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EUROPEAN COOPERATION
IN SCIENCE & TECHNOLOGY

Impact
of networking

The impact of networking

Since 1971, COST has contributed to the European Research Area (ERA) by providing networking opportunities to researchers and innovators in order to strengthen Europe's capacity to address scientific, technological and societal challenges. It has three strategic priorities: promoting and spreading excellence, fostering interdisciplinary research for breakthrough science, and empowering and retaining young researchers and innovators. COST carries out its mission by funding bottom-up, excellence-driven, open and inclusive networks for peaceful purposes in all areas of science and technology.

COST is fully aware that measuring impact and articulating the value of the COST programme is more important than ever. Therefore, we are very pleased to present in this brochure an impact model that demonstrates the effect of networking through tools such as meetings, conferences, short-term scientific missions and training. This model is inspired by the Report of the independent High-Level Group on maximising the impact of EU Research & Innovation Programmes 'LAB – FAB – APP — Investing in the European future we want' of July 2017.[1]

Following our impact model, this brochure illustrates the positive change networking brings to the ERA. This is demonstrated by facts and figures and through the testimonials of our researchers and innovators. COST, at its heart, is about people. The large number of proposals and high participation rate in COST Actions show that researchers and innovators perceive a real need to team up and collaborate. Over 2 000 COST Action participants in leadership positions dedicate huge amounts of energy and time to volunteer for projects they believe in. They do this because they see significant individual benefits in serving their Action in a leadership role. Hence, when considering impact, we must also look at the beneficiaries themselves.

We hope you find plenty of inspiration from reading about how COST networking is driving forward the European science and technology community. After all, collaboration is not an option, it is a must.

1. http://ec.europa.eu/research/evaluations/pdf/archive/other_reports_studies_and_documents/hlg_2017_report.pdf

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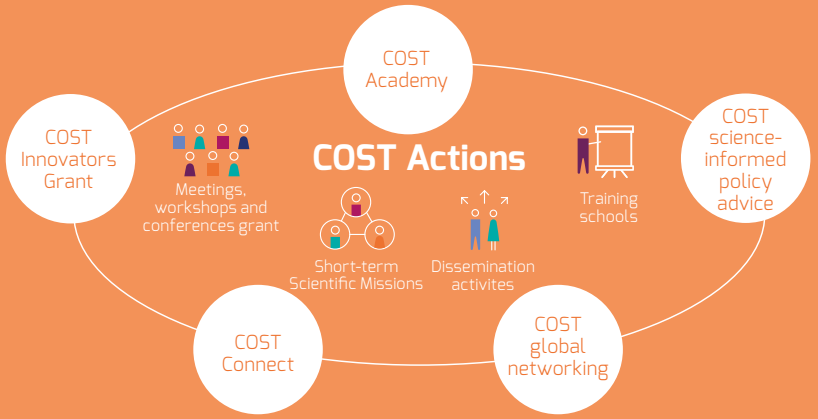
Activities	 p. 8			
Input	Ideas	Resources	People	

The COST approach to measuring impact

The COST Association measures impact according to five main components that are logically linked in its impact model: inputs, activities, outputs, outcomes and impacts. In planning its activities, COST places a high emphasis on potential results and impacts. The COST Strategic Plan defines clear targets and KPIs that feed into this impact model.

Impact model components

Inputs: people, ideas and resources

COST provides the resources to bring people together around an idea. For example, initially, a group of researchers can have an excellent idea that needs a collaborative effort to achieve it. Having received approval to start a COST Action, COST National Coordinators from the 39 country members of COST select the best researchers to work together in a network to achieve results based on this idea. The unique open framework of a COST network already incorporates two of COST's target impacts. One involves bringing people together, from all kinds of research backgrounds, who are not necessarily already in contact. The second impact concerns giving younger researchers and researchers from less-research-intensive countries the opportunity to join these networks, thereby contributing to capacity building in research and innovation.

