

**Economy  
finance  
& management**

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**Econ**

**Luxury,  
Arts & Culture**

**Arts**

**Risk, society  
& sécurité**

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**Education**

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**Modeling and  
experimental  
science**

**Science**

**New French Research  
University**

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**Law &  
Political science**

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**New French  
Research  
University**

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# New French Research University

Four higher-education establishments, University of Cergy-Pontoise (UCP), ESSEC Business School and the two engineering schools EISTI and ENSEA, aims to become a leading world-class university within 10 years with scientific ambition. Thanks to their labellisation as one of the 19 initiative d'excellence, the four establishments receive annual funds from the national agency of research to be an attractive place for the best international researchers and students, to contribute to the increase of innovation and of technology transfer towards companies and to play a key role in the transformation and in the modernisation of education.

Our goal is to reshape the academic environment in the Cergy-Pontoise area, which is situated to the west of Paris, and to offer

a whole new university model for the French education system. It aims to become an international research university that will figure in the top 200 world list within 10 years by training experts and managers able to tackle the global complexity of the 21st century.

This university will be structure around 6 graduate schools:

- Modeling sciences
- ESSEC business school
- Engineering science
- Humanities, heritage and creation
- Law and political science
- Education



## Six key research axes

Among the diversity of our research, six themes are particularly explored and are the fertile ground of our development:

- **Risk, Society and Security**

Model, evaluate and control extreme risks in fields as diverse as finance, health, food security, the environment, industry and terrorism.

- **Economy, Finance and Management**

Plan ahead for and accompany transformations in the economic, financial and managerial sectors in the context of an increasingly globalized economy and digital innovation.

- **Humanities, Arts and Heritage**

Create an ecosystem dedicated to the study and transmission of the art of French living and savoir-faire, focusing on the heritage, creation and luxury industry.

- **Modeling and Experimental Science**

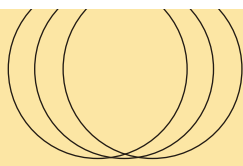
Rise to the environmental and health challenges of tomorrow by focusing on research in areas as different as decision sciences, artificial intelligence and big data.

- **Law and Political Science**

Study areas as diverse as possible that reflect today's changing and uncertain world – for example, geo-political science, elections, cybersecurity and cyber-defence.

- **Education**

Develop the educational systems of tomorrow, based on innovative teaching methods and new classroom architectures.



## Zoom on: Pôle judiciaire de la Gendarmerie nationale

(National Centre of Expertise dedicated to forensics and forensic intelligence)

Society is often unable to predict and cope with extreme risks. Being able to model and subsequently regulate risks (which can also include disease, environmental or industrial accidents) is now becoming an important area of research and our research is actively involved in this field.

Food safety research is an important topic for public health and one area we are focusing on is the use of static techniques to model the amount of specific food contaminants that could potentially be ingested over a short period of time by a population. Such analyses are not easy because of the dimensional aspect of the problem: a given contaminant may be found in a very large number of products at once. Such mathematical models, which take into account both spatial and temporal aspects, will allow us to better characterize populations at risk and so ultimately protect them in the future.

The PJGN is a centre of expertise dedicated to forensics and forensic intelligence. Since its moving to Cergy-Pontoise in 2015, the 550 researchers of this centre are working closely with our research teams combining the excellence of both institutions to prevent risks and ensure security.

Researchers have also developed a method based on extreme value theory (EVT) to detect so-called time clusters early on in a set of data. A time cluster is defined as the time interval in which the number of observed events is much higher than the expected number of events in a given geographical area. An “event” can be any type of health event, and the researchers have already successfully used their technique to detect time clusters from weekly counts of Salmonella isolates reported to the national surveillance system in France. Salmonella causes bacterial gastroenteritis and can sometimes be fatal.

