Scientia

SHAPING A BETTER WORLD THROUGH SOCIAL SCIENCE AND HUMANITIES RESEARCH

HIGHLIGHTS:

- Using Dreams to Depict the Nightmare of the Holocaust
- Multilingualism – A Barrier or a Blessing?
- Race & Wellbeing in the US: The Psychological Toll of a Broken System
- rETHICS: Research Ethics Training for Health in Indigenous Communities

EXCLUSIVES:

- The American Historical Association
- The Linguistic Society of America

Issue: #126

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WELCOME...

In this captivating edition of Scientia, we showcase a diverse selection of research achievements across the humanities and social sciences, from history to linguistics, and from economics to sociology.

In the first section of this edition, we take a journey through time, featuring highlights in the field of historical research. We open this section with an enthralling interview with Dr James Grossman, Executive Director of the American Historical Association, who discusses the critical role of historical thinking in public life. Next, we meet several impressive researchers who work to illuminate and understand different aspects of our history, from the evolution of scientific thought in ancient Greece and Rome, to socially inclusive educational systems in Soviet Russia. Our final article in this section investigates how computational linguistics can accelerate historical research.

This leads us to our second section, where we explore the fascinating world of linguistics. Here, we feature an exclusive interview with Professor Penelope Eckert, President of the Linguistic Society of America, who describes the ways in which this leading organisation supports linguistics research and highlights its societal value. From here, we showcase a number of exciting research endeavours, from using mathematics to drastically improve speech recognition technology, to investigating the challenges and wonders of multilingualism.

In the next section, we introduce several social scientists who are pushing the frontiers of our knowledge in the fields of economics and politics. By confronting the challenges of our time and developing mechanisms to bring about change, their goal is to improve how our economies, institutions and societies function.

Our final section in the edition is dedicated to achieving health equity. Here, we highlight research that strives to close population gaps in healthcare, through understanding and addressing the barriers that under-served communities face when seeking medical care. Through culturally sensitive provider training and accessible screening programs, the research teams in this section are working towards creating a fairer world.

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Meet The Team...

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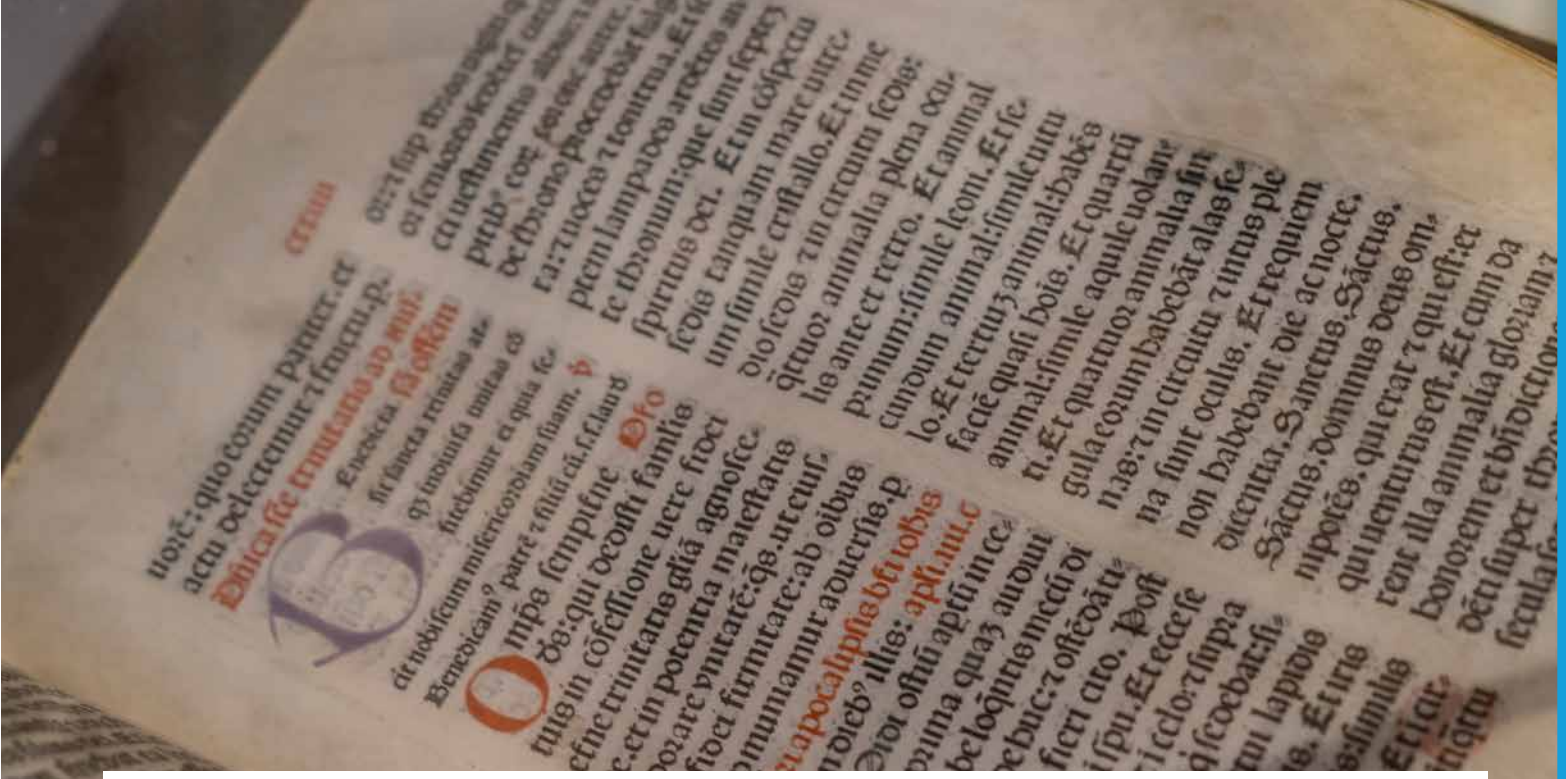


UNDERSTANDING HUMAN SOCIETY AND BEHAVIOUR THROUGH HISTORICAL RESEARCH

To open this diverse and fascinating edition of Scientia, our first section explores several revelations in the academic field of history. Conducting historical research is of critical importance, as understanding the past allows us to better understand the present, whilst also offering us a means of predicting what might happen the future.

A rigorous understanding of the mistakes that humans have made throughout history also allows us to notice similar patterns and warning signs, to avoid making the same poor choices again. Likewise, investigating events that have had positive outcomes, such as successful social movements, policies and educational programs, can allow us to more effectively facilitate positive change in the future.

To open our section on historical research, we have had the pleasure of speaking with Dr James Grossman, Executive Director of the American Historical Association (AHA). As the largest organisation of professional historians in the world, the AHA boasts more than 12,000 members and serves historians studying all periods in global history. In our exclusive interview, Dr Grossman discusses the Association's work on behalf of the entire discipline and the critical role that historical thinking plays in public life.

In the next article of this section, we meet a team of young researchers at Humboldt University Berlin who explore the fascinating world of ancient philosophy, and how it relates to the origins of scientific thinking. Here, we discuss the team's varied research projects into models of knowledge in the ancient Greek, Roman and Arabic worlds.

We then travel forward in time to the Renaissance – the period in European history from the 14th to the 17th centuries, which marked the transition from the Middle Ages to modernity. In Florence, Italy, the Renaissance was a time of unprecedented innovation in science, politics and culture, but the factors driving such advancement are often debated. In this section, we meet historian Dr John F. Padgett and his colleagues at the University of Chicago, who analyse social connections to illuminate how borrowing tactics from seemingly unrelated social phenomena converged to facilitate revolutionary change across Florence.

From the Florentine Renaissance, we again skip forward several hundred years to the first half of the 20th century. During this period, GDP was low in Europe, but Europeans became healthier, lived longer and gained

more leisure time, while inequality declined. To understand changes in the economy and human health that took place during this time, Dr Daniel Gallardo Albarrán from the University of Wageningen and Dr Herman de Jong from the University of Groningen used a comprehensive framework analysis addressing many aspects of human development. In this section, we explore how their findings could help to shift the primary focus of governments from increasing GDP to developing policies that address a broader range of economic and health-related issues, such as work-week reduction and reducing inequality.

On the topic of decreasing inequality in the 20th century, our next article introduces the Soviet Russian Workers' Faculty – an institution founded to educate the working-class population for a more egalitarian society. Here, we showcase the research of Dr Ingrid Miethe of the University of Gießen in Germany, who studies the spread of Workers' Faculties across the globe. She also explores how these faculties have played into educational exchanges between socialist nations and how they developed in the context of unique cultures and varying global influences.

Of course, there are also many negative aspects to 20th century history, including the widespread genocide that occurred under the Nazi tyranny in Europe during the 1940s. In the next article of this section, we showcase the research of Dr Christiane Solte-Gresser from Saarland University, who interprets Holocaust literature about dreams to help tell the story of the six million people who were murdered during this time.

