (and generally speaking there is no lack of candidates). “Discovering hands-on the principles of airflow over and under a wing is far more motivating than doing an applied maths seminar on the same

subject!” notes Jean-Marc Picard, UTC professor with the department of Mech.Engineering who proposed and pioneered this project at UTC.

“What we see here is one attractive pedagogy-related aspect of the project: to be able to transmit a certain number of complex notions, while having the students tackle and analyse some very enriching problems. For example, in retro-engineering. None of the Caudron Rafale C430 technical drawings exist now, so we had to digitize every single part and there is no model of this aircraft where all the parts had been restored perfectly. Or again, in the area of materials: the student became aware that wood and linen fabric, ‘noble’ and ecological matter used in planes of yesteryears are very proposing, inasmuch as we can now use non-destructive tests (ultrasonics/ infrared ...) to check for absence of faults invisible to an eye-inspection where the material resistance might be endangered”.

## A federating project

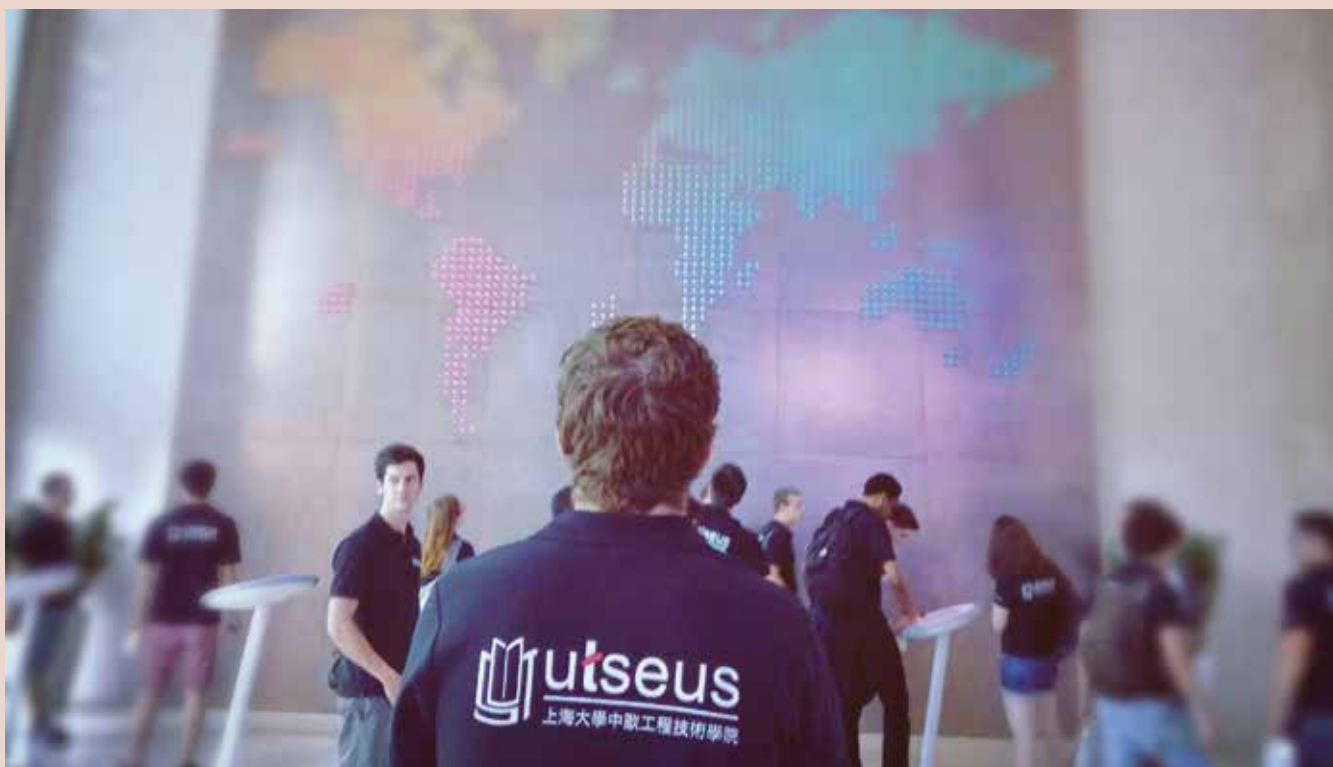
Another attractive feature is that the project as a whole is transverse, calling for, many different skills: mechanical engineering, materials, computer sciences and their applications and

even bio-engineering for the choice of wood or linen. “The experience is federating and gives the students a wider vision of engineering sciences and likewise prepares them for a future professional position, as a sort of orchestra conductor with mastery of the full gamut of engineering techniques and skills”, underlines Jean-Marc Picard.

Last point: the reconstruction of these two aircraft involves participation of students registered for a credit course (CC) in project management – and in this role they are entrusted with scheduling, task distribution, planning and follow-up, PR & communications and a constant search for new sponsors.

Again, being a scale-one exercise, the project provides excellent training.

Ever since it was launched, this project has served as a regular spring board, professionally speaking, for the student-engineers. Several participants have carried out their internships in the aeronautical sector and for a few registered for a Master’s degree in aeronautics, with either the “University of Brunswick – Institute of Technology” (Germany) or the Cranfield University (UK), before being recruited in aeronautics. ■



# Identical trends on the Shanghai campus

Utseus (\*Sino-European School of Technology of the Shanghai University), is an academic association of the three French universities of technologies (UTs) and the Shanghai University. In China project based learning and development of intercultural skills is becoming increasingly important.

**Utseus proposes three one-semester 'mobility' programmes for student engineers matriculated at one of the three French universities of technology: UTBM (Belfort-Montbéliard), UTC (Compiègne) and UUT (Troyes): one addresses 2nd year students, while the other two, at Master's degree level, aim at students finishing their engineering diploma training.** These training courses, especially at the Master's degree level, leave plenty of scope for pedagogical innovation and make provisions for numerous meetings and projects with Chinese or Franco-Chinese companies, start-ups and other local actors engaged in innovation-intensive activities (cf. Interactions #42, January 2017, dossier, pages 5-12). But the objective here is also to develop these 'active' forms of pedagogy – which are quite novel in China – in the framework of the Bachelor's degree that aims at Chinese Utseus students specifically. UTC Emeritus Professor Jean-Pierre Caliste – responsible for three credit courses in 3rd year at Utseus, asserts “the first CC focusing on project management was organized in autumn, 2017. At this point in time, the students have not, as yet, done any group project work. I ask them to get organized in teams of 6 to address a subject that will involve several ‘deliverables’, including a ~ 10 page publication. The subject matter is ‘general’

in its scope and not an engineering problem per se. Each group chooses its own theme (museums, salaried students ...), but there is an overriding proviso that the team comply with the specs and delivery dates. Over and above the students' inexperience here, our main difficulty lies in their numbers, much more than those met at UTC, around 70 students in each seminar class, which makes it physically impossible to supervise each student individually! What I do is ask them to work with a project management software package, so we can follow their progress a posteriori”.