Center of Research in Economics, Finance & Actuarial Sciences on Risk (CREAR)

Our Key partners: ATOS, SAGEM-SAFRAN, M2M, RATP, SANOFI, CERBA, Mérieux Nutrisciences, 2CSI, SYSLEY, L'OREAL, CLARINS, THALES, Allianz, ElipseLife, SwissReia

1 Centre for the Acceleration of Technology and Knowledge Transfer (CATTS) Risk, Society & Security in the Excellence Initiative

### Risk, Society and Security

# Can we avoid health risks



## Zoom on : Extreme Risks and Rare Events

Our research centre in Risk, Society and Security is designing statistical and econometric techniques to analyze and predict events. We are applying these methods to data from the financial markets, natural disasters, environmental risks and insurance, criminality, to name but a few.

We are studying risk-related topics such as extreme movements in financial markets, such as stock market crashes, and are applying extreme value theory (EVT) to these markets too, analyzing the statistical distribution of extreme returns, and how financial regulation affects market volatility. The results from this research can directly benefit financial institutions for when it comes to risk management.

Other analytical techniques include the use of Multilevel Monte Carlo methods to compute how likely it is for a company to default and how uncertainties (probabilistic or not) affect individual and public short- and long-term risk management decisions. This research can be applied to optimize environmental policies design, for example, and to make better insurance-related decisions when faced with standard as opposed to extreme risks.

Developing extensions of bootstrap, EVT and so-called ruin theory is also an important area, as is the use of survey sampling theory when dealing with big data. The idea here is to design appropriate survey sampling plans to efficiently estimate a characteristic of interest when the dataset being analyzed is too big to be exploited in its entirety.



There is no escaping; the digital revolution with digital technologies profoundly modifying our way of working, our design and production processes and our customer relations. Digital transformation is forcing businesses to look beyond conventional models and adapt to disruptive new technologies. A business' future success will of course depend on how good it is at exploiting these and capitalizing on the incredible possibilities they offer.

Our research team is an important actor in this revolution with researchers playing a key role in training the leaders of tomorrow's digital economy. They will be helping to answer questions like: "how will big data change financial trading?". Big data allows us to feed in more information than ever before into a system that requires detailed knowledge of all possible influencers. Analyzing this data will make it possible to trade in a more accurate and informed way and will dramatically affect how financial transactions are executed.



Other important topics being tackled include the evolution of mobile application markets and mobile payment systems. Major software companies such as Apple and Google are disturbing the status quo in these fields by imposing and enforcing their own rules. Developers, for whom the game has changed dramatically, thus now need to assess how these new trends will impact this market in the future and how they can exploit the trends to generate revenue. Mobile payment has seen a number of trials in recent years based on Near Field Communication (NFC), for example. Indeed, preliminary results are indicating that NFC might be an efficient and effective technology for mobile payment in the coming years.

#### Our Chairs:

Accenture Chair in Strategic Business Analytics, Chair of Networked Business Models, Chair on Digital Disruption, Communication and Brand Strategies / Sales and Marketing Strategy Chairs, ESSEC Media & Digital Chair, Chair in Philanthropy, Chair of Leadership and Diversity, Edgar Morin Chair on Complexity, ESSEC Change Management Chair, ESSEC Managerial Innovation and Operational Excellence Chair, ESSEC Amundi Chair in Asset I& Risk Management, ESSEC Finance Chair, Energy and Commodity Finance Research Center

**Our key partners :** Accenture, BNP Paribas, Philips, Carrefour, Danone, Orange, Société Générale, TF1, Aviva, Amundi, SAS, Talan Solutions, SOPRA STERIA

**1 Centre for the Acceleration of Technology and Knowledge Transfer (CATTs) Business, Finances, management in the Excellence Initiative**

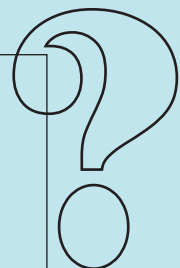
#### Economy, Finance & Management

# Will big data revolutionize the trading room

Other subjects covered in the economy, finance and management axis are Management & Society, Finance & Economy, Energy and Commodity Finance, Mathematical Research Applied to Finance, and Modelling Science.