Activities: networking

The DNA of a COST Action is networking. Every Action has access to several networking tools, including meetings, training schools, short-term scientific missions (STSMs), dissemination tools and conference grants. Moreover, the COST Association frequently hosts events (called COST Connect) in order to put different networks in contact with relevant stakeholders from policymaking, industry and society. These tools and events serve two main purposes: to kindle new forms of collaboration and coordination, and to give researchers additional skills in research and research management.

Outputs and outcomes: network effects

Innovation is often understood as the feat of engineering and product development. An innovator develops something which is launched on the market, adding value to both the economy and society. However, innovation starts with ideas (as clearly explained in the Harvard Innovation Value Chain). The first step, and probably the most crucial, is the generation of ideas. Many might well like the idea of Archimedes' 'Eureka!' moment but, in practice, new ideas are inspired by somebody else's ideas or work, emulating these to achieve societal benefits. In many cases, this emulation happens across disciplines: COST Actions are interdisciplinary by nature.

As a second step, a more established idea may have matured completely but may still lack a practical application; thus, converting ideas into practical applications is the next logical step. Finally, it might be that many people are working on an important idea at the same time, but a lack of common procedures, methods and/or standards impedes collaboration or co-creation. In this case, coordination and standardisation between practices and standards might be the next logical step.

In all three cases, a COST Action is an ideal platform to advance science and innovation. The Action starts with an idea, although such an idea does not have to be fully mature. The openness of a COST Action allows different parties with different perspectives on the idea to join in, creating a 'market place of ideas'. This intermingling enables researchers to choose the ideas that suit them best. Equally, a COST Action is open to all kinds of participants, including those from application-oriented research organisations, industrial partners and societal stakeholders.

As a concrete output indicator, COST targets the common drafting of proposals for intensified research cooperation between Action participants, for example for funding from Horizon 2020, other European funding schemes or for various national grants. It also targets the publishing of novel, interdisciplinary articles and publications co-authored by different Action participants, as a major effect of the intensified collaboration between participants.

At the level of mid-term outcomes, COST looks to Action participants concretely working together in multi-year research projects, which can lead to breakthrough science and technology. Furthermore, COST sees its networks as a fertile breeding ground for the coordination and ultimate adoption of common standards, procedures and methods for scientific work, and for scientific and technological applications, in the form of products and services.

Outputs and outcomes: capacity building

The second main effect of networking involves capacity building. Many existing European funding schemes for research and innovation, including Horizon 2020, tend to generate the so-called 'Matthew effect' whereby most of the funding goes to well-established researchers in major, prominent institutions in Western European countries. However, excellence might well only exert its biggest effect when it reaches as many researchers as possible, regardless of their position or occupation. Some ideas only have the greatest impact in a context that is economically, socially and geographically different from the place where they originate. This requires the effective participation of researchers from different parts of Europe, including those who are often left out of big European research efforts. Similarly, ideas may have a greater effect when they are taken up and reinterpreted by researchers from different generations, with different perspectives on the world and the challenges they face, and with different backgrounds and skill sets.

The COST framework is tailor-made to ensure that everyone gets a fair opportunity to participate, develop their skills and achieve a more prominent position within the network. Actions are encouraged to involve younger researchers and to give them positions of responsibility which will help them accrue useful leadership skills. Furthermore, COST ensures – by means of several baseline requirements and enabling efforts – that researchers from less-research-intensive countries participate in these networks and take up leadership positions. For example, the COST conference grant is exclusively designed to enable young researchers from less-research-intensive countries to visit leading conferences in their field, thereby establishing themselves in the research landscape.

As concrete output indicators, the COST Association targets the development of new research collaborations involving young and less-connected researchers, which can help their career development.

For mid-term outcomes, COST encourages the development of new research infrastructure (or improving existing infrastructure) which is intended to help tackle societal challenges.