## A very enriching cultural shock

The second CC (on quality assurance, or QA) will take place in the springtime. Drawing on their experience with a project, the students here will be invited to redesign an object and to produce a dossier that supports their design and findings. In 2017, for example, the assignment for each group consisted of transforming an existing product into a connected object with new functionalities. But the key point here is that the teams are mixed – each with 2 Chinese students and 2 French students doing their second year 'mobility' studies at Utseus. “For both Chinese and French, this

represents a very enriching cultural shock”, notes Jean-Pierre Caliste. “The Chinese discover that the French are more familiar than them in project-intensive collaboration, are highly self-reliant, anticipate difficulties and takes lots of initiatives. The French realize that the Chinese are more immediately reactive, but demonstrate their capacity for a high level of creativity”. The third CC deals with agile project management, and focuses mainly on creativity and innovation. Here again, the students are invited to address a project in mixed team formations. In 2017, the idea proposed was to imagine assistance systems for firemen engaged in fighting a fire. In the future Utseus intends to go further – developing more team-based pedagogy for the Chinese students, enhancing their autonomy and their capacity to innovate and encouraging them to move into entrepreneurship. Moreover, the aim is to reinforce intercultural skills of both Chinese and French students, enhancing and encouraging remote collaboration on joint projects. A project called the Interaction Laboratory Innovation (ILI) will receive means needed – rooms fitted for collaborative work (white boards, large PC-connected interactive large screens ...), makerspace for prototyping, audio and video equipment for network sessions between the French UTs and Utseus. ■

# InnovE-UT: 'Flipped classes' and remote learning

In 2014, the three French Universities of Technology (UTs), viz., Compiègne (UTC), Belfort-Montbéliard (UTBM) and Troyes (UTT) opened a joint course combining, in particular, 'inverse' (or flipped class) pedagogy and remote learning - its name is InnovE-UT. The first evaluation for this course has been positive.

**S**upported by the three above-mentioned Universities of Technology, by the INSA Group, by the CESI (Centre des études supérieures industrielles) and the University of Lorraine, InnovENT-E is one of the projects selected as 'innovative pedagogy' under the Government incentive investments for the Future plan. Its aim is to develop innovation-intensive training and export-oriented modules compliant with the needs expressed by SMEs. For this purpose, InnovE-UT, a minor specialty proposed jointly by UTBM, UTC and UTT, is an excellent illustration. In order to widen the scope of teaching offered, the three French UTs share 9 credit courses (3 for each UT) all with remote access. Students are required to choose a minimum of 3 modules: one in their initial UT which they follow in live class formation and one each from the other two UTs which they follow remotely. "In order to facilitate distant learning, we have digitized and course contents and supports and put them 'on line'", explains Pascal Alberti, head of the InnovE-UT programme and of one of the CCs offered by UTC. "Whether the students follow the CCs remotely or not, we were able to introduce also the concept of 'flipped' class pedagogy which encourages the students to increasingly become positive actors of their learning process. Before each course, all the students registered for my CC are supposed to have read/studied the documents made available on the 'minor web-site, essentially videograms where I present the theory and indicate links to additional resources (scientific papers, etc.).

They are also required to exchange in respect to course contents, via a specific CC Forum: they ask questions and I answer 'on line', or they even answer questions raised by their class-mates, which constitutes another way to acquire new knowledge. Finally, when we get together in face-to-face class formation, we can have an in-depth discussion of these answers".

## Approximately 500 students each semester

This minor has another specific feature in that considerable leeway is left for remote collaborative project work, on real, concrete subjects provided by industrial partners: the work load is subdivided among several teams with students on a single site, exchanging via the collaborative platforms or simply using Skype. Inasmuch as InnovE-UT is accessible for the students registered at one of the 3 UTs, no matter what their major specialty is, and also open for non-French students doing a mobility internship in one of the UTs, these projects provide an excellent way to gain new, intercultural skills. Three years after the InnovE-UT programme was launched, the assessment today is seen as conclusively positive. Depending on the

semester, somewhere between 400 and 500 student-engineers from the three French UTs are registered for this minor course and the attractiveness of flip-class pedagogy and remote learning is self-evident. "Even if it is difficult to measure scientifically the results of flip-class pedagogy, my own feeling is that they are positive", explains Pascal Alberti. "The 'lectures' are much more interactive and allow the students to go beyond basic understanding of problems and often beyond the initial limits set to these problems, since the exchanges with and among students leads to

further in-depth questioning. It is, admittedly, an approach that requires more work input, but at the same time also a greater degree of flexibility in the learning processes. Students can consult on-line resources as and when they so desire, can revise when they want to, answer MCQs to self-assess their progress for certain part soft h course and/or can follow other CCs when registered for a mobility stay in a non-French university". As Marion Mézeraï, in charge of the InnovENT-E at UTC - who accompanied the lecturers in designing this minor course - sees things, the objective can now consist of disseminating this principle of remote 'flipped' classes beyond the scope of InnovE-UT: "Naturally there can be no question here of generalizing the principle, but rather to reach out to new audiences; for example, student entrepreneurs or salaried students registered for an engineering diploma and for whom the course offers a flexible way to complete their training on certain specific points". The concept also opens the way to some interesting prospective such as facilitating access for enterprise to certain continuous education programmes, without having to be physically present at UTC, or again, to develop some these training module for an international context and market. ■

<http://webtv.utc.fr>  
> Présentation du mineur InnovE-UT

## An XXL-sized creativity-intense workshop

December 1st and 2nd, 2017 – as every year since 2014 – UTC participated in the competition, "48h to make ideas come live". For two full days, at the UTC Daniel Thomas Innovation Centre, student-engineers from various majors and students from the Institut polytechnique LaSalle-Beauvais and from ESCOM (École supérieure de chimie organique et minérale) addressed in team formations subjects proposed by local companies. The objective assigned is to see innovative concepts being presented, underscoring their pluridisciplinary features, but also to see teams from other Regions and countries confront their ideas. Organized in the framework of InnovENT-E, this event brought together some 1 500 students spread over 8 centres in France and several venues programmed outside France (Chile, Argentina, Bahrein, Morocco, Algeria...). This is another way to have student-engineers, notably those registered under the InnovE-UT programme (for whom the challenge is indeed compulsory) – to take part actively in collaborative work-sharing.