The following emblematic research areas highlight this diversity:

- **Social responsibility:** businesses should balance profit-making activities with activities that benefit society. Social responsibility today plays a key role in a business's success and is important for employee, client and supplier relations.
- **Commodity markets and energy finance fields:** the development of state-of-the-art theories and techniques in the pricing and risk management of financial positions in banking and industry.
- **Finance and risk management:** researchers are focusing their efforts on new problems such as long-term portfolio strategies with stochastic interest and inflation rates, real estate, commodity markets and foreign investment.
- **Data:** researchers are making use of sophisticated tools to solve optimization problems for direct applications in telecommunications, design of data and distribution networks and bioinformatics.



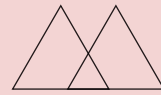
#### Zoom on : Four emerging research areas

## Zoom on: Berenson, the robot art critic

Another project being carried out by the Foundation for Cultural Heritage Sciences is the development of the famous Berenson robot, which can evaluate whether people in an art gallery or museum like or dislike a work of art, simply by observing their facial expressions thanks to a camera in one of its eyes. If they smile, this means they like the object being contemplated while a frown means they dislike it. This positive or negative data is recorded by Berenson and fed into a neural network simulator, allowing it to not only develop an overall impression of the art object but to memorize this impression too. Thanks to its neural networks, the robot learns to respond to the reactions of humans and imitate their behaviour, rather like a human toddler would.

One of the aims of the project is to discover whether Berenson can learn on its own in a developmental way. Another is to test how robots that start out with exactly the same neural networks acquire different preferences depending on the type of interactions with humans they have. The results from this work will help advance cognitive sciences by shedding more light on how human children learn to appreciate aesthetically pleasing objects or concepts.

Berenson is named after the famous American art critic Bernard Berenson, who like his robot counterpart wore a bowler hat.



**Luxury, Arts & Culture**

# Can we promote and value our heritage ?

Heritage is a direct link to the past and is intimately linked to a nation or culture's identity. It is valuable and unique and should thus be preserved and protected by all means. We also need to enhance our understanding of ancient objects and works of art thanks to innovative tools and state-of-the-art technologies.

Our research centre in Humanities, Arts and Heritage plays an important role in this context. It brings together research specialists from many disciplines, including the physico-chemical and life sciences, information sciences, humanities and social sciences.

Examples of our recent projects, undertaken by the Foundation for Cultural Heritage Sciences and directed by ETIS laboratory, include analyses of ink in the blacked-out sections of letters

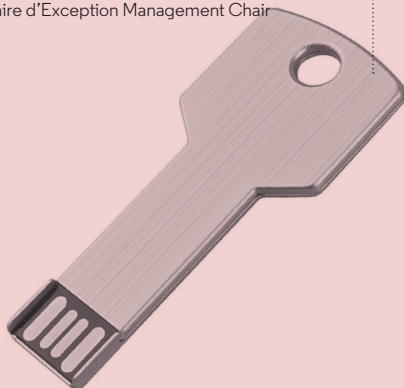
written by Queen Marie-Antoinette to her friend Count Axel de Fersen. These documents have been decoded thanks to X-ray and infrared spectroscopy imaging, revealing, once and for all, that the relationship between the two was indeed romantic and not simply platonic.

Another project involved constructing 3D models from digitized old floor plans of the Chateau de Versailles. They did this using a set of image-processing algorithms that help to detect and localize the main structures of the buildings from plans dating from the time of the Ancient Regime. A new partnership with the Chateau de Versailles aims, in particular, to further promote the savoir-faire et excellence à la française and the French luxury sector, which is a reference the world over, by developing new business models specific to this industry sector.

**Our Chairs:** ESSEC Center of Excellence in Luxury, Art & Culture, LVMH Chair, Savoir-Faire d'Exception Management Chair

**Our key partners:** LVMH, Chanel, Château de Versailles, Van cleef and Arpels, Chanel, National French Library, Clarins, Sisley

**1 Centre for the Acceleration of Technology and Knowledge Transfer (CATTS) Heritage, Luxury & Arts in the Excellence Initiative**



## Zoom on: Collaboration with Shaanxi province

Specialized in the study of cultural heritage, the Foundation for Cultural Heritage Sciences is worldwide recognized by its excellence. The Shaanxi province, in China, is collaborating with the foundation and is using our research strength to preserve and restore their heritage particularly thanks to our ability to analyze and restore materials.