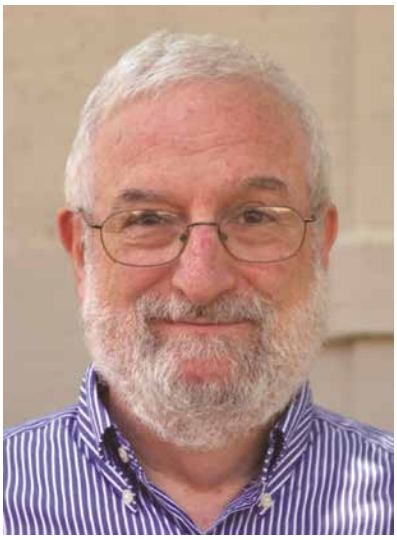
Professional historians, such as those discussed above, must trawl through countless primary sources for each study they

conduct. Until recently, such historical documents were housed exclusively in archives and libraries, meaning that historians would need to travel to read them. However, in recent years, increasing numbers of historical documents are becoming digitised so that historians can now access many online. Furthermore, increasingly-advanced software now has the capability to accurately interpret text in these ancient documents, allowing researchers to search for specific information more efficiently than ever before.

At the forefront of this technology is Dr Klaus Schulz, Dr Florian Fink and their colleagues at Ludwig-Maximilians-Universität in Munich. In the final article of this section, we introduce the team's intelligent software, which performs 'post-correction' on digitised historical documents to fix any errors created by the digitisation process. The team's new software allows historians to conduct their research with far greater ease and efficiency than ever before.

THE AMERICAN HISTORICAL ASSOCIATION

As the largest organisation of professional historians in the world, the American Historical Association (AHA) represents more than 12,000 members and serves historians representing every period in global history. The AHA promotes the study of history in myriad ways, including providing leadership, fostering collaboration, awarding distinguished work, facilitating innovative teaching, and disseminating research. In this exclusive interview, we have had the pleasure of speaking with **Dr James Grossman**, Executive Director of the AHA, who discusses the Association's work on behalf of the entire discipline and the critical role of historical thinking in public life.



When and why was the AHA first established?

The AHA was established in 1884 and chartered by Congress five years later for the promotion of historical studies, the collection and preservation of historical manuscripts, and for kindred purposes in the interest of American history, and of history in America.

These purposes included bringing together diverse constituencies – including professors, archivists, members of state and local historical societies, and amateur historians – to support one another's work in part by discussing issues of common interest, which were usually research related.

What are the Association's aims and vision today?

The AHA promotes historical thinking and historical work in a wide variety of venues, from classrooms at different levels to national parks, museums, digital spaces, and any other place where people engage the past or historical thinking can add value.

‘The AHA promotes historical thinking and historical work in a wide variety of venues, from classrooms at different levels to national parks, museums, digital spaces, and any other place where people engage the past or historical thinking can add value.’

The Association convenes communities of historians to inform one another’s professional practice, and establishes standards of ethics and professional practices for people doing historical work. It also advocates on behalf of historians and the importance of history itself across a wide landscape of public culture and policy.

The AHA is a trusted voice for history education and works to develop standards for good practice in teaching. How do you achieve this?

The AHA does not take a position on what ‘best teaching practices’ are. It’s likely that different pedagogical approaches are more effective than others in different environments. It’s one thing to teach history in a middle-school classroom and another in a graduate seminar. Consider the differences between teaching history in a national park and in a Congressional briefing. Do different aspects of history call for different pedagogical strategies?

What we do emphasise is that teaching begins with thinking about learning. Anyone trying to teach history has to consider the desired learning outcomes, and the learning cultures of the audience at hand. Classroom teachers need to think about assignments as central to the learning process, rather than as mere assessments.
Our role is not to tell people how to teach. It is to create spaces for historians to think and talk about teaching, and to promote the value of history education in a wide variety of venues.

Why is history education important, and why is historical thinking so critical in modern life?

History students sift through substantial amounts of information, organise it, and make sense of it. In the process they learn how to infer what drives and motivates human behaviour from elections to social movements to board rooms. They learn how change happens, how institutions and individuals interact to shape both continuity and change.

Everything has a history. To think historically is to recognise that all problems, all situations and all institutions exist in contexts that must be understood before informed decisions can be made. No entity – corporate, government, non-profit – can afford not to have a historian at the table.

Think also about the ways in which policy makers, politicians, advertisers, and others invoke history to legitimate policies, products and ideas. All Americans need the tools to identify and evaluate implicit and explicit historical claims and statements. For example, 'Make America Great Again' is a historical statement. It implies a time in the past. It implies an interpretation of what life was like at that time for some identifiable group of people. Consider the frontier and American Indian iconography that adorns so many products and sports teams. Why do these particular images attribute value or cultural meaning? Because historical symbols, artefacts, arguments, etcetera, are all around us it's imperative for people to do the historical thinking required to understand the work that is being done by these evocations of the past.

The AHA promotes the value of historical thinking through a variety of print and digital publications, a very active social media presence, briefings for Congressional staff, contributions to and interviews with media from across the country, and our engagement with historians as teachers in diverse venues.

The AHA facilitates collaboration between historians from various different specialisations – please describe some of the ways in which you achieve this.

Our annual meeting, with its attendance of 3500–5000 people, is the largest annual gathering of professional historians in the world. Our program committee looks for sessions that entail conversations among historians of diverse perspectives. We look for panels that organise conversations among historians who ask similar questions but look at different times and places; or who look at similar phenomena but ask different questions. We have organised grant funded initiatives that focus less on a particular topic than a particular professional issue, hence bringing together people who teach and study different times and places.

How do you fund history research and reward outstanding achievement in the field?

The AHA awards 31 prizes for specific achievements and eight more for accomplishment over an extended period of time. The Association also awards various research grants, fellowships and travel grants to its annual meeting.

Finally, the AHA recently hosted the landmark conference 'The Future of the African American Past'. Please explain the significance of this conference, and what the main outcomes were. How will these outcomes influence the future of the study of African American history?

'The Future of the African American Past' was a major aspect of the opening of the National Museum of African American History and Culture. The collaboration between a new Smithsonian Museum and the world's largest professional association of historians pointed to the interwoven nature of historical scholarship that takes place in various venues: research universities, museums, historic houses, and other types of institutions represented on the program. The very collaboration on an international conference with such a broad intellectual scope called attention to the new Museum's commitment to scholarship and the AHA's commitment to public culture.

The content of the conference, available to the public as edited (and therefore digestible) video, both reflected on the last two generations of scholarship in African American history, and sketched a variety of pathways forward. The substantial public attendance at this essentially academic conference was quite striking, and attendees walked away with a good sense of the field of African American history and how scholarship in that field establishes the basis for the work of this new museum.

www.historians.org

AMERICAN HISTORICAL ASSOCIATION

PHILOSOPHY AND SCIENCE MEET AT HUMBOLDT UNIVERSITY BERLIN

A new program at Humboldt University Berlin encourages academic discussion about Greek, Roman and Arabic models of knowledge and the intersection of philosophy and science. Georgia-Maria (Giouli) Korobili, Benjamin Wilck, Gonzalo Gamarra Jordan and Juliane Küppers are some of the brilliant doctoral students taking part in the program, which was officially established in October 2014.

Philosophy and Science today are two very distinct academic disciplines, but they are founded upon a set of the same fundamental ideas developed in ancient Greece, Rome and later in the Arabic world. In fact, many established scientific theories were developed from philosophical principles introduced by philosophers from the most prominent ancient civilisations. Examples include the concept of mind and body duality, or theories on the force of attraction between atoms.

Academic settings that encourage multi-disciplinary research and discussion are still somewhat rare, but can be extremely valuable: they can help to expand our knowledge and understanding of fundamental ideas, by encouraging scholars to consider new perspectives that link notions from different disciplines together.

The Philosophy, Science and the Sciences doctoral program at Humboldt University does exactly this – bringing together philosophers, classicists, Arabists and science historians to discuss their research in different disciplines, and prompting them to develop new perspectives on how these might be connected. Scholars in the program contribute to the current understanding of the relationship between scientific concepts and philosophical ideas developed in the Roman, Greek and Arab worlds.

The trainee research group is encouraged to explore the connections or differences between different philosophical and scientific theories of the past. This is done through sharing ideas and discussing possible interactions between different methods for finding knowledge, as well as between different disciplinary fields (e.g. philosophy, mathematics, medicine, astronomy, etc.) or ideas developed in different cultural contexts (e.g. Greek, Roman, Arabic). For instance, ideas in astronomy could be analysed in relation to the philosophical notions of the ancient philosopher Aristotle, who was correct to argue that the Earth was spherical, while his theory that everything in the Universe revolved around Earth turned out to be false.

There are numerous possible subjects to explore, as many of the scientific disciplines we know today were developed in times of vital occupation with ancient philosophical principles and spirited debates on how to apply and advance them, such as during the height of Arabic philosophy or in the early modern European period.

The doctoral program, led by Professors Jonathan Beere and Philip van der Eijk, started in October 2014 and is funded by Deutsche Forschungsgemeinschaft (DFG). Teaching staff includes professors at Humboldt University and the Free University Berlin, as well as distinguished international scholars who travel to Berlin. New doctoral students are accepted into the program every year and from October 2017, additional funding by the German Academic Exchange Service and the Einstein Foundation will offer further scholarships for the course. The program is integrated within the Berlin Graduate School of Ancient Studies (BerGSAS).