# *In the shoes of a supply chain manager... or those of an academic*

In the CC on Supply Chain Management, in the department of mechanical engineering, there are also some striking and successful innovations, such as organizing a serious game as an examination, with the student-engineers lecturing their academic mentors

**T**he end of year period is both game-oriented and serious for students registered in the Supply chain management CC. Dec.21, 2017, they will sit their course exam organized as a serious game, lasting one full half-day. Each time will be required to simulate the supply chain of a company producing small, artificial Xmas trees as decorations: this involves negotiating with the suppliers (roles played by students in a competing team, production and stock management, delivery to the shops... but also sales of the Xmas trees to customers with highly variable profiles, roles also played by other UTC students and personnel. From supplier behaviour to customer satisfaction, not forgetting labour, storage and transportation costs, the teams participating will be assessed on their global performance. A game rounds up a semester, because in order to model the supply chain of a company, each group must first define the chain and hand in three successive status reports explaining their choices and methods.

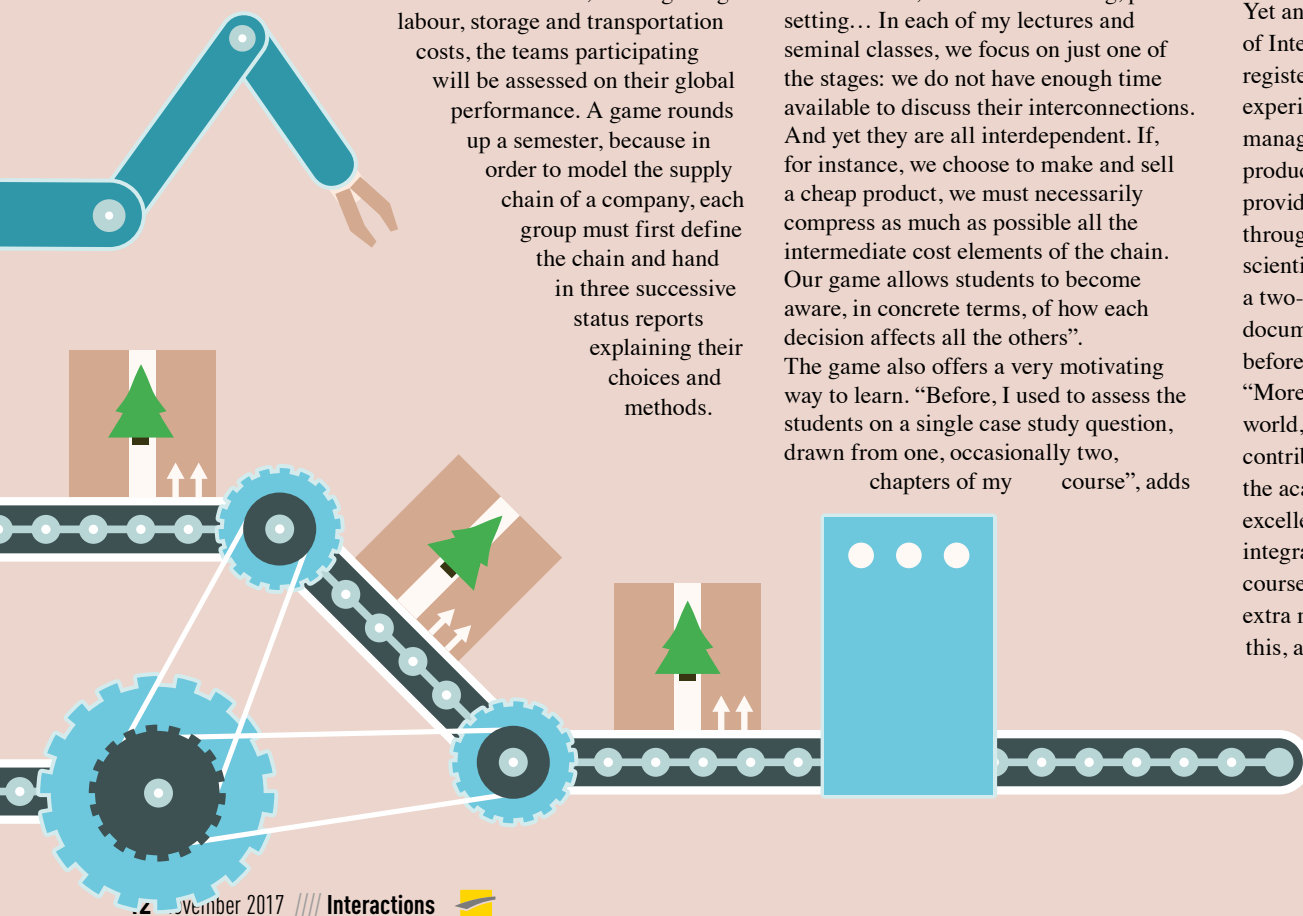
## Results transcending expectations

The game, initially 'designed' by the academic in charge of this CC, Joanna Daaboul, was tested for the first time early 2017 with a previous class of students. "My CC relates to optimism a complete supply chain, from procurement of raw materials to delivery of the finished end-products to customers", explains lecturer Daaboul. "Between the two extremities there are numerous stages that require fairly tough mathematical skills: the definition of procurement strategy, factory and assembly locations, warehouse siting, sales outlets, transportation of goods and materials, demand forecasting, price setting... In each of my lectures and seminal classes, we focus on just one of the stages: we do not have enough time available to discuss their interconnections. And yet they are all interdependent. If, for instance, we choose to make and sell a cheap product, we must necessarily compress as much as possible all the intermediate cost elements of the chain. Our game allows students to become aware, in concrete terms, of how each decision affects all the others". The game also offers a very motivating way to learn. "Before, I used to assess the students on a single case study question, drawn from one, occasionally two, chapters of my course", adds

Joanna Daaboul: "for example, a question about localizing factories and warehouses. Most students found the exercise tedious and that led to the idea of the game. The results exceeded my expectations. Preparations took 5 times more work than just doing the case study exercise, but they found the workload lighter. They really get involved in the game, doing some calculations I hadn't even required ... they are more attentive and more active in classroom formation".