Scientific and societal impact

The long-term impacts of COST Actions can be somewhat diffuse, since bottom-up networks often have divergent objectives. There is nothing wrong with this; in fact, COST celebrates this diversity in its networks and their objectives. Nevertheless, the COST Association aims, in general, to have two main types of impact:

- Scientific impacts: these are interdisciplinary collaborations leading to breakthrough science. In some cases, this might be a significant breakthrough achieved somewhere along the way. In other cases, it might be a concrete product or application developed from an idea; or, the consolidation of a research field, with different players reaching a common understanding and collaborations. For example, this could manifest itself in new research groups, projects, journals or conferences in the field. Finally, it could also be that the participants realise that an idea is no longer worth pursuing. In fact, the realisation that an idea should be discarded in favour of a new one can also make an important, although neglected, impact.
- Societal impacts: these bridge the innovation divide and participation gaps in the ERA. It is well known that not all regions are equally integrated in the ERA. Young researchers and researchers from less-research-intensive countries and regions can find it more difficult to join networks of excellence to fully develop their potential. Through the bottom-up, inclusive instrument of COST Actions, the COST Association aims to overcome these imbalances to achieve a flourishing and well-functioning ERA.

How do we measure impact?

The means of measuring impact are never self-evident, particularly for projects where many people are involved and where the results of this involvement centre around people reaching targets together. COST employs a 'measurement chain' logic in its impact model. On the level of outcomes, there are reliable ways of measurement, such as monitoring and Action reports. These focus mainly on the activities and direct outputs of Actions. On the level of mid-term results, there are measurement instruments like follow-up surveys, retrospective reporting and network analyses, which might not capture the full richness of the outcomes but can provide structured data on them. Finally, the identification of long-term impacts involves storytelling and pathway analysis which provide relatively unstructured but potential very rich information about the long-term effects of COST Action networking. The underlying philosophy is that a solid performance in lower parts of the chain will reinforce the higher parts of the chain.

COST Connect

"COST Connect is an excellent way of getting together in the same room all the links needed to transform new knowledge into positive societal challenges and speeding up the process. Being there allowed me to see that we, the scientists, can have a say in political decisions that can make the world better."

Antonio J. Meléndez Martínez
Lab. Colour and Quality of Food (Nutrition and Bromatology Section), Faculty of Pharmacy, University of Seville, Spain

"Through COST Connect I confronted my experience in developing an interdisciplinary, intersectoral community of experts with other colleagues having the same challenge in different contexts. It was amazing to realise that by simply connecting experiences you understand that we all are deeply connected by challenges, ideas and contexts."

Flaminio Squazzoni
Associate Professor of Economic Sociology, Department of Economics and Management, University of Brescia, Italy

"It was one of the most successful events I have attended in Brussels. It was very well organised and focused on the current challenges existing in the area of digital heritage documentation. I managed to network and brainstorm with key players on current digital heritage activities."

Marinos Ioannides
Electrical Engineering and Informatics, Digital Heritage Research Laboratory,
Cyprus University of Technology

COST Academy

“The COST leadership workshop motivated me to engage in a leadership position within my COST Action ENEC (European Network for Environmental Citizenship). To me, the role of working group leader is a golden opportunity to network and practise my leadership skills in a highly international context.”

Jelle Boeve-de Pauw, Postdoc Project Manager at the University of Antwerp Department of Training and Education Sciences, Belgium

“The science communication trainings are actually the only opportunity us scientists have to learn about scientific communication. This is an area that was neglected by our community for too long. I firmly believe that a good idea and its execution mean nothing without its proper communication. That is why I enjoy every second of these professionally prepared and thoroughly planned workshops. Moreover, I try to pass on the lessons learned to my peers and I have implemented many tips and tricks in my daily scientific communication routine thanks to COST Academy.”

Ana Rotter, Scientific Associate / National Institute of Biology / Marine Biology Station

COST science-informed policy advice

“The COST Action ‘Mining the European Anthroposphere’ examines current scientific knowledge on how to assess the availability of anthropogenic resources for future raw material markets. The UNECE Expert Group on Resource Management recognised the potential impact of the findings and fully integrated them into the UN Framework Classification for Resources. The outcomes leave traces in the sustainable management of resources in Europe and beyond. The network activities impressively show how science, industry and policy work together across disciplines to achieve the Sustainable Development Goals.”