Those who become part of the training group are automatically part of an international network of partner universities, where doctoral students can spend a semester abroad. These include the Classics and Philosophy departments at Princeton, Harvard, McGill University, New York University, the University of Chicago, Leuven and Cambridge. Conversely, students from partner universities can take part in the activities in Berlin and attend a broad variety of courses, reading groups, tutorials, workshops or short courses, all of which are taught in English. Dissertations are written in both German and English, covering a wide range of philosophical or philological topics. Every doctoral project focuses on a specific area of dialogue between philosophy and the sciences and students are encouraged to communicate with their teachers and each other in order to situate their work within a larger framework.

CREDIT: Christoph Geiger

Giouli Korobili, Benjamin Wilck, Gonzalo Gamarra Jordan and Juliane Küppers are four students who are currently taking part in the program. Their dissertation projects explore different aspects of philosophy and science, ranging from ancient Greek philosophical strategies for refuting or establishing mathematical principles to early modern theories on particle physics.

The Charité building, CREDIT: Uta Kornmeier

Giouli Korobili: Aristotle's Work on Youth, Old Age and Death

Giouli Korobili's research project explores the ideas discussed by Aristotle in the last part of the *Parva Naturalia*, entitled *On Youth and Old Age, on Life and Death, on Respiration.* Her thesis aims to provide a new English translation and commentary of these texts, while also critically analysing the issues discussed within them and identifying potential medical and earlier philosophical influences on Aristotle's thought.

A considerable number of scholars have previously questioned the unity of the work, putting forward the claim that the first six chapters so clearly comprise a self-contained piece of work (i.e. *On Youth and Old Age, on Life and Death)* that they must be treated as separate or in isolation from the remaining 21 chapters (i.e. *On Respiration*). In her doctoral research, Korobili argues the opposite, which is that chapters 1–6 pave the way for the rest of the work in that they seek to establish the basic principle that runs throughout the whole treatise, namely, that the soul lies in the heart, in the middle of the body (cardiocentrism).

She argues that the whole treatise comprises 27 chapters, in which Aristotle places particular emphasis on the localisation of the soul within the living body, the critical factors ensuring life, and the importance of the processes of nutrition and respiration, as well as on such topics as the proper way of pursuing inquiry in natural science or the boundaries between natural philosophy and medicine. In the analysis section of her thesis, Korobili seeks to establish the relevance of the ideas put forth in these texts to earlier and contemporary biological and medical theories, such as those constructed by Presocratic philosophers, Plato and Hippocratic writers.

While working on her doctorate, Korobili was offered the opportunity to become part of an outreach project visualising ancient Greek medical and philosophical ideas about body, soul, and their interaction. The aim of the project, directed by Professors Philip van der Eijk and Thomas Schnalke, was to hold an exhibition open to the public in the Berlin Medical History Museum of the Charité (Berlin's Medical School) in the central room housing the 19th century physician and pathologist Rudolf Virchow's specimen collection. The exhibition was entitled 'The Soul is an Octopus. Ancient Ideas of Life and the Body' and was accompanied by an illustrated catalogue (to which Korobili contributed) guiding the audience through the fascinating world of ancient anatomy, physiology and medicine.

As part of her work within the program, Korobili and Dr Roberto Lo Presti organised an international conference 'Nutrition and the Nutritive Soul in Aristotle and Aristotelianism' at Humboldt University Berlin. The 3-day conference brought together established scholars and graduate students working on philosophy and science from antiquity until early modern times, exploring the way in which the most basic type of soul operates in the body. The proceedings of this conference are to be published by De Gruyter in the series 'Topics in ancient philosophy'.

Juliane Küppers: Ancient Atomic Theories and the Development of Particle Physics During the Early Enlightenment

Juliane Küppers recently began her third doctoral semester and is working on a research project analysing 17th century works published in Latin that discuss particle physics and atomic theories.

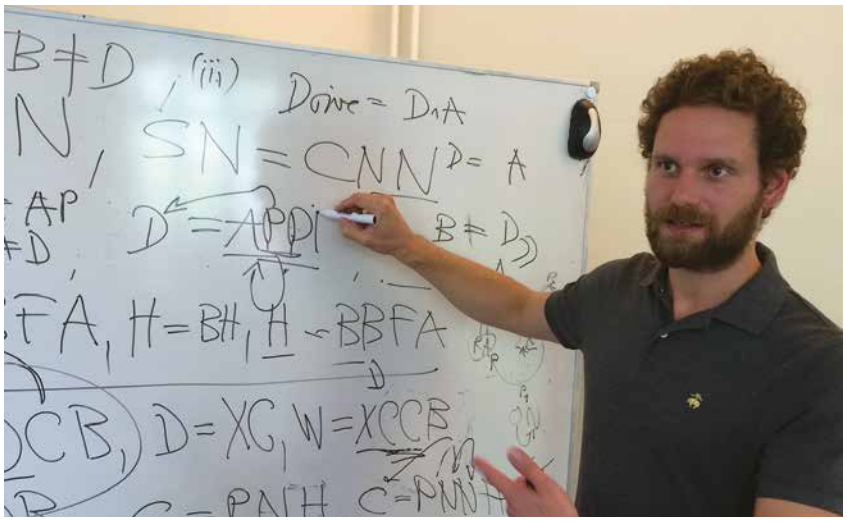
In particular, she will focus on the writings of the French philosopher Pierre Gassendi, mainly his *Philosophiae Epicuri Syntagma* and his *Syntagma philosophicum*, who – in a time when the idea of atoms as the indivisible 'building blocks' of matter was not widely accepted – advanced ancient atomic theories and refined them. In particular, his concept of atoms banding together through constant movement, basically tiny vibrations, to form matter was an influential notion that would be adapted into later theories on the force of attraction. However, most of his writings have not yet been translated or systematically commented on, and Küppers believes that further analysis of his views would prove to be a valuable contribution to the field.

In her work, Küppers will also show where certain atomist theories originated and refer back to the extant fragments from the writings of the hellenistic philosopher Epicurus and the 1st century BC poem *De rerum natura* by the Roman Lucretius. These texts outline basic ideas about the fundamental elements of matter, proposing that atoms are the particles that make up all things in the Universe.

Küppers is currently spending the autumn term 2017 as a Visiting Fellow at the Harvard GSAS Department of the Classics. At Harvard, she plans to explore a number of aspects of her project, including computational methods of analysing natural philosophical and scientific treatises.

'With my dissertation, I hope to not only add to the reception history of Lucretius' *De rerum natura* in my original field of study. I also want to contribute to interdisciplinary research on physics during the early Enlightenment with the expertise of a Classical Philologist,' she explains.

The Flammarion Engraving



Benjamin Wilck: Philosophical Strategies to Prove or Disprove Mathematical Principles

Benjamin Wilck's research project examines ancient Greek philosophical methods as ways to prove or disprove mathematical principles. He looks in particular at Aristotelian dialectic. 'This dialectical method is an ability, rather than a theory – it provides general, topic-neutral, logical means to put a given scientific principle to the test,' he says. 'Since the dialectician must not be committed to any specific scientific or philosophical beliefs, no scientific knowledge is required in applying such dialectical tests.'

Wilck's doctoral research aims to shed light on the extent to which Aristotelian dialectic is applicable to the actual scientific practice. 'The principles of a science cannot themselves be established or refuted by means of a scientific proof,' explains Wilck. 'Rather, a different method is needed, and finding such a method has occupied philosophers since Plato and Aristotle.' His research focuses on the question whether or not philosophical dialectic manages to undermine the rigorous proofs of Euclid's Elements. 'Currently, I am working out an axiomatic reconstruction of Euclid's number theory to show how precisely Euclid makes use of his definitions of odd and even in mathematical proof,' says Wilck. 'For, these are among the definitions that Aristotle dialectically refutes.' This will be the core of his doctoral dissertation, which will explore the scope and limits of Aristotelian dialectic concerning mathematical practice.

Wilck aims to complete his doctoral research in April 2018. After that, he plans to publish further research on related topics, including a paper on the ancient sceptic Sextus Empiricus, which will examine the question of the applicability of philosophical scepticism to scientific principles.

Gonzalo Gamarra Jordan: The contest between Aristotle and Syrianus on Plato's Ideas

Gonzalo Gamarra Jordan's doctoral dissertation is at the centre of an important conflict between the Aristotelians and the Platonists of antiquity regarding mathematical objects. 'In the last two books of his *Metaphysics*, Aristotle presents a series of criticisms of important Platonic ideas,' explains Gamarra Jordan. 'These include the Platonic Forms and the intermediate ontological status of mathematical objects, and the idea that these underlie and structure the whole Universe, that is to say, that they are the principles of all things.'

The main text of Gamarra Jordan's research is the *Commentary on Metaphysics M & N* by Syrianus, a Neo-Platonist philosopher who was head of the Athenian Platonic Academy during the 5th century CE. 'Part of my interest in Syrianus lies in the fact that he was the first philosopher to explicitly tackle Aristotle's criticisms head-on,' says Gamarra Jordan. 'Another reason is that, in the act of defending Platonism, Syrianus presents sophisticated accounts and arguments for the Platonic ideas in question.'