## En route for 'reverse pedagogy' examinations?

Yet another innovation: just as this issue of Interactions goes to press, the students registered for this CC are invited to experiment a flip-class configuration, managing and proposing a course on product pricing strategies. "It will provide a way to teach them how to sift through and sort out information from scientifically "reliable" sources; preparing a two-hour lecture needs a lot of prior documentary spade-work to be done beforehand", underlines Joanna Daaboul. "Moreover, in a very fast-evolving world, the younger generations can also contribute and offer their skills/talents to the academics. If their lecture is deemed excellent, I promised the students I would integrate certain sections in my own course, quoting them as authors, which is an extra motivation for their work. Following this, and if the experiment is satisfactorily concluded, I would like to extend the principle to others course and even test flip examinations, where the students "build" the exam contents ..."





# Cutting edge tools to learn how to work collaboratively

Two years ago, with the support of the Sorbonne Universities Cluster, UTC installed and equipped a “digital hall” specifically to meet the needs of project intensive pedagogy: the platform has 5 collaborative work areas, each equipped with an interactive, tactile table and display board, as designed by UTC research scientists. The result is very positive.

**O**ccupation now close to 100 % ! The digital hall has proven to be a growing success for both UTC academics and students. Today the Hall is used on a regular basis by a dozen or so CCs that address subjects like creativity, innovation or project management, but also serves from time to time as a support for other CCs that include project-work phases. The display units and tactile tables were designed by the UTC labs Costech and Heudiasyc – to encourage and enhance co-design work and collective intelligence. Using the units and tables enables the students to learn how to make good use of this sort of collaborative tools that we shall see increasingly present in corporate situations. In addition, they also offer several advantages in terms of pedagogy.

## Increased levels of participation

The first advantage is that, with these tools, all students present can be active during collaborative work sessions. Each participant can, to illustrate, bring up a virtual keyboard on the table and noting his/her ideas on a digital Post-it®, sharing with fellow students by ‘sliding’ the notes or transferring them to a display unit while another student can rank and classify the ideas as they and when they appear. “Using the interactive table encourages

and enhances creativity and cross-fertilization of ideas thanks to the face-to-face exchanges across the table while the display units serve to achieve convergence of ideas and proposals that help when it comes to making decisions”, explains Thierry Gidel, lecturer and research scientist working at the UTC-Costech Lab. “What we have observed with the use of these tools is that distribution of ‘exposé-time’ than with classic Post-its®, paperboards or other traditional brain-storming tools used in collaborative work sessions. It also proves much better than a group, of students round a PC with a large screen display. In this configuration, the student who accesses the PC keyboard tends to become “the boss” and the other students then become more passive”. Joanna Daaboul, who, teaches at the UTC Mech.Eng Dept. shares this view: “With the interactive table and display units, the more reserved, ‘shy’ students can propose their ideas via the virtual Post-its® without having to speak up in public”. And to the extent that more brains are contributing here, the results are all the more relevant and globally interesting. Finally I can conclude that students simply love working in the Digital Hall”.

## A multitude of possibilities

Another inherent advantage is that the display units and interactive tables integrate a multi-user multifunction software package offering a wide range of possibilities: co-construction of a business model, or scenario or schedule, mapping the processes, commenting a map... Moreover, the software used was designed to guide beginners as to best uses, facilitating also the learning of collaborative work methods.

Naturally, other software package can be developed to handle specific

cases and applications (cf. article below). The pedagogical interest of these tools is not limited to the students as audience. The digital hall also serves as support for an experiment in interdisciplinary collaborative work conducted

by a nearby school. In a partnership with CIREL, a laboratory specialized in education sciences at University of Lille 3, the UTC-Costech Lab has just launched a thesis on training for collaborative work based on use of tactile display units and their contribution to specialist training. ■

With the interactive table and display units, the more reserved, ‘shy’ students can propose their ideas via the virtual Post-its® without having to speak up in public.



# Urb'act, learning by games

How, we may ask, are we supposed to train students to engage in concertation in regard to an urban planning project? One answer lies in Urb'Act, a "serious game" that makes use of the digital display tables and tactile screens installed in the 'Digital Hall'.



the society at large (the inhabitants and associations) would like to see a maximum area devote to green-band land and also to ensure accessibility to the 'going' market prices. "In a classic course or even in seminal formation, it is impossible to have the students become aware of how important (and difficult) it is to come to agreements among parties", underlines Nathalie Molines, senior lecturer in geography at the UTC Dept. of Urban Systems Engineering (GSU). "In like manner, it is difficult to have them become more aware of the financial implication of each decision and the impact of multiple unknowns that can occur along the 10-15 years that is the typical span for an urban project. Hence our idea to get them involved via a serious game "Urb'Act" that we are developing currently with support of the Sorbonne Universities Cluster."

students will decide among themselves who plays the role of prime contractor, financiers and promoters. Each student will receive a card outlining the positions to be defended.

On the table, the participants will have a digitized planning zone, enabling them to inscribe the project boundaries: noting where exiting constructions will be preserved, or/destroyed, where buildings will be built, with relevant communication routes and facilities... In order to define this global plan, the students will be required to discuss and converge wherever possible to conciliate the desiderata of each party, while guaranteeing a balanced budget, functional and social 'mixity' and the assurance that the project as a whole is compliant with current environmental standards. As the game progresses, they will be required to take other external factors into account: e.g., a change in political majority, a financial crisis which will need a complete redefinition of the project and/or rescheduling of the investments over time. Following these two 2h sessions, the academic in charge will debrief the work done and proposals: were they 'operationally acceptable' or not and if so, why?