Ulrich Kral
Research Assistant, Institute of Water Quality, Resources and Waste Management, Vienna University of Technology, Austria

Soraya Heuss-Aßbichler
Professor for Mineralogy and Petrology, Ludwig Maximilians University of Munich, Germany

Activities

Global networking

“I am a junior researcher who is establishing a line of research in the field of toxicology, so I started modifying and optimising a method known as the comet assay which measures DNA damage/repair; in my case, it resulted from exposure to environmental contaminants. I contacted Professor Andrew Collins who was the editor of the journal that accepted my study and chair of hCOMET Action. I wrote a motivation letter expressing my interest in the Action and got the approval of my institution, Jordan University of Science and Technology (JUST). Currently, I am an observer in the network and have joined two working groups. Since I joined the Action, I have received a number of invitations to attend conferences, meetings and training workshops with a generous refund of any incurred costs. I am overwhelmed by the support of our Action chair, JUST and COST. I belong to a large international science family which has crafted my expertise, because COST cancels out borders, nationalities, religious believes and gender differences.”

Shreen Nussair
Assistant Professor at Jordan University of Science and Technology - Faculty of Pharmacy, Department of Clinical Pharmacy

606

H2020, European and national common research proposals

(2017/2018)

3 761

Peer-reviewed co-created publications

(2017/2018)

New (interdisciplinary) research collaborations for researchers

“My story about COST Actions is the most positive story related to any international project or grant I have ever been involved in. The biggest part of it is the collaboration that was started with the help of the short-term scientific mission (STSM) scheme with Dr Peter Mooney. While I was attending a workshop in Como, Italy – also funded by the same Action mapping and the citizen sensor – I met Dr Mooney who suggested I should visit him in Ireland to talk over and start working on some of the research ideas we laid out in Como. I gratefully accepted his offer and we submitted the STSM proposal in autumn 2015. I eventually visited him in November 2015. During that time, we started research into OSM tagging patterns. The STSM report was just the first output. At that time, I was struggling with my PhD studies as I couldn't find a suitable theme for the thesis. The fruitful STSM visit impacted my PhD thesis. During 2016, we published three papers as a direct effect of the STSM visit. Two were short papers at the peer-reviewed conferences GISRUK 2016, Greenwich, UK and AGILE 2016, Helsinki, Finland and later that year we published a paper in the peer-reviewed ISPRS International Journal of Geo-Information (IJGI). This research success led to the University in Nis, Serbia accepting my PhD thesis proposal; Dr Mooney was a member of the thesis proposal commission. In 2017, we had another paper published in GISRUK 2017. In January 2018, I visited Dr Mooney in Ireland again to continue our research and we submitted another paper to AGILE 2018. I am continuing to work on my thesis with him and we have a lot of plans for the year ahead.”

Nikola Davidovic
Research and Teaching Assistant, Faculty of Electronic Engineering, University of Nis, Serbia

New research leadership skills and experience for less-connected researchers

> “I always say that I learnt more in these 3 years in COST than in 10 years of my career.”

Lara Pajewski
Professor of Electromagnetic Fields in Sapienza University of Rome, Department of Information Engineering, Electronics and Telecommunications

> “The leadership meeting helped me to get another view – which is not a hierarchical way – on how to connect people and motivate them to think and work together. It encouraged me to try to lead research activities even if I am not a classic ‘leader’.”

Brigitta Tóth
Senior soil scientist at Institute for Soil Sciences and Agricultural Chemistry, Centre for Agricultural Research, Hungarian Academy of Sciences, Hungary

215 Approved common projects on interdisciplinary research (2017/2018)

35% (2017/2018) Success rate of COST Actions spin-off proposals in H2020

> "It enabled me to get into the European research arena, to learn more about how European projects work and helped me during and after the COST Action to participate in other European projects such as FP7 and currently H2020."

Elias Kyriakides
Associate Professor and Vice-Chair, Dept. of Electrical and Computer Engineering; Associate Director for Research, KIOS Research and Innovation Center of Excellence
University of Cyprus

Coordination of standards

Powering up for the Internet of Things

For researcher Chiara Mariotti, being part of a network on developing wireless power transfer systems led to grants for international exchanges and recognition through the 2016 Women in Wireless Power Transfer Award.