'In the dialogue between Aristotle and Syrianus, one of the prominent issues at stake is the status of mathematical objects,' he adds. Put simply, do mathematical objects have an independent existence on their own right (Platonism), or are they only by-products of our minds (Aristotelianism)? 'In other words, when I look at my iPhone, is the rectangle that I "perceive" produced by some capacity of my mind or is my mind being informed by a form of a rectangle which exists independently of my thinking? This is one of the points of contention between these two ways of thinking.'

Gamarra Jordan sees the aim of his project as twofold. The first aim is to elucidate the dialogue between Syrianus and Aristotle, and the second is to present a systematic account of Syrianus' metaphysical system, that is, to explain the basic structure of reality according to Syrianus' extant works.

Meet the researchers

Giouli Korobili

Giouli Korobili is a PhD candidate specialising in Classical Philology at Humboldt University, Berlin. Her work so far has been centred on classical philosophy and languages, with a particular focus on Latin and Ancient Greek languages, as well as the views of Greek philosopher Aristotle. Her research interests, however, extend to ancient Greek and Roman medicine, ancient and modern rhetoric, metapoetics, botany and iatromechanics. Her latest publications include 'Nutrition, Life and Health of the Ensouled Body' in U. Kornmeier (ed.) *The Soul is an Octopus. Ancient Ideas of Life* and the Body, Berlin 2016, pp. 68–75, 'What do people call death? Aristotle's scientific approach to a natural phenomenon' (forthcoming by Medicina&Storia) and 'Aristotle on the role of heat in plant life' (forthcoming by De Gruyter).

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Gonzalo Gamarra Jordan

Gonzalo Gamarra Jordan is a PhD candidate in Philosophy at Humboldt University in Berlin. His research interests include ancient Greek philosophy and ancient Greek mathematics. Outside of ancient philosophy, he has a strong academic interest in Philosophy of Mathematics (esp., Leibniz, Berkeley, Husserl, and Wittgenstein), Kierkegaard, and Ancient Chinese Political Philosophy. Originally from Bolivia, before moving to Berlin with a Fellowship from the Deutsche Forschungsgemeinschaft, Gamarra Jordan graduated from St. John's College NM, where he studied the Great Books of both the Western and the Eastern traditions.

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Juliane Küppers

Juliane Küppers is a PhD student in Classical Philology at the Free University Berlin. Her fields of interest include philology, history of science and ancient philosophy. Küppers' current work researches the ideas of 17th century French philosopher Pierre Gassendi in his Latin language work *Philosophiae Epicuri Syntagma*. She was awarded a scholarship from the Deutsche Forschungsgemeinschaft to conduct her research. In the past, Küppers worked as a part-time editor for the press office of the Freie Universität in Berlin and published articles on scientific research projects in university publications, for example in the supplement to the German newspaper 'Der Tagesspiegel'.

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Benjamin Wilck

Benjamin Wilck is completing a PhD in Philosophy at Humboldt University in Berlin. His research interests are rooted in ancient philosophy on the one hand and formal logic and theory of science on the other hand. His current research aims to critically examine the use of philosophical methods such as Aristotelian dialectic and Pyrrhonian scepticism to reject or support scientific principles, particularly mathematical definitions. Throughout his academic training, Wilck received a number of grants and awards, the latest being a scholarship from the Deutsche Forschungsgemeinschaft, for the Philosophy, Science and the Sciences program at Humboldt University.

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THE SOCIAL CONTEXT OF INNOVATION

The Florence Renaissance was a time of unprecedented innovation across multiple domains of culture, science and politics. The causes of such widespread advances are often debated, and difficult to pin down. **Professor John F. Padgett** uses social network analysis to illuminate how borrowing tactics from seemingly unrelated social phenomena converged to facilitate revolutionary change across Florence.

A Time for Innovation

The Renaissance in Florence, Italy was one of the most innovative times and places in western Europe, generating world-altering advances in art, political thought, science, banking, public finance and republicanism. Scholars have long sought to understand the social context in this city that produced not only particular innovations, with their own local histories, but also spill overs in innovation from one domain to another.

Using primary archival sources, Professor John F. Padgett of the University of Chicago has devoted 30 years to assembling a database that traces the historical evolution of multiple social networks in the city, among about 80,000 persons over 150 years (1350–1500). These range from kinship and marriage networks, to economic partnerships and commercial credit, to political elections, factions, and public debates. This research has been funded by the US National Science Foundation, the Hewlett Foundation, and the Neubauer Collegium.

Inspired by the biological sciences, where relationships between molecules within an organism, and organisms within an ecosystem, are often context dependent and best understood through network representations, Professor Padgett's work seeks to understand how complex social networks facilitated innovation in Renaissance Florence. As with a biochemical reaction, innovations in one social network were often catalysed by activity in adjacent social networks.

In a series of studies into each of the evolving social networks listed above, Professor Padgett and his team have identified an organisational innovation or change of focal interest, and have situated that innovation in the multiple-network context of its production. For example, if focal attention is on banking innovation, Professor Padgett and his collaborators reconstruct in person-by-person detail not only the economic networks of those bankers, but also their kinship and political networks. Florentines, after all, were the historical source for our current stereotype of 'Renaissance Men' (and perhaps not as many women as we would like, but some).

Though revolutionary innovations often appear to have sprung from thin air, the team's work demonstrates that they are often the product of a combination of

forces that may seem unrelated on the surface. These networks illuminate factors adjacent to an innovation that shaped its emergence and ultimate form.

Social Network Structure Enables Revolutionary Political Change

In a study of the rise to power of Cosimo de' Medici, the founder of the Medici political dynasty during the Florence Renaissance, Professor Padgett traced the unusual degree of centralisation of this revolutionary faction in the marriage- and business-network social foundations of its emergence. This unique example represents Florence's transition from the late medieval tradition of numerous urban political factions to the birth of a united Renaissance state.

Prior to Medici, Florentine politics consisted largely of competition between guilds and wars between urban feudal houses. Professor Padgett and his colleagues focused on Medici's 'social embeddedness' – the ways in which his social relationships shaped and enabled his rise to power to form the Florence state.

Cosimo de' Mendici had many vocations and connections, and was a member of both elite marriage networks and numerous business partnerships, which allowed him to behave opportunistically in each of his circles to shape interactions between them. Since he was the singular point of overlap between some of these circles, he was at low risk of being found out when supplying contradictory information to different groups.

This allowed him to take robust action when opportunities to advance his own interests or hinder his opponents' power presented themselves, ultimately moving the Medici family into a position of power over a much broader region than ever before. Through his social connectedness, Cosimo de' Mendici was able to leverage the existing system of inter-guild and inter-family feuding to create an entirely new system.

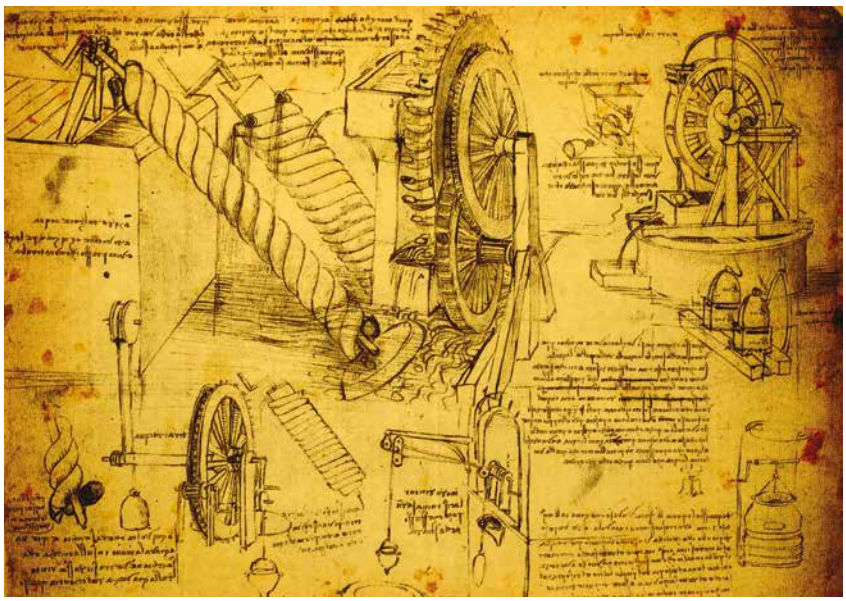
Economics Shaped by Family and Friendship

In the 1380s, a new form of business organisation emerged in Florence – the partnership system. For the first time, rather than companies being exclusively run by a single person or family, businesses emerged with multiple legal owners or partners from different families.

These partnerships formed the basis for financial capitalism by protecting business owners from financial ruin in the case of a business failure. It also allowed companies to simultaneously become more generalist and more specialised: the overarching company could cover many markets, while the various partners could specialise in their market within the company.

Through a network analysis inspired by biochemical pathways, Professor Padgett found that the business innovations in this case were not strategized, rather an unintended consequence of repression of class revolt. Prior to the partnership system, businesses were based primarily on paternal inheritance or membership in a guild. As these systems became destabilised in a changing urban political environment, marital ties and client pressure began to determine the direction of businesses. This reorganisation of elite social networks to favour victorious pairings encouraged the partnership system to emerge.