**A**s often occurs with urban planning projects, the parties engaged focus on attaining their own objectives, and these often prove mutually incompatible. Let us imagine that the prime contractor (viz., the locally elected authorities) wish to build a new urban pole by irrigating and densifying an urban zone: for example, the promoters (who finance the operation) will seek to promote a less dense housing scheme but with high-price accommodation, i.e., that will sell at a more expensive level, while

## A prototype ready for July 2018

This game-oriented "app" will specifically rely on using the tactile tables and displays installed in the Digital Hall. In just two sessions (each 2h), the game will model a complete project from 'design-conception' to final prototype delivery. Round each table, 3 pairs if

The objective of the ongoing Urb'Act project is to develop a prototype of the game by July 2018. The latter will be field-tested with students registered for urban system engineering at UTC, but also with students doing a Master's degree in urban planning at University of Paris 4 (Paris-Sorbonne). Other projects will follow to experiment the gaming approach with other audiences, incorporating improvements as the games evolve. ■





## A new look on *vascular therapies*

In the call for projects issued by the European Research Council (ERC) the project proposed by Anne-Virginie Salsac has been approved and selected, Nov. 28, 2017. This Council financially supports exploratory projects that potentially led to major scientific, technological and societal discoveries, where level of scientific excellence is assessed by international jury. New ideas at the interfaces of 'classic' scientific research specialties are particularly appreciated by the jury and the French proposal success rate stands at 15%. Through Anne-Virginie Salsac proposal, UTC benefits here from its first ERC grant. Below is a summary of her research work and achievements to date.

**A**nne-Virginie Salsac and her research team at the UTC-BMBI Lab (bio-mechanics and bio-engineering) are investigating : fluid bio-mechanics as relevant to health issues.

Combining digital modelling and experimental work, the team has carried out modelling of flow phenomena: from micro-circulation paths to hemodynamics of major blood vessels. So, what is the challenge here? A-V Salsac answers "By characterizing blood flows, from microcirculation to major vessels, we can help develop ways to optimize diagnosis of disorders and consequent therapeutic treatments via these vascular circuits".

The team is investigating endo-vascular therapies, a protocol which consists of moving bio-medical devices to a target zone via the blood vessels which enables a local treatment that is considered to be not very invasive. "Our research work focuses notably on the use of microcapsules as vectors to transport active ingredients and on their behaviour when they interact with our body fluids," adds Anne-Virginie Salsac. "How, for example, does the capsule envelope deform with the forces generated by these fluids? How can we control the release of the ingredients transported, by acting on certain mechanical characteristics of the envelope or by stimulating envelope rupture using ultrasonics? Sophisticated modelling and characterization

techniques open the way to discover how to optimise these microcapsules as a function of the applications envisaged".

The team is also doing research on endovascular embolisms of abnormal vessels that therefore require "closing".

"We launched a project on the clinical use of surgical glues, for example, to deal with certain arteriovenous malformations", details Anne-Virginie Salsac. "What we have is an entanglement of small, very fragile vessels, hence a risk of serious haemorrhage. Injecting glues is a standard clinical practice, but there have not been many academic studies on this topic to date. So far, our knowledge-base here is largely empirical. There are some outstanding questions as to way the glue reacts, how it polymerises in contact with blood, etc. In order to gain a better mastery of this therapeutic act, we need to understand

the associate and very complex phenomena better".

The research conducted by Anne-Virginie Salsac and her colleagues on blood flows and microcapsules are recognized as producing world-class results led to the award of three awards in 2015: the CNRS Bronze Medal and two trophies from Femmes en Or (Women in Gold), one for innovation and one from the public vote, before this ERC grant, Nov. 28, 2017. ■

Anne-Virginie's interview  
can be seen on [www.  
http://webtv.utc.fr](http://webtv.utc.fr)

Likewise the interview of  
Jean-Pierre Bourguignon,  
Chairman of the European  
Research Council (ERC) is  
set out in Interactions #29

### DID YOU KNOW THIS ?

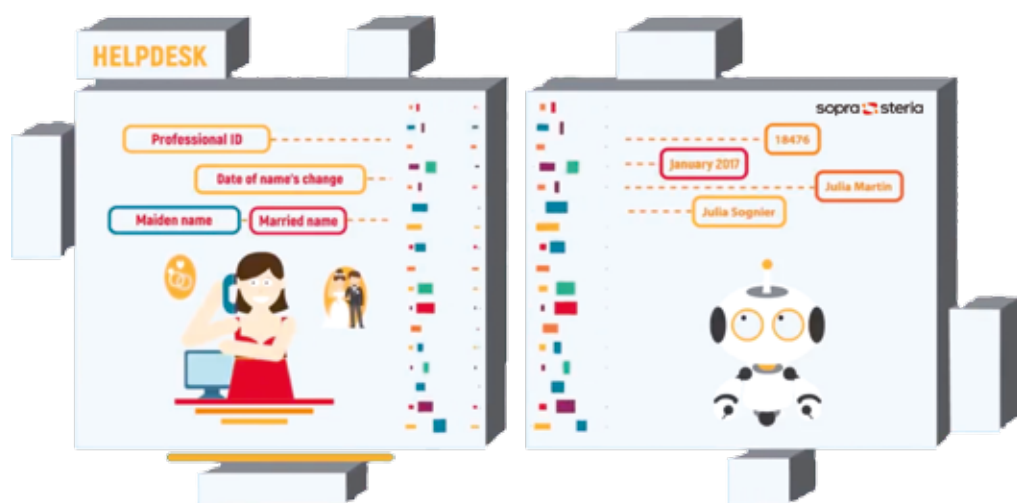


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CONFERENCE

# The Man-Machine Interface (MMI) at the heart of tomorrow's economy

Simon Collot, AI (artificial intelligence) expert at Sopra Steria, delivered a lecture in September at UTC to demystify the subject, inviting the audience to join him on a tour of the opportunities opened up by new AI-based innovations. Here is summary of his analysis and update.



**C**urrently used in the service sector and in various industrial sectors, artificial intelligence has become increasingly present in a day-to-day professional and private spheres. The obstacles that remain are more human than technological. « The challenge lies every bit as much in writing the programming bricks as in convincing the colleagues in an enterprise that they can count on gains in efficiency and also to reassure them as to the resulting division of labour between men and machines: one of the roles of Sopra Steria being to accompany people in this acculturation”, explains Simon Collot who has notably been assigned advisory missions for and with the energy sector engineers and decision-makers. Whilst these AI derived innovations are often seen as a threat, expert Collot is convinced,

he says, that Machines will assist Men but not replace them. “Automating certain processes will enable workers and operatives to concentrate on higher added value tasks and to be assisted in doing so”.