Classroom design is changing and is going from a classic configuration with the teacher in front of blackboard and neatly ordered rows of desks to one that is more flexible and better adapted to digital technologies and other modern teaching tools. Here, teacher and pupils will be able move freely from one desk to another, and from one computer station to another as needed. The goal is to help encourage innovative teaching approaches that aim to improve learning.

Late 2016, researchers at the research centre in Education set up an international competition, called Archiscola, to allow students to put forward their vision of what the school of tomorrow should look like. The propositions came in last year and a new chair, the Transition2 chair, was created.

Researchers and architects are now working together to help redesign traditional classrooms so that new technologies like interactive screens and smart tablets can be used there on a daily basis and under the best conditions. Today's classrooms are not at all adapted to these technologies - for example, they might be too bright for an interactive screen to be seen properly, or the Wi-Fi signal might not be strong enough for an entire class of connected pupils.

In less than a year, Transition2 has already contributed to several projects in France: a primary school, two middle schools and a high school. The researchers and architects are now working on the design of an innovative digital-ready school that includes a "garden classroom".



# What will **Education** the classroom of the future look like ?

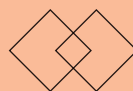
## Zoom on: The future of schooling and the effects of radical societal change

The research centre in Education is also actively involved in a number of other important initiatives in education. Researchers at the TechEduLab, for example, use innovative software to analyze the effect of new digital technologies on how both teachers teach and pupils learn. They are also looking at how the digital environment is affecting distance learning and how MOOCs can be used to a university's advantage. TechEduLab's new "Magazine de l'Education" describes all these advances and analyses and more.

One of the priority areas of study is to find out how the schooling system in general is being affected by contemporary social change - in particular by new teaching and learning methods and by society's changing relationship with norms, rules and institutions, and its relationship with knowledge and how we pass this on. Some of these changes may only be temporary but others might be more fundamental and could shake up the very foundations of schooling itself and profoundly change the way we teach young people in the future.

Some topics under study include: parenting and the role it plays in the education sector; the factors that influence how language is learnt at school; pupil health (including pupil emotion and suffering); French literature and language teaching and the tools employed; the history of teaching and how we have learnt from past failures; and authority in education and violence in the school environment.

# Can we personalize medicine



## Zoom on: Robots as diagnostic tools and the fight against serious wound infections

Experimental sciences are particularly well developed in by our researchers thanks to its 10 research laboratories focusing on several priority areas of the France Europe 2020 National Research Strategy, including, for example, health and well-being, and sustainable development.

Scientists are working on developing robots for better understanding autism, for instance, and say that artificial intelligence could be more efficient in diagnosing this disorder than humans. Robots are like newborn babies that know nothing about their environment and they learn by imitating those around them. In their experiments, the researchers studied how a robot behaved when it was made to interact with an adult, a child with autism and a child without autism. The found that the robot had much more difficulty with learning tasks when with children, and especially children with autism. The robot was also able to detect the micro-movements (or saccades) made by an autistic child compared to a healthy one, thanks the highly sensitive cameras in its eyes. The human eye is unable to detect these movements.

Another important research project focuses on developing efficient and painless treatments for serious wound infections, which are often caused by drug-resistant bacterial biofilms. One of these is an innovative gel-laden skin bandage or dressing that protects the wound from these biofilms and so allows it to heal. The researchers would ultimately like to see such dressings being produced in industrial quantities.

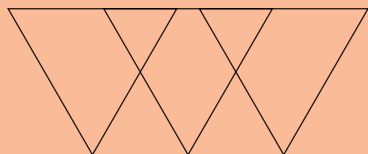
Personalized, or precision, medicine will replace the traditional and outdated “one size fits all” medical approach to one that will be safe, precise and tailored to each individual. Progress in this field is coming along in leaps and bounds and patients are already able to, for example, swallow a video-capsule the size of a normal drug capsule so that doctors can “see” inside his or her small intestine. And gone will be the days of bulky pacemakers as researchers develop next-generation devices containing miniaturized electronics that can be implanted directly in the right ventricle of the heart and be remotely controlled.