Wireless power transfer (WPT) systems can remotely power up mobile devices or charge batteries in everyday household objects such as TV remote controllers, alarm sensors and smoke detectors, for example.

Such systems can contribute to the successful evolution of the Internet of Things (IoT), which involves the massive deployment of wireless sensors connecting a network of physical devices, vehicles, home appliances and other items embedded with electronics.

The focus of the COST Action 'Wireless Power Transmission for Sustainable Electronics' (WIPE) was on efficient WPT circuits, systems and strategies for battery-free systems.

Empowering women in science

Mariotti was a PhD candidate at the University of Perugia in Italy when the Action began and her research group participated. She says: "I was really excited by the fact that we were looking for very innovative solutions for the Internet of Things development by proposing unconventional materials for electronics and unconventional design approaches."

Mariotti's PhD research topic focused on the development and demonstration of additive manufacturing technologies for radio-frequency applications. Given the overlap with the focus of the COST Action, she was motivated to apply for a short-term scientific mission under the network.

"I got the grant to spend six weeks at Portugal's University of Aveiro, in October 2014," the 30-year-old explains. "Then, in 2015, I won another grant for a short-term scientific mission to spend two months at Georgia Institute of Technology in the USA. Moreover, I applied for the 'Women in Wireless Power Transfer' in 2016 and was the recipient of the grant. This meant I was funded to participate in the Wireless Power Transfer Conference in Aveiro in 2016." The Women in Wireless Power Transfer initiative was proposed by the COST Action to support young female researchers in emerging technology research fields.

In February 2016, Mariotti was awarded her PhD and is now working as a radio-frequency design and concept engineer at Infineon Technologies Austria in Villach. "Overall, the COST Action was a very positive experience, and an opportunity that definitely helped me in my career," she says.

Making connections

Professor Nuno Carvalho, Chair of the Action, is understandably upbeat about the team's achievements.

> "The Action has put Europe on the map – when we first started, most of the research was coming from Japan and the US," he says. "We focused on combining communications with wireless power transmission – now many groups across Europe are working on this."

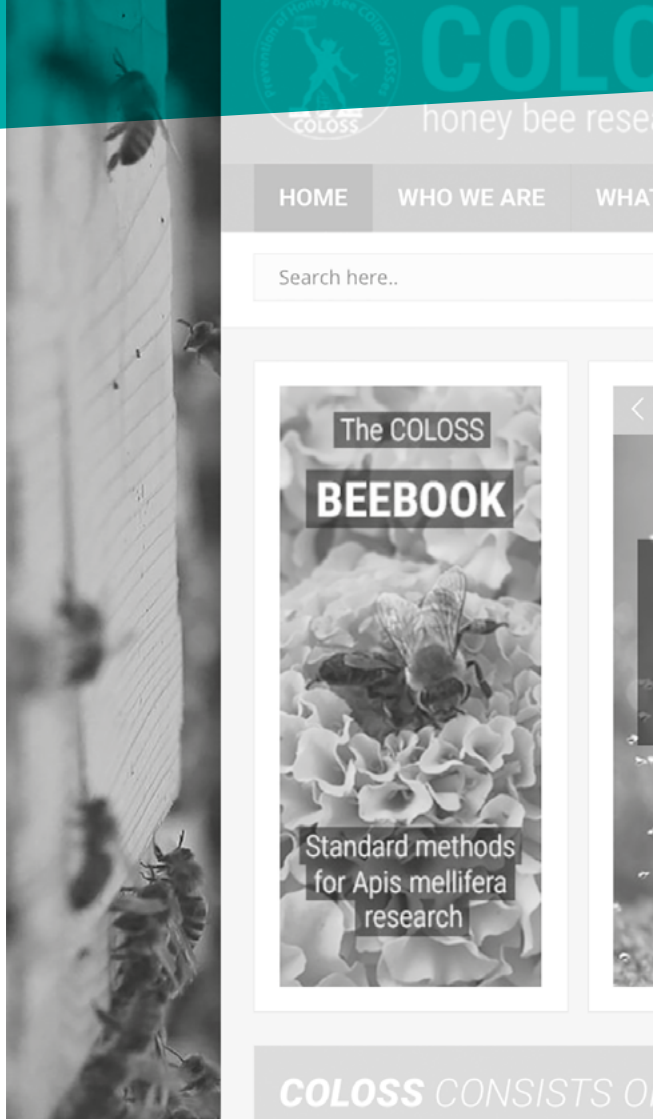
The Action also made an important contribution to regulatory standards. Carvalho explains that researchers participating in the Action teamed up with Japanese counterparts to prove the case for using a dedicated charging frequency of 5.8 GHz for WPT. This advice was taken on-board by the International Telecommunication Union, a UN agency for coordinating ICT issues globally.