## Increasingly “agile” solutions

With chatbots, specific trade-oriented solutions, auto-diagnosis in the aerospace sector, we see AI is unavoidable when it comes to proposing new services to clients and to gain in productivity in an increasingly competitive commercial context. It is a new technology that relies essentially on implementing three key stages: a situation stats and description thanks to analysis of complex data, predicting the next events, using models and

– for the more advanced solutions – solving and correcting the problems as and when detected. “With AI the solutions are never ‘frozen’ and with auto-learning systems they can be improved and adapted to fit a changing environment”, adds our engineer, specialist in computer sciences and applications.

At this point in time, computers can now imitate human conversation very closely. This potentiality can be of high interest to customer services – certain solutions have already been tested and others will come in the near future. After on-line message systems handled by automatons, you will soon be able to call up an automat. Banks are among the most advanced enterprises using AI. “One of our customers has proposed extending the weekly/monthly cash withdrawal limit outside the account holder’s opening hours, or to engage in a dialogue with a robot and open a new account in a totally automated manner”. Although the electric power companies have been later starters in this field, they are also engaged in the AI revolution. Their customer advisory services will soon be able to rely on a technical assistance to propose personalised contracts to each consumer/customer. These new services will allow the enterprises to have a rapid ROI (return on investment) but other long term evolutions are currently being studied in our laboratories. Decentralized, renewable energy production in tomorrow’s ‘smart cities’ will be included in these major work programmes. Design of ‘smart’ networks is, indeed, very necessary to be able to balance supply and demand. News from AI-intensive sectors will be dense ... Sopra Steria has the intention to satisfactorily accompany its customers as these evolutionary trends come to be. ■



## abécédaire de l'innovation #2

Big data | Cellular behaviour | Acoustic Encapsulaytion | Heterogeneous milieus | Interfaces | Ludification | Nuclear magnetic resonance (NMR) | Pathogenicity | Vascular Therapies | Wikipedians ...



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# First Jacques Vabre 'Transat' Race for Tom Laperche



The two-man crew set sail from Le Havre, November 5, at 1:35 pm, viz., Tom Laperche a UTC undergraduate majoring in Mechanical Engineering in the Sports Elite student section, with co-skipper and architect Christophe Bachmann. They crossed the finishing line in Bahia (Brazil) November 24, at 4:16 pm on board their single hull, racer the Lion d'Or – ranking 7th in the “class 40” sail-boat category.

**This was a remarkable performance for Jacques Vabre Transat “blue”, Tom Laperche, all the more so when you realize that in July 2017 their boat was still an empty hull!** Tom Laperche was chosen by the BG Race committee (a shipyard for fast offshore sailboats based in Saint-Malo) from among a group of “under 25” contenders.

What was his mission? Nothing short of developing, optimizing a class 40 single hull racer with high reliability, to qualify for the next Jacques Vabre Transat Race. The boat's name: Lion d'Or. Our brilliant undergrad accepted the challenge and decided to do an internship on this very theme. Given the scale of the operations needed, Tom actually started his internship two month ahead of schedule, in July 2017, to design the boat's equipment (ballast, engine, batteries, map-table

...) and also took part in the choice of rigging and ship fittings. He also dealt with the electronic on board, from discussions with suppliers to boat fitting and certifying the instruments. This marked a high degree of confidence by the BG Race officers, guaranteeing Tom's autonomy in this chapter!

This represented phase 1 of Tom's internship. After the boat was duly fitted out, then next step was to gain in performance under sail. Tom also contributed to a semi-circular polar diagram which sets the boat's speed as a function of wind force and direction and “sailects” (which is used to set the sails – angles and spread), optimizing the auto-pilot plus a process to analyse real time weather data. All of this is intense work bringing to bear all the technical engineering and project management skills acquired by Tom at UTC.

## Life on-board with Tom

Tom Laperche and Christophe Bachman updated Internet surfers regularly via the social networks and gave them a great opportunity to live the race “from inside the boat”. Some excerpts :

**November 11 :** Boat progressing well and structurally in good shape. We haven't mastered all the tricks of the trade to go really fast – not easy when everything is brand new! Still discovering ...

**November 19 :** The scene outside is worthy of a major modern art museum... we never get bored watching sunrises and sunsets through these cotton wool sculptures and giant phantasmagorical animals in the sky!

**November 25 :** we still have our noses on the grindstone. It is a hyper-interesting adventure, ending we think on Friday. Our thoughts are nearing the finishing line, but in the meantime I feel just absolutely great at sea; I'll need to “rehumanise” soon!

## A few figures for the Lion d'Or crossing

Time 19 days, 1 hour, 0 minute  
and 4 seconds!

Average speed: 9.98 knots

Time behind boat #1: 1 day,  
14 hours, 15 minutes and 49  
seconds1 jour, 14 heures, 15  
minutes et 49 secondes



By October, Lion d'Or was finished and certified “ready” for the Transat Race. Tom and Christophe Bachmann sailed from Le Havre Nov. 5 and arrive in Bahia, Brazil 19 days later, a fine performance indeed for a first participation of both boat and skippers. But the adventure does not stop here for Tom, will sail Lion d'Or back to France before returning to the UTC lecture halls. Next year our young skipper would like to move to a “higher perspective”, doing his end-of-studies internship in the aerospace/aeronautics domains. For all this and more we wish him “Fair winds!” ■

Visit - <http://webtv.utc.fr> Under the headings - Notre quotidien > Vie de l'université, culture, art et sport > "Tom Laperche – UTC undergrad. and sail-boat champion"



## AGENDA

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### UTC Open Days

January 13 / March 10, 2018

As happens every year, UTC will open its doors twice, on Saturday Jan.13 and March 10, 2018 welcoming lycée students, their teachers... and exchange about admission procedures, possibilities to do internships abroad. Lectures during the "Open Days" will complete the information needed.

### The PTC (Parametric Technology Corporation) Lecture on Industry of the Future

March 15, 2018

PTC, in a partnership with UTC, will organize a lecture on the theme- "The link between University/Enterprise related to productivity of Factories of the Future.

### International Symposium on Aircraft Materials (ACMA2018)

April 24-26, 2018

During ACMA2018, the attendees will be able to discuss the latest developments in the extensive field of materials used in today's aircraft assembly, and will doubtless be inspired to envision some future ideas in a specifically multidisciplinary approach. There will be special thematic sessions (projects/poles/networks) and mini-lectures on ongoing research and "hot" industrial issues.

<https://acma2018.sciencesconf.org/>

### Conference on "System of Systems Engineering" IEEE SOSE 2018

June 19-22, 2018

This 134th edition of the international conference on "System of Systems Engineering" will be convened at the Jussieu Campus (Sorbonne-Universities Cluster) in Paris and will focus on "Systems of systems Management and Control: Frontiers between cyber, physical and social systems".