Our scientists are at the cutting edge of this research too. In colonoscopy, for instance, they are developing algorithms that allow gastroenterologists to more easily detect the polyps that

**Partnerships :** Testing logiciel Sogeti,  
Business Intelligence Talan Solutions et  
Sopra Steria, Business Analytics SAS, Cloud  
computing VMWarre, Capgemini ERP

can cause colorectal cancer. Other telemedicine applications include using sophisticated imaging techniques combined with EEGs and patient clinical data to treat diseases like epilepsy, cerebral haemorrhage and Creutzfeldt Jakob's.

They are also working on applications like wireless stents for stroke patients. Today, stents are normally detected using MRI, which is a complicated and costly imaging technique, but the new devices will emit a radiofrequency signal that will allow them to be detected much more easily. Another wireless system being developed is an implant that can monitor oxygen levels in bone marrow. This will be particularly useful for surgeons to determine the oxygen levels in the different parts of the spinal cord of patients suffering from trauma after an accident.



## Zoom on: Law and Criminal Sociology

Other topics in the Law and Political Sciences axis that our researchers are focusing on include European law and economics with topics as diverse as competition and securities law, international trade regulations, contracts and arbitration, intellectual property law and corporate governance.

The researchers are also at the forefront of research in jurisprudence, focusing on topics such as legal and political philosophy, the history of political and legal thought, and legal theory.

Criminal sociology is also an important subject, with a special laboratory, which is one of its kind in France, dedicated to this subject. Some of the topics studied here include: justice, criminal practices and policies (including how courts are organized and function, juvenile justice, sentence enforcement and re-offence, and financial and international justice); monitoring and technology (including national cybersecurity and cyberdefence strategies, the use of “covert” surveillance and CCTV - Closed-Circuit TeleVision, or CCTV -, and the controversial use of “sensitive” files); minorities and discrimination (including police checks on migrant populations, administrative and judicial control of immigration, and how the government deals with the discrimination of visible minorities).

Other priority topics include: economic law (the globalization of the world economy and how this is affecting labour laws and corporate rights); criminology (public law); and public and private international law.

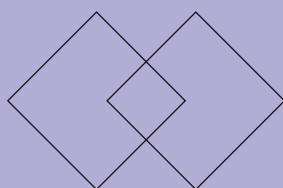
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Political and economic activities are becoming increasingly linked around the world so future governance systems will need to take this new reality into account. The behaviour of voters is also changing with public opinion being swayed more than ever before by information published on the social networks

These networks are becoming ever more important present and are in some cases the primary source of information for citizens now. Compared to traditional media, in which qualified and informed journalists choose which information to publish, the social networks are a free for all, with anyone being able to post any information they like. This means that all information is on an equal footing – regardless of its accuracy or legitimacy.

**Our key partners :** Danone, Total, Michelin, European Commission, Académie diplomatique internationale (ADI)



And that is not all: the algorithms on Facebook, for example, act as filters and people are recommended articles similar to those on which they have already clicked. So, someone who has shown an interest for the politician Mr X, for instance, will no longer receive articles that talk about Mr Y, which inevitably strengthens their belief in Mr X's ideas. Although these phenomena have always existed to an extent, they are being accentuated by social media, say the researchers.

They are also focusing on topics such as negotiation, participatory democracy, electoral behaviour, our relationship with politicians, abstention, the political sociology of precariousness, vote analyses methods, globalization, the history of political ideas and much more.