Another critical innovation in capitalism was the development of economic credit. Personal credit pre-existed (and continued



in) the Renaissance, but in Florence a business system emerged by which companies vastly expanded their offering and tracking of credits and debits of goods through double-entry bookkeeping.

By analysing records of credits and debts between Florentine businesses along with marital and political ties, Professor Padgett and his team were able to construct a more complex understanding of how the credit system emerged. As with many of Florence's innovations, social ties played a major role. The public reputation and social status of a business owner influenced their ability to secure a loan. Friendship and kinship were the initial determiners of who got credit or not, but increasing tax scrutiny from an evolving political landscape eventually forced the formalisation of a mathematically advanced credit system.

These Florentine multiple-network-rewiring processes have been generalised to the other historical cases of the emergence of organisational novelty: the stock market in early-modern Amsterdam, the consolidation of Germany in 19th century, the divergent outcomes of similar economic reforms in the Soviet Union and China, and the emergence of the biotechnology industry in late 20th-century America. Underlying this generalisation of Florentine insights to new applications is Professor Padgett's adaptation of the concept and models of 'autocatalysis' from the biological literature on the origins of life.

Blurring Class Lines Through New Status Symbols

Kinship and marriage have long played a major role in determining social status in class-based societies. Medieval class structures based on feudal systems were rigid and categorical, with limited class mobility and marriage prospects relegated to within one's designated group; elite families only married to other elite families. During the Renaissance, Florence saw the breakdown of this medieval social status and hierarchy among categorical groups into a continuous hierarchical status with potential for mobility.

Once again, Professor Padgett and his colleagues were able to use records to determine the social networks that made this transition possible. They found that during this time, social stratification could be determined by either wealth, political office, and age of family. However, rankings of a family within each of these three systems often did not align. Thus, a member of a family with great wealth but poor political standing could marry a member of a less wealthy family with an old name.

As families sought to make suitable matches across these three components, it opened the door for new men who were successful in politics or business to marry into old families, gaining upward social mobility. As a result, distinctions between elite families began to blur and become more fluid. Just as marital ties shaped Florentine economics and politics, developments in economics and politics made novel marriage pairings possible.

Expanding Social Understanding

Currently Professor Padgett is in the process of extending his multiple-network and autocatalysis ideas about social innovation to language. He is studying William Faulkner and political debate in the Florentine *Consulte e Pratiche* to uncover how social networks shaped the linguistic landscape of the Renaissance.

Nothing Occurs in a Vacuum

In all of these cases and others, social-organisational innovation came from a cross-network advances and the recombination of multiple networks. Every Renaissance innovation can be tied to activity in adjacent social networks. For example, radical economic change does not occur through the evolution of one network in isolation, but rather the evolution of that network in the surrounding 'catalytic' context of kinship and political networks. Advances in any one network fuelled new processes in others, creating an innovation feedback loop that ultimately shaped the course of European history.

One of Professor Padgett's most intriguing findings is that innovative Florentines were usually conservative in their motivation; seldom were they setting out to create something novel, instead simply working to improve upon the familiar. Innovation occurred not so much by the intentional invention of new tools for old purposes, as by the opportunistic adaptation of old tools for new purposes.

Meet the researcher

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Professor John F. Padgett obtained his PhD in Sociology and Public Policy from the University of Michigan in 1978. After serving as an Assistant Professor at Harvard University, he joined the faculty of the University of Chicago in 1981, where he currently serves as a Professor of Political Science and Sociology. Since then, he has also served as a Research Professor at the Santa Fe Institute and held numerous prestigious Visiting Professor positions at universities across Italy. Over the past 25 years, he has been constructing a massive quantitative data set about social-network evolution between years 1300–1500 in Renaissance Florence using primary archival sources, with the goal of understanding how social networks enabled the innovation of this period.

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THE UNIVERSITY OF CHICAGO

HEALTH AND WEALTH IN THE 20TH CENTURY: IMPLICATIONS FOR TODAY

The 20th century brought significant improvements in income and health of citizens across many countries worldwide. **Dr Daniel Gallardo Albarrán** (University of Wageningen) and **Professor Herman de Jong** (University of Groningen) have used a comprehensive framework addressing many dimensions of human development, to take a new and closer look at changes in economy and health during the first half of the 20th century.

'The Great Escape'

Over the centuries, human societies have gone through countless transformations affecting the wellbeing, health and quality of life of people around the world. Despite the wars and economic struggles that marked the first half of the 20th century, this historical period brought exceptional advances in the health and leisure time of a large number of countries.

The economic growth of European nations, typically measured in Gross Domestic Product (GDP) per capita, was considerably low until the 1950s. Yet, Europeans became healthier, taller and lived longer, while also gaining more leisure time. In many parts of the world, the advent of the 20th century resulted in a clear break from the challenging past marked by widespread poverty and illness. Such was the significance of this change that the Nobel laureate Angus Deaton described it as a 'Great Escape' from the previous reality marked by early death, poverty and poor health.

Improvements resulting from this escape were most pronounced in developed countries, and the observation of these effects is supported by the ready availability of long-term data. Dr Daniel Gallardo Albarrán (University of Wageningen) and Professor Herman de Jong (University of Groningen) have conducted extensive research exploring a range of dimensions reflecting the economy, health and wellbeing of citizens in several countries worldwide.

Better understanding the changes brought by the 20th century could have far-reaching implications for the present day. This includes informing how we should best measure the welfare of nations, and encouraging the use of more comprehensive approaches that consider a range of different dimensions of the economy and citizens' health. Findings could also benefit governments and policy-makers by helping them identify critical areas of welfare to prioritise in their interventions. This could encourage more policies that focus on workweek reduction, lowering inequality and making improvements to healthcare services.

Links Between Income and Health

Professor de Jong has been carrying out economic history research focused on the 20th century for many years. His studies are based on a novel approach that measures levels of growth and economic wellbeing using broad indicators of human welfare. In his analyses, Professor de Jong has compared labour productivity and working wages between European countries over the first half of the 20th century, while also studying causal relationships between these and inequality, health and leisure, which are often seen as key indicators of economic welfare.

This work is based on the observation that advanced European nations experienced noteworthy improvements in life expectancy and health as they were entering the second stage of a

so-called Kuznets curve. In economics, a Kuznets curve is a graph representation outlining the hypothesis that as a given economy develops, market forces first increase and then decrease economic inequality. In the second stage of maturing industrialisation, income within nations becomes more equally distributed. This hypothesis may explain the slow rise in per capita income observed in the 20th century alongside improvements in living standards for most of the population.

To better understand the underlying mechanisms of this apparent paradox, Professor de Jong examined and analysed indicators that reflect citizens' economic living standards and overall human development. This work was developed further by Dr Gallardo Albarrán as part of his doctoral thesis.

Beyond GDP and National Income

The most common measures of living standards in the 20th century and today are GDP and the underlying relations within the National Accounts, which represent the economic activity of a nation. However, economics scholars have often expressed their concerns that National Accounts might be incomplete, and that GDP only truly measures economic activity that passes through the market – that is, the output of a country.

In addition to GDP, Professor de Jong and Dr Gallardo Albarrán's work considers other important factors affecting living standards within nations, including wages, consumption, mortality rates, life expectancy, inequality and leisure time. Using a comprehensive framework, the researchers examined all these factors in combination to achieve a better understanding of changes in human welfare in Europe and the US during the first half of the 20th century.

Human Welfare in the 20th Century

In an article published in Explorations in Economic History (volume 72), Dr Gallardo Albarrán identified a number of key findings related to the welfare of different countries during the first half of the 20th century. First, he found that living standards in Western Europe were slightly below two-thirds of those in America. Despite the similar leisure time for workers in the two regions, life expectancy was four years lower in Western Europe, which also had lower consumption rates. Second, Northern Europe was found to have much closer welfare levels relative to America than measured by GDP per capita, with higher life expectancy and consumption levels. Living standards in Southern Europe, on the other hand, were slightly lower, mostly due to heavy mortality rates among its citizens.

While Dr Gallardo-Albarrán's findings were consistent with previous work suggesting that US citizens were ahead of Europeans in terms of wellbeing, the percentages he derived were markedly different. For example, according to Human Development Index (HDI) rankings, in 1913 Italian wellbeing was 75% of that in America. Yet, using an alternative measure of welfare, Dr Gallardo Albarrán found Italian living standards to be roughly one third of those in the US. This appears to be a more realistic calculation, especially considering that life expectancy in Italy was seven years lower.

Similarly, analyses revealed a greater welfare gap between the US and the UK than that reported by HDI, primarily due to the longer working hours and higher mortality rates of British citizens.

Dr Gallardo Albarrán's findings highlight the importance of considering other factors, such as consumption, health, mortality, life expectancy and leisure time, to achieve a more comprehensive and accurate picture of a country's welfare.

Analysing Growth

Dr Gallardo Albarrán's work also addressed the question of whether the first half of the 20th century in Western Europe should be characterised as one of either missed or taken opportunities for improving broader wellbeing. Overall, he found that income growth significantly underestimated welfare growth in Western Europe between 1913 and 1950. Taking Britain as an example, in 1950, British citizens were at far lower risk of infectious diseases, had an increased life expectancy of 16 years, lived in a more equal society, and spent almost 200 hours less per year at work compared to 1913. This prominent improvement in welfare is almost three times higher than growth based on income per capita only.