<http://sosengineering.org/2018/>

### 9th Conference on Powder Science and Technologies, UTC

July 3-5, 2018

Powders are at the core of numerous industrial applications such as pharmaceuticals, cosmetics, chemistry, agro-food products, materials, energy and the environment. The scientific and technological issues addressed associated with the characterization of such complex milieus and the shaping processes are being investigated under a vast pluridisciplinary field of research and engineering, including process and product engineering, the science of materials, physics, physico-chemistry of dispersed milieus and solid state chemistry.

[www.utc.fr/colloque-stp.html](http://www.utc.fr/colloque-stp.html)

## AWARD

# Virginie Simon, based in San Francisco, elected best French business woman in California

With her UTC engineering diploma (majoring in Biotechnology) and a PhD from University Paris 6 (Pierre & Marie Curie) in genetics, Virginie Simon co-founded the company MyScienceWork in 2010. This digital platform – with offices in France and the Luxemburg initially – designed to share and analyse scientific and technological publications – opened a business sub-office in San Francisco as of 2014. Virginie was singled out by the Franco-American Chamber of Commerce in San Francisco and awarded a prize for her successful installation on the US West Coast. She answered some questions from Interactions.

## Do you see this award as a major step in your business career ?

This year, for the first time, a new category was created, exclusively for business-women, among the French American Business Awards. I was awarded the Golden Globe in this first edition. It is the sort of event that points, I feel, in the right direction. In the Silicon Valley, there are very few women holding managerial, executive positions, notably among the Net Giants. And the situation is even less favourable in France. However, let me just add that things are changing - various polls carried out by investment funds show that initiatives launched by mixed teams carry less financial risks.

## What key evolutions has MyScienceWork undergone since it was created?

The contents of MyScienceWork have been extensively enriched with a free access offered to some 70M scientific papers in a wide variety of specialties, ranging from nanotechnologies to scientific software programming. Over the past few months we have also put 12M patent claims on line, from the EPO (European Patent Office) and from the US Patent and Trademark Office. In January 2017, we launched Sirius, a Big Data service offer. Thanks to the size and quality of our own data base, we can now propose studies to analyse on request the 'state of publications' in a given specialty area. Statistical tools and graphics also allow us to display numbers, authors, evolutionary trends and types of documents related to a given subject matter. Our product is especially well adapted to public institutions and private companies who wish to define their business/research strategy in a scientific industrial area. Currently, to illustrate this, we can note that a French engineering has entrusted us with a mission to study Blockchain.

## How did your installation in the USA go?

Well, before we decided to set up shop in California, we had a sort of 3 month immersion period in Silicon Valley. That allowed us to get a better insight into potential markets for our products and also to learn 'hands-on' another way to operate a business, viz., in California, Here the working



hours and the places to work are very flexible. Americans are highly organized and talk straight. Meetings must be short, to the point and the allotted schedule must be complied with to the minute! In the Silicon Valley, it is not difficult at all to meet the top executives of the major companies but you feel sort of overwhelmed by their sheer size and the distances involved. Finally, we chose to locate ourselves in San Francisco which is a human-scaled city with an important financial centre. This is a setting conducive to start-ups and entrepreneurs registered from all round the world. For a certain time, my start up MyScienceWork was housed in an open-space office with 15 other nationalities!

## What advice would you give to French start-ups if they wanted to follow in your footsteps?

The decision to "set up shop" in the USA must be taken seriously. There are numerous administrative formalities (both in respect to the company and the founder(s) individually: driving license, work visa ...). It takes several years before you are in order on all these questions. It is better to do a fund-raising operation before you go rather than attempt this in the US. At MyScienceWork, we have no remorse at all for accepting the challenge – the US has become our primary market, followed by China and France. ■

[www.mysciencework.com](http://www.mysciencework.com)

<http://webtv.utc.fr> > Nos startups (Our start-ups)  
> MyScienceWork, the social network for research scientists

## START-UP

# When sports activities become a game!

Kumpa is a recent start-up company created by two UTC students which proposes an “app” for smartphones, turning your jogging and bike exercises into a game.



**W**hen you set yourself training objectives, repetition can become boring. By downloading Kumpa to your mobile phone, each step you take or each pedal circle brings you points, presents challenges or allows you to measure your performance against other runners/bikers and corner their bounty! Several story-lines are proposed either as a team or individually with the aim of adding some “peps” to your sporting activities. Early 2018, you will be able, for example, to race through Maya countryside scenery as portrayed in the famous TV programme Ushuaia. Other adventures will soon become available, such as the mythical ‘Pacman®’, or run loose in a Koh Lanta setting. Scores obtained and regularity in your efforts each week unlock new game levels. Each “title” represents 4 weeks’ training. Please note that Kumpa is not an augmented video-game like Pokemon Go® where players become totally addicted to the Pokemon universe - the aim here is rather to motivate you to make a

physical effort and thereby improve your physical condition. The authors have already imagined some corporate formula to increase emulation among colleagues. Bearing in mind ‘safety’ and ‘pleasure’ factors, there is an accessory to attach the phone to your hand without the need to actually ‘hold’ it and audio-alerts go off only at crucial moments in the games, inviting you to look then at the phone screen.

## This is a UTC-made project

With the initiative launched a year and a half ago in the framework of the UTC Entrepreneurship Elite section, the project has evolved. One of the two co-founders Maxime Robinet, explains “I was influenced by my training in design and first thought of creating a connected sports object but demand was oriented more specifically to software with sports activity “apps” being among the most popular smartphone downloads that exist”.

Maxime is currently finishing his engineering diploma, majoring in Mechanical engineering with the elective specialty Design. An encouraging example was seen in the American Zombie Run® which came on the market in 2012. The Kumpa project has since become a registered company, just a few weeks ago. The business model adopted is to see customers purchase episodes and what are called “power ups” that allow them to gain points and extra “lives” but also to sign partnerships with various sports goods brands. Discussions are under way with major companies such as Banda Namco and the TV channel TF1. After some experimentation in France early 2018, our start-up executives also entertain the ambition to win over the American market in a longer term perspective. More later, surely... keep tuned ■

<http://www.kumpa.co>

## RESEARCH

# Data science at the core of the digital revolution

With the advent of Big Data, data science per se has become a research field in its own right, where corporate investments can be seen to be quite ‘massive’ too. Dr Benjamin Quost, research scientist and lecturer at UTC-Heudiasyc Lab, updates Interactions’ readers on the latest trends observed in this area.