ESSEC Center of Excellence for  
Governance and International Dialogue,  
European Center for Law and Economic

#### UCP

- 11 000 undergraduate students, 9 000 graduate students
- 2 300 international students
- A multidisciplinary comprehensive university: science & technology, law, economics & management, human & social science • 24 research centres
- 3 schools: Political science, Technology, Education
- 1 Institute for Advanced Studies
- 6 technology platforms
- 3 foundations for research

#### ESSEC

- 5 867 students in full-time undergraduate and graduate programs, 34% of international students
- 5 000 managers in executive education • 50 000 graduates worldwide • Ranks among the top schools worldwide
- 3rd master in management in France, 5th worldwide according to the Financial Times ranking for its master in Management
- 162 permanent faculty of 36 nationalities, 21 corporate chairs and 7 centers of excellence • 4 campuses in Cergy, Paris-La Défense, Singapore and Rabat • 195 partner universities in 43 countries

#### EISTI

- 500 undergraduate students, 800 graduate students
- Graduate school of computer science and mathematics engineering

#### Master in Big Data

- Master in Quantitative Finance and Risk Management
- 2 campuses in France (Cergy/Pau)
- 5 Advanced Master degrees (Mastères Spécialisés) : Erp management/Risk management / Business Intelligence / Economic intelligence / Quality, Security, Environment
- 1st engineering school in France for the integration of the students to the labour market
- 6 Chairs (Sogeti, Capgemini, SAS, Talan Solutions, Sopra Steria, VMWare)

#### ENSEA

- Graduate school in Electrical Engineering and Computer Systems with 10 specializations
- 900 students enrolled, 250 masters of science in engineering delivered yearly, ratio of 9 students/professor
- 2 joint research center, 62 permanent academics and 95 PhD students : ETIS in Information Technology and Systems and QUARTZ in Control and Cyber Physical Systems
- 100% of graduates have a significant co-op work and an international experience
- 145 international partner universities in 38 countries, including 29 partnerships for double-graduation
- 5 national dual degrees : Paris Dauphine, Audencia, Grenoble Ecole de Management, Institut National Supérieur de Techniques Nucléaires, Research Master ISIM

# The Paris Seine Initiative and its strengths

## Zoom on: Some of the research partnership structures

#### - Institute for Advanced Studies

Created in 2007, the Institute for Advanced Studies (IAS) aims to foster collaboration between our researchers and the international scientific community in all research fields through, among other initiatives, its visiting scholarship and conference programmes. Every year, 60 visiting professors are invited by the IAS and the new International Research Centre (inaugurated in October 2016) provides office space for visitors, an auditorium and housing for visiting scholars.

#### - 6 Technology Platforms

FACLAB Open Lab for Public Exchange for Innovation

PEPTLAB International Research Platform on Peptides: Molecular, Diagnostics for Health Care, Well-Being and Environment

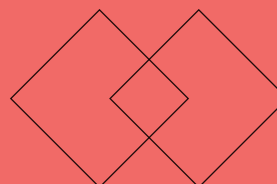
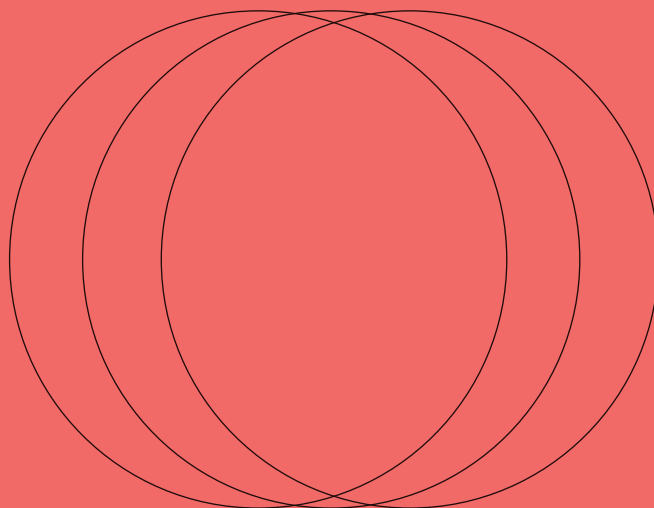
TECHEDULAB Interactive Centre for Studies in New Numerical Technology

LASERINNOV Characterization, conservation and restoration platform

COSMETOMICS@UCP Characterization, efficiency measurement and innocuousness of cosmetic products

MICROSCOPIE ET ANALYSE Structural or functional analysis of natural or synthetic materials





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