Dr Gallardo Albarrán collected similar observations for most other European countries, which also reported declines in mortality rates and inequality, as well as an increase in leisure time. When looking at drivers of welfare growth over time, Dr Gallardo Albarrán considered 1913–1929 and 1929–1950 separately. In the first period, 1913–1929, he found the growth trajectory of Western Europe to be considerably steeper than the American one.

Despite the detrimental effects of WW1, consumption grew and was more equally distributed among countries. The introduction of the eight-hour working day increased workers' leisure time, and citizens health improved through better sanitary services and diet.

From 1929 to 1950 welfare growth was lower, with consumption rates being approximately half of those in previous years and no further reductions in working hours. However, welfare growth in Western Europe persisted, primarily due to further progress in sanitation and medicine, which allowed major infectious diseases to be treated.

Throughout the first half of the 20th century, mortality rates in both the US and Western Europe declined, particularly within the 0–5 age range. Overall, the decrease in child mortality was found to play a key part in the welfare growth of these countries, with mortality rates also declining less for older ages.

A Comprehensive Study of Human Welfare

The research carried out by Dr Gallardo Albarrán and Professor de Jong has led to a broader understanding of the changes in economy and health that took place in Europe and the US during the first half of the 20th century. Critically, their results suggest that income per capita sizeably underestimates the welfare growth experienced during this 50-year period, and that this approach offers only a limited view of welfare development.

By including other factors relevant to human development in their analyses, the researchers found that despite the negative effects of armed conflicts and financial crises, the 20th century marked a period of great improvements in the health and leisure time of citizens in Europe and the US. These improvements had a profound impact on people's lives, with lower mortality rates and better living standards.

Prof de Jong and Gallardo Albarrán's findings support recent arguments made by economics scholars regarding the limits of GDP in measuring citizens' wellbeing and quality of life. Thus, while GDP per capita showed an improvement in European living standards of less than 30% between 1913 and 1950, the composite indicator of welfare used by the researchers suggests that the wellbeing of citizens approximately doubled.

This work presents a valuable opportunity for both methodological and policy-related developments. From a research perspective, it could lead to the implementation of more realistic measures of welfare that consider a broader range of factors affecting citizens' wellbeing. By highlighting the importance of health for citizens' wellbeing, this research could prompt the development of a more comprehensive measure of welfare growth that considers the key role of a country's health system. Future research may also pay greater attention to trade-offs associated with income inequality, as well as identifying more clearly the potential benefits associated with greater leisure time.

The findings could also aid our understanding of the financial and economic crisis of the early 2010s – providing insight into whether economic growth alone is enough to produce welfare improvements. They could also help to shift the primary focus of governments from increasing GDP to developing policies that address a broader range of economic and health-related issues.

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Dr Daniel Gallardo Albarrán is a post-doctoral researcher at the University of Wageningen. He holds a doctoral degree in economics from the University of Groningen. Gallardo Albarrán's most recent work explores aspects of health, the diffusion of medical knowledge, and economic growth in the twentieth century. He has presented his work at a number of international conferences and published his work in several international journals. He has been a visiting researcher at the London School of Economics in London as well as Carlos III in Madrid.

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Dr Herman de Jong is a Professor of Economic History and former Dean of the Faculty of Economics and Business at the University of Groningen. He holds a PhD from the University of Groningen and has been teaching there for 20 years. Professor de Jong has over 70 publications in his name and has presented his work at a number of universities worldwide. His work focuses on economic and social history, as well as long-term economic growth and development. He was visiting professor at the Hitotsubashi University in Tokyo and is President of the European Historical Economics Society.

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THE WORKERS' FACULTY: THE GLOBALISATION OF SOVIET EDUCATION

The borrowing and lending of educational models between nations has a long and interesting history. However, much of modern literature focuses on transfers between capitalist societies. **Professor Ingrid Miethe** of the University of Gießen studies the global transfer of socialist educational institutions, specifically the adaptations of the Soviet Russian Workers' Faculty – an institution newly founded to educate the working-class population for a more egalitarian society.

The Workers' Faculty

Throughout history, a core component of socialist countries has been the elevation of working-class and peasant populations through the elimination of inequalities in opportunity. One of the greatest barriers to opportunity is lack of access to quality education. Education opens up career paths and potential for advancement in society. However, in many societies, access to education is limited to the affluent and upper class. Consequently, education for the masses has been an important focus in socialist countries. One of the unique contributions of the Soviet Union is the Workers' Faculty, an educational acceleration institution for the working class.

Professor Ingrid Miethe of the University of Gießen in Germany studies the spread of Workers' Faculties across the globe, particularly how these faculties have played into educational exchanges between socialist nations and how they developed in the context of unique cultures and varying global influences. In her new book, *Globalisation of an Educational Idea: Workers' Faculties in Eastern Germany, Vietnam, Cuba and Mozambique*, Professor Miethe fills gaps in the research and history of this educational transfer.

The Origins of the Rabfak

The first version of Workers' Faculties opened in Soviet Russia in 1919, shortly after the October Revolution. Called Rabfak, short for rabočij fakul'tet, these institutions were designed to quickly prepare peasants and workers for higher education. With the professed goal of removing educational inequalities due to class status, these facilities aimed to develop a new intellectual class in Russia, borne from humble roots. They served to create new opportunities for the working people while simultaneously insuring that this new intellectual class would be loyal to the communist government and promote the socialist cause. Workers' Faculties continued to proliferate in Russia and spread across other Soviet nations following the formation of the Soviet Union.

Following World War II, the Workers' Faculties found new homes in socialist countries in Europe, with versions popping up in East Germany, Poland, Czechoslovakia, Romania, Bulgaria and Hungary. At the same time in Asia, the newly established independent nations of China, Vietnam and North Korea also began to adopt the Workers' Faculty model. As socialist movements spread across the globe, Workers' Faculties followed, finding their way to Mozambique and Cuba, the last country that – at least by name – still has operational faculties today.

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Creating Global Context

Professor Miethe's work aims to illuminate the history and principles of educational exchange between socialist countries. Most studies of international educational exchanges and globalisation focus on capitalist countries. Meanwhile, reviews of educational transfer between socialist nations tend to be pairwise and lacking context as to how they fit into broader globalisation patterns. In her book, Professor Miethe creates a comprehensive picture of socialist educational transfers by illuminating exchanges between socialist countries across four continents. She focuses on the Workers' Faculty due to its long history, from Soviet Russia to present-day Cuba, and its implementation in vastly different cultures and contexts.

Professor Miethe's research seeks to explore three overarching questions. First, what national traditions and international transfers influenced how Workers' Faculties were established and run in each culture? Second, how did the design of each culture's Workers' Faculty differ and what role did it play in each unique context? Third, what can Workers' Faculties teach us about the history of international educational transfers and how do these transfers interplay with globalisation?

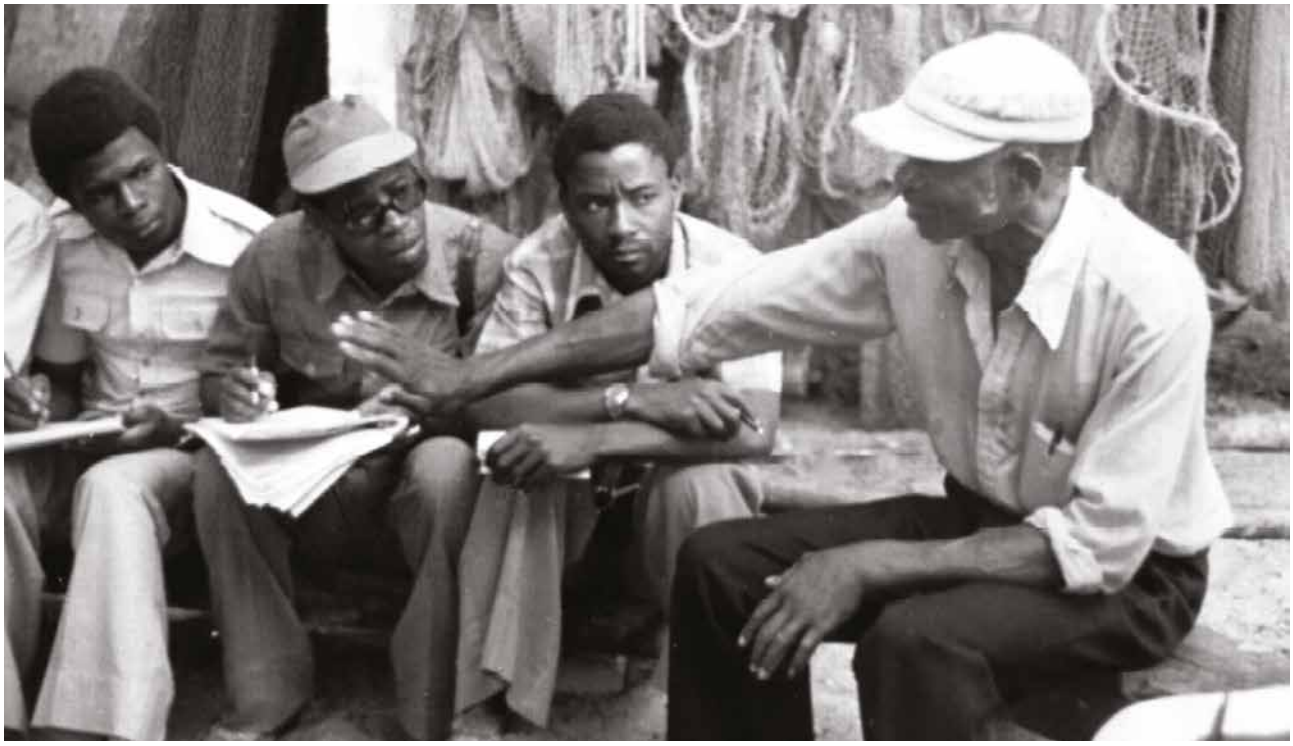
To offer answers, Professor Miethe's book offers a broad history of Workers' Faculties before diving into in-depth investigations of the emergence and progression of these faculties in countries on four continents: Germany in Europe, Vietnam in Asia, Mozambique in Africa, and Cuba in Latin America. She then ties these case studies together by discussing how each one fits into a larger context within the globalisation of education and spread of socialist ideals.