**A**pplications based on analysis of recurring features in data bases with millions of examples and hundreds of thousands of variables - as found, for instance, in industrial service sector, in energy ... offer some hitherto unknown opportunities. “Statisticians used to complain they didn’t have enough data, whereas today the new challenge often relates to the sheer quantity of information to be processed”, notes Benjamin Quost. Starting with the first academic publications on the topic in the early 2000s, the number of research projects and associate investments have literally taken off. Following a period of experimentation, over the past 4 to 5 years, the technologies involved have matured and now pervade a great many areas of activities. Creation of powerful, efficient algorithms and ever-increasing processing power levels and speeds have multiplied tenfold the capacity for scientists to analyse situations and have even in certain to solve the problems without human intervention. “Previous concepts, such as neuron networks have been perfected; we have now progressed to self-learning machines, for example by combining deep learning process and reinforcement Pavlov learning”, underscores Benjamin Quost, who

reminds us of the success of the Alphago game programme, winning against the world’s finest Go champions, something considered to unthinkable 15 years ago. Among other applications that use vast amounts of data provided by sensors and users are the ‘smart’, driverless cars developed by colleagues at UTC-Heudiasyc also rely, to a large extent, on new possibilities to be found in artificial intelligence (AI). The level of expertise attained by this joint UTC-CNRS research laboratory, created in 1981, designates it as a key player in research which often receives assignments and contract offers from its entrepreneurial partners. This unit brings with it a definite strategic added value.

## Applications in day-to-day life

Over and above “High Tech” applications, current solutions that can readily be accessed via personal computers (PCs), connected support devices or on-board sensors are already available on sale or being developed. As lecturer Quost stresses, “Enterprises propose projects as varied as connected buildings or posture detection via sensor equipped tee-shirts”. Inasmuch as Dr Quost is in charge of the elective

specialty “data mining and decision-making”, he has been able to observe at first hand the level of enthusiasm displayed by students in regard to Big Data as a topic. What we see as a trend in data science to replace human operators by machines could also lead to a future social upheaval. Moreover, the spectacular progress noted in data science relate to fields where the quantities of data available are stupendous. Some of the general problems are characterized by limited data inputs. “Research and associate investments are focused a lot on Big Data, but we should not neglect Small data, where we endeavour to analyse incomplete data or data with noise.” he explains. Making models on the basis of “poor” information sources represents a promising step forward in areas such as biology and medicine, where the data can indeed be limited or incomplete, often with uncertain quality and this can be important when it comes to making decisions. ■





## He dared to be successful

Romain Fournials is Vice President - Laboratory Diagnostics Middle East and South East Africa for Siemens Healthcare. He graduated from UTC in 2001 and in parallel from Université Laval, city of Quebec in their biomedical specialty electives. He is now a specialist of health technologies who progressed career-wise by daring to accept international challenges at every stage.

**E**ver since he was a teenager, health issues were always a theme that he found interesting. And when he was admitted to the UTC biomedical major this allowed him to combine his sensitivity to 'human beings and their welfare' and his passion for technology. "At the time I enrolled at UTC, it was one of the very few engineering schools in France offering a biomedical cursus and was likewise pathfinding in terms of international exchange possibilities", he recalls. His student years at Compiegne also allowed him to combine sports and academic studies. He was registered under the UTC Sport Elite section in athletics; he trained for the 110m hurdles at national level all the time he was at UTC. "Marc Monetti, who was in charge of the cursus, helped me get organized to pursue both my studies and to continue high level athletics." This flexible, tailor-made organization plan is one of the key added values of going to UTC, providing Romain the opportunity to go abroad early on. "I was lucky in that I was able to complete my core programme training in Canada after 2 ½ years in residence UTC-Compiegne". This first trans-Atlantic experience was highly rewarding and decisive for his early professional career steps. With a double degree (UTC engineering and Université Laval, City of Quebec, he decided to stay on in the 'Belle Province' (viz., Quebec) an extra year to gain a Master's degree in Science and Technology. So, after only 5 years' studies in France and Quebec, Romain now had his three university degrees.

intellectual standpoint, those were very enriching years that led on to my starting a research career – however, I had not inclination to spend too much time in a laboratory environment", adds our ever curious graduate. Over these two years 'in the field', Romain had built up a solid hands-on professional experience that now enabled him to seek managerial positions. He was appointed head of the area France, Belgium and French-speaking West Africa. This managerial function was an eye-opener for human resource aspects, which was something he appreciated a lot. Three years and one month later, late afternoon, he recalls that his boss proposed that he take on Business Development Middle East and South East Africa. He knew nothing about these places and his family was settled in France, but Romain decided to accept immediately. For this seasoned manager, knowing how to seize opportunism rapidly is an important asset if you want to succeed. "Never hesitate to plunge into new experiences when you are 24-25 years old" adds Romain, quoting the self-made English business magnate Richard Branson, "If you are offered a superb opportunity and you are not quite sure you can manage it, go ahead and accept and learn how to do the job later". Romain Fournials has been working in this region of the world for 9 years. At has been a choice that opened his vista and horizons. The economic dynamics of the Persian Gulf countries offer an ideal setting to quench his thirst for new challenges and business deals. "Here, things move faster and bear no comparison with the slow procedures underpinning calls to tender that we see in Europe – opportunities abound here and are realistic". Romain also observes how important human relationships are when

working with foreign partners. Even though his professional work is focused on cutting-edge imaging and laboratory diagnosis, quality contacts with others is primordial: "Often the deal is settled over a cup of tea". For those students attracted by this sort of experience, Romain Fournials advises that they first do a 6 month internship abroad, to get acclimatized..■

### Knowing how to set up and seize opportunities

With his formal academic training behind him, Romain Fournials went on to the job market in 2003, and was recruited by the German-American company Dade Behring, as a consultant to identify potential laboratory solutions for the company's customers. "From an

#### BIO EXPRESS

##### 2003-2008

Dade Behring: consultant then Health Solutions Manager for France, Belgium and Africa

##### 2008-aujourd'hui

Siemens Healthcare: Market Development Manager, Director then Vice President - Laboratory Diagnostics Middle East and South East Africa for Siemens Healthcare.



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