For Carvalho, the most rewarding part is the networking opportunities that the network provided: "The best thing is the people – when we brainstorm with others who have different backgrounds and different points of view, we can create new ideas together."

He adds: "Here in Portugal, we estimate that we buy 20 million batteries every year just for TV remote controllers. Now imagine that you can recharge remotely – and get rid of the batteries."

New research infrastructure on societal challenges

COST Action COLOSS was instrumental in advancing research on honeybee colony loss. Its members came up with new standards for bee research and monitoring bee colonies all over the world. They also set up a database that scientists and other stakeholders could use to draw conclusions on honeybee losses globally. The network is now the global association for honeybee research – a network of over 1000 members from 96 countries worldwide.



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EVENTS | NEWS | JOBS | ARTICLES

15th COLOSS Conference 2019 * Sept. 07-08 * Canada

COLOSS Virus Task Force Meeting * March 05-06 * Germany

COLOSS B-RAP Workshop * February 6-7 * Sweden

COLOSS Monitoring Group Workshop * February 5-6 * Sweden

COLOSS Survivors Task Force Workshop * March 18-19 * Italy

F **1214** *MEMBERS FROM* **95** *COUNTRIES*

COLOSS Association

Career advancement for less-connected researchers

"I can say that I would not have come back to Europe if it weren't for COST. It showed me that I can create my career here and even get a better position than in the USA."

Andreja Kutnar
Associate Professor in the field wood science at University of Primorska, Koper, Slovenia

"COST is the best thing that happened to me during my PhD."

Barbara Zorec
Research and Teaching Assistant, Faculty of Pharmacy, University of Ljubljana, Slovenia

"All my career in academia has been in close ties with COST. I started my PhD through COST and I am working in academia thanks to COST."

Evgenii Vinogradov
Research Associate, Department of Electrical Engineering (ESAT), Leuven, Belgium


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Scientific impact

Europe pioneers in artificial intelligence hardware

A COST Action has created a major research community for a young technology that could underpin future artificial intelligence – memristors. The network has generated over 100 scientific breakthroughs as well as new projects, while fast-tracking opportunities for young researchers.

Collaboration in the COST Action 'Memristors - Devices, Models, Circuits, Systems and Applications' (MemoCiS) has led to innovations such as new algorithms, testing models and applications. Notable applications include a camera that processes images similarly to human vision, a sensor that detects early-stage prostate cancer from a blood test and a testing platform for a spin-off, ARC Instruments, that helps multinationals to develop memristor-based devices.

Over 160 participants from 24 countries in or near Europe joined forces to progress the technology in MemoCiS. "We have created the largest memristor research community in the world," says the Action Chair, Professor Julius Georgiou of the University of Cyprus.

"Memristors are a means to create low-cost, extremely compact information processors in hardware," Georgiou adds. Memristors store much more information than transistors – the established data-processing technology – and can self-organise like neurons in the brain. They could underpin innovations ranging from intelligent healthcare solutions to advanced electronic platforms that can be deployed in remote environments.

Participants in the Action have also strengthened the future of memristor research. They have secured Horizon 2020 funding for new projects – RAMP, SYNCH and NEURAM – founded the world's first international conference on memristive technology, and fostered dozens of emerging young scientists.

"The Action is an excellent opportunity for Europe to become the world leader in hardware for artificial intelligence," Georgiou acknowledges.