Defining the Workers' Faculty

A critical component of studying and understanding the Workers' Faculty is distinguishing it from other educational institutions. Though the original Rabfaks in Russia showed a great deal of variation in their implementation and structure, beyond all variety they and other Workers' Faculties share some common traits.

First and foremost, the Workers' Faculties emerged as a tool for social transformation following a revolutionary political change. Their mission was to aid transition to a socialist state through the creation of a more equal society. They were aimed primarily at peasants and the working class. While other groups that faced barriers to education, such as women and ethnic minorities, may also have benefited from the faculties, these target groups came second to economic categories.

The chief aim of the Workers' Faculties across all national cultures was to provide an accelerated preparation for university coursework for the labour class. The curriculum was intended to level the playing field for people who were not offered educational opportunities during their regular school trajectory but were intent on gaining an education following the revolution. The faculties were integrated into universities as autonomous units, in a construction intended to underscore the prioritised standing of the working-class students within the university.



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The final characteristic that differentiates Workers' Faculties from other institutions was their objective and long-term goals. Their stated purpose was to support the social restructuring of higher education. This contributed to changing the student compositions of universities to the benefit of the socialist party. Ultimately, the goal was to nurture a new intellectual elite with a working-class background and strong loyalty to their socialist rulers.

Finding Hidden Details

Studying the global spread of Workers' Faculties means dealing with complex issues. While their institutional history within the Soviet Union is fairly well documented, records of their dissemination to other countries around the world are rarely investigated. This is in large part due to the conditions under which a Workers' Faculty would normally be initiated – following a revolution and major social upheaval. For short-lived regime changes, especially those that have not aged well in the eyes of history, this means that records may be sparse.

By sifting through thousands of documents in local languages, Professor Miethe identified the emergence of numerous Workers' Facilities across Europe, Asia, Africa, and Latin America. This includes short-lived institutions that were run in many places from Poland following WWII to Afghanistan in the early 1980s.

For her deep case study, Professor Miethe chose a Workers' Faculty on each of the four continents that she knew she could obtain sufficient data on. She then dived into finding every record possible. The bedrock of the study consisted of primary source research in the various national archives. This was supplemented by eyewitness interviews. Professor Miethe and her team found only very limited academic documentation on the Workers' Faculties in the various countries, although they found some 'grey literature' in the local languages. These newspaper articles, university reports, government publications and other non-academic material produced during the programs' existence helped the team to fill out additional details about the programs and the cultural climate surrounding them.

German Tradition and Soviet Means

Following WWII, Soviet-occupied East Germany saw the rise of worker education modelled after the Russian Rabfak. These programs met Professor Miethe's qualifications for classification as Workers' Faculties. The movement started with the 1945 formation of preliminary study divisions, Vorstudienabteilungen (VA), designed to help peasants and their children start down the path to higher education. While the VA took many notes from Soviet Rabfak models, it was also based heavily in German traditions of providing auxiliary courses for workers, and some were not directly associated with universities. Furthermore, implementation was inconsistent across the occupied area.

In 1949, in an effort to consolidate approaches, the VA were converted to Workers' and Peasants' Faculties, Arbeiter- und Bauern-Fakultäten (ABF). The ABF were clearly modelled on the Russian Rabfak, with integration into the university system and direct references to the Soviet institutions appearing in documents about the design of the faculties. While attendance was high in the first four years, it began to wane in the mid-1950s. Due to high drop-out rates, the programs were eventually modified to create more specialised paths. As

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the political motives of the ABF were secured in the late 1950s, the majority of ABFs were shut down by 1963.

Professor Miethe concludes that both Soviet and German traditions played into the formation of Workers' Faculties in East Germany, and the Soviet model was pulled upon more heavily for the politically motivated ABF. Soviet occupation of the region assisted in the transfer of educational structure to East Germany.

The Vietnamese Adaptation of the Workers' Faculty

Following the defeat of the French colonial administration in 1954, a newly independent Vietnam struggled to obtain political stability. North Vietnam desired a communist state modelled on those of the Soviet Union and China. A small group of Vietnamese leaders had spent time in Soviet Russia and participated in the Rabfak system. Inspired by the programs to empower the working class through education, these leaders cited the Soviet system in the formation of the Central Worker-Peasant Complementary Education School (CWPS).

Though the CWPS was sparked by Soviet Rabfaks, the school itself was modelled more closely upon institutions in neighbouring China and was an independent school, not associated with a university. This decision fit organically with the existing education system in Vietnam and represents a culture-specific modification of the Workers' Faculty model.

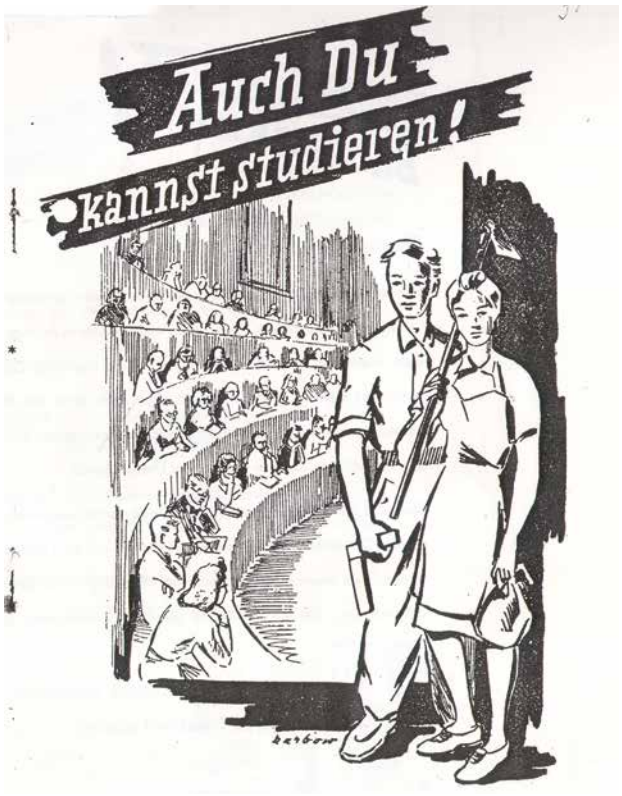
Despite this difference, the goals of the CWPS was aligned with that of the Soviet Rabfak. The school was meant to educate workers to both achieve educational equality and create a population of educated workers suitable for state level positions. While these efforts were successful in Hanoi, it had less impact in rural regions of Vietnam, where most of the working class resided. Ultimately, the program was shut down in 1964.

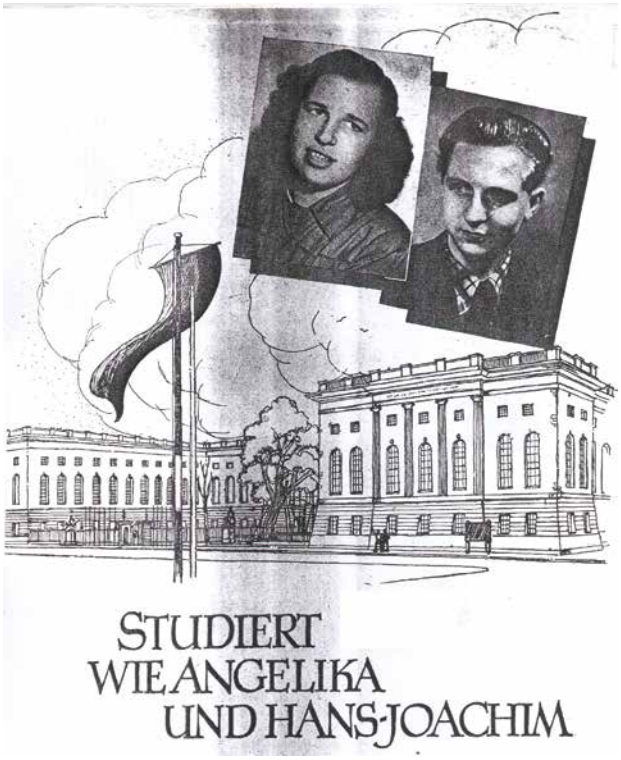
Indirect Transmission in Mozambique

After a decade-long struggle for independence from the Portuguese, the People's Republic of Mozambique was formed in 1975. However, efforts to educate the peasant population started well prior to independence. Based in exile in Tanzania, leaders of the Mozambique Liberation Front, Frente para a Libertação de Moçambique (FRELIMO), planned the reclamation of their country. As rebellion leaders began liberating portions of the country in 1965, FRELIMO schools were formed in these liberated zones to provide foundational educational for independence fighters and their children.