High-level showcase

One young researcher, Ioulia Tzouvadaki, achieved a string of successes through the network, which she joined while doing her PhD.

During a MemoCiS research placement, she developed the prostate cancer sensor. "This is less painful than current tests and detects the cancer biomarkers at the most treatable stages," she says.

Collaboration with other MemoCiS participants encouraged Tzouvadaki both to go to Stanford University, USA as a postdoctorate fellow in 2018 and to successfully apply for a Marie Skłodowska-Curie postdoctoral fellowship at Southampton University in the United Kingdom, working with Professor Themis Prodromakis from February 2019.

"The Action inspired me to think big," she says. "I went to Stanford to replicate the high-level experience. Its good dynamic and the opportunity to meet Themis and a team with common interests also led to my Marie Skłodowska-Curie application."

At Southampton, Tzouvadaki will translate research into commercial applications with Professor Prodromakis, who is leading research on metal-oxide memristors and applications. His group is a partner in RAMP and SYNCH and has secured major national grants, while ARC Instruments is his initiative.

"MemoCiS was about sharing know-how and experience," he says. "The community has grown massively and showcased European expertise."

> "The Action is an excellent opportunity for Europe to become the world leader in hardware for artificial intelligence."
>
> Dr Julius Georgiou
> Professor, Department of Electrical and Computer Engineering, University of Cyprus
> PhD Micropower Electronics for Neural Prosthetics
> MEng Electrical and Electronics Engineering

Societal impact

The first reference for sign language grammar writing empowers signers all over the world

Researchers from 15 countries worldwide started from a crucial issue: the absence of comprehensive, state-of-the-art grammars takes its toll on sign language learning, training and interpreting. Most signers are born to hearing parents, who, in turn, ideally have to learn sign languages in order to communicate with their children.

Unlike spoken languages, sign languages can only be learnt through face-to-face interaction, given the generalised lack of learning material.

> “The Action was our starting point for something bigger – we wanted to actually produce grammars.”
>
> Prof. Josep Quer

Acknowledging sign languages

Despite the importance of formal training, sign language grammars remain a widely unknown territory. Most sign languages are not even formally recognised as languages, although virtually every country in the world has a sign language of its own or even a variety of them.

Studies on sign language grammars have been scattered and only date back to the 1960s, which is why little is known about how such languages emerge and evolve.

The network, led by Prof. Josep Quer (Universitat Pompeu Fabra) and Prof. Carlo Cecchetto (University of Milan-Bicocca/CNRS), includes researchers from 15 countries worldwide. They developed the SignGram Blueprint– the first-ever tool to study sign language grammars as a whole.

It takes the form of a multimedia handbook and works as a standard for both linguists and non-specialists interested in writing up a grammar.

The Blueprint includes a checklist of topics or building blocks that need to be addressed when writing up a grammar. Each building block comes with explanations, methodological tips and examples from sign languages, as well as bibliographical support. The handbook will be available free of charge by the end of the year.

The guide will also help linguists understand, monitor and document how sign languages evolve. Differences in the way young and elderly signers use sign language can be staggering, which is also due to the absence of a standard way of teaching sign language grammars. This is why sign languages are endangered, Prof. Cecchetto explained.

A network for a bigger purpose

The network will take the SignGram Blueprint one step further through their Horizon 2020-funded collaborative research project SIGN-HUB, which will see them develop actual grammars using innovative software developed from the handbook.

Studying sign languages is like entering a parallel universe. It's so gratifying because you can easily see the direct link between basic research and its results in real life. We have developed a real blueprint, which will contribute to a standard for teaching sign languages to signers and interpreters alike, or to sign language assessment in different domains, Prof Quer commented.

The project will also be creating assessment tools to identify language difficulties in signers who have suffered brain damage, have developed dementia or were born with language impairments. The Horizon 2020 project also holds an educational and cultural purpose, as it plans to uncover new facets of historical events such as Shoah, World War II or the Spanish Civil War by looking into elderly signers' experiences.

Language normally evolves through sound, so we are somewhat biased to see language through that lens. We want to explore how these silent communities experienced such defining events in our history, Prof Cecchetto added.

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