Nevertheless, at the time of independence, the vast majority of the population was illiterate. Upon independence, the Portuguese educated elite left the country in droves. Since only an insignificant minority of attendees in Mozambique universities were Mozambican, the country was left with few capable of teaching the newly freed population. In 1977, FRELIMO leadership formally aligned itself with the socialist bloc and began developing connections with socialist countries. This led to advisors from these countries, particularly East Germany, traveling to Mozambique to both aid in structuring a socialist government and serving as educators, providing courses for workers.

In cooperation with foreign educators, FRELIMO began pursuing the goal





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of forming a Faculty for Former Combatants and Vanguard Workers, Faculdade para Antigos Combatentes e Trabalhadores de Vanguarda (FACOTRAV). This initiative was consistent with FRELIMO's own experience to educate independence fighters and matched the party's socialist outlook. However, at the time when foreign educational advisors arrived, civil war broke out in Mozambique. Despite the restrictive budgetary conditions created by the war, the FACOTRAV was founded as a new university faculty in 1983, clearly shaped in accordance with the ABF model brought into discussion by the East German advisors.

The program lasted through 1990 with diminishing participation and was eventually abandoned with socialist political motivation. Though the FACOTRAV highly resembled the Rabfak system in both structure and motivation, these features were acquired indirectly through contact with East German educators associated with the ABF program.

Educational Inspiration in Cuba

The Cuban Workers' Faculty represents a unique institution when compared to the other case studies in Professor Miethe's work, since there were two main types. After the Cuban revolution of 1959, the country became increasingly in conflict with the United States and from 1961, officially began orienting itself towards socialist ideals and the USSR.

Though a well-developed education system existed in Cuba at the time of the revolution, it was highly class-divided. The emergence of the new government led to sweeping educational initiatives which quickly raised literacy rates and brought broad education to a wider range of Cubans. In 1962, university reform sought three major goals: making university education accessible to all members of the population, raising its quality, and forming tight connections with the new socialist government. However, much of the adult working population lacked education beyond basic literacy. To truly realise these goals, additional programs would be needed.

Though concepts for a university of the people already existed in Cuban culture and history, once formally aligned with socialist regimes, the Cuban government expressed explicit interest in developing a Rabfak-style program for the education of adult workers. The Workers' and Peasants' Preparatory Faculty, Facultad Preparatoria Obrera y Campesina (FPOC), was founded with the Rabfak model in mind, with the aim of securing political power within the universities. These Workers' Faculties served to close the educational gap between classes in Cuba and eventually led to the formation of the V.I. Lenin Special School, an elite school for FPOC graduates. These educational institutions are still operational today, but they have changed their character to rather regular adult education centres.

A Complex Tale

Professor Miethe's work demonstrates the complex influences that shape how educational institutions and ideas are shared and adopted across cultures. While each of these cases took inspiration from the Soviet Rabfak, whether directly or indirectly, their implementations shifted to build upon existing institutions and were each unique by nature of their cultural context and political goals.

Meet the researcher

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Professor Ingrid Miethe began her career studying Education, Political Science and Sociology at the Technical University Berlin and a PhD in Political Science from the Free University Berlin. She obtained her venia legend in education at University Halle-Wittenberg. She served as a Professor of General Education at the Protestant University of Applied Science Darmstadt for eight years before joining the faculty of Education at the Department for Social Science and Cultural Studies at the University of Giessen as a Full Professor in 2010. She is a member of many professional organisations, including the *International Sociological Association* and she is Vice President of the *German Educational Research Association*. Professor Miethe's present work focuses on the history and transformation of Workers' Faculty and on educational transfers between the Socialist bloc and countries of the Global South.

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JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN

USING DREAMS TO DEPICT THE NIGHTMARE OF THE HOLOCAUST

It began with a boycott of Jewish shops and it ended in the gas chambers, as Adolf Hitler attempted to exterminate the Jewish population in Europe. Six million victims were annihilated and their voices and stories lost forever. **Professor Christiane Solte-Gresser** from Saarland University in Germany interprets Holocaust literature about dreams to help tell the story of the millions who disappeared.

The Power of Dreams

Our dreams are the subject of intense study and scholarly debate across research fields, such as neurophysiology, psychology, cognitive science, cultural studies, memory research, philosophy, and theology. Sigmund Freud, the founder of psychoanalysis, attached previously unheard-of importance to dreams by discovering they can open the doorway to the unconscious mind. He argued, for example, that dreams are wishes we are looking to fulfil in our waking life.

People frequently also use the concept of a dream to discuss the ideals they desire to attain in their life – for example, the 'I Have a Dream' speech delivered by Martin Luther King Jr or the idea of 'The American Dream'.

Given the importance of dreams in expressing our hidden desires or our deepest fears, dreams are regularly used as a literary device by artists, composers, poets, playwrights, novelists and non-fiction writers. Taking the series of Harry Potter books as an example, even before Harry knew he had magical powers, the magic had started to percolate through into his dreams. By mixing reality and imagination inherent in dreams, the author is able to creatively explore an aspect of the story in order to evoke certain expectations and elicit certain emotions or reactions from the reader.

Using Dreams to Come to Terms with the Holocaust

The Holocaust, also known as the Shoah, was state-organised genocide in which six million Jews and other victims were murdered by the Nazis and their abetters during World War Two. Part of the Nazis' plan was total annihilation of the Jewish population in Europe, and as a result, Jewish people were eradicated in most towns and cities.

In many ways, the Holocaust is a story that has never fully been told. Holocaust survivor Primo Levi described the Holocaust as an event without witnesses, as most victims were annihilated and their voices silenced forever. Of the people who survived the Holocaust, many were either too traumatised to explain what they experienced, or they did not feel able to speak on behalf of the dead.

The Holocaust is also difficult to portray in conventional narratives or visual approaches, because it exceeds our

‘Occasionally the survivors even perceive their liberation as a dream and see their imprisonment as the only true reality’

Erwin Hahs: *Konzentrationslager,* watercolour, pencil, varnish (52 x 70 cm)

imagination. Holocaust survivor Elie Wiesel described the event as the murder of humanity. As such there is a paradox inherent in depicting the Holocaust – that is the telling of something that is untellable. This is where literature, and especially the literary depiction of dreams, comes into the picture. Given the importance of dreams in our everyday lives and as a literary device to express the unutterable, it is not surprising to see that numerous texts about the Holocaust use the dream as a narrative or poetic technique. For example, a Holocaust survivor’s nightmare can reflect the transmission of the trauma experienced in the concentration camp.

Overview of the Dream Cultures Research Training Group

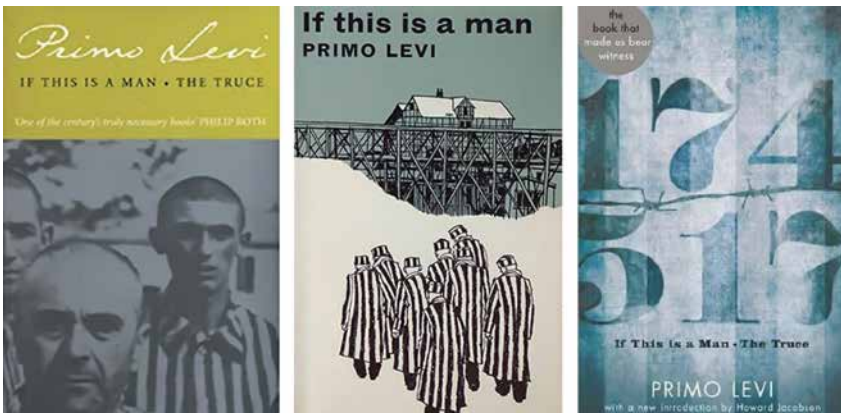
Professor Christiane Solte-Gresser is a contributor and spokesperson at the European Dream Cultures Research Training Group, at Saarland University in Germany. The European Dream Cultures Research Training Group researches the literary, media and cultural histories of the dream in Europe.

Alongside her colleagues in the research group, Professor Solte-Gresser explores how the representation of dreams in literature and arts transcends eras, media, languages and cultures. This research is innovative in its approach to dream interpretation – in contrast to psychological decoding of dreams, it is cultural-constructivist and focuses on poetics and media.

Analysis of Holocaust Literature

In her scientific research, Professor Solte-Gresser explores Holocaust literature to gain new perspectives and to increase our understanding of the Holocaust. As she explains: ‘The literary and autobiographical texts produced during the Nazi tyranny and right after WWII already show a significant source of knowledge, namely both knowledge about dreams and about the Holocaust trauma.’ Professor Solte-Gresser also focuses on post-Holocaust texts, which, as she explains, ‘pull the dreamer right back into the concentration camp experience.’ Her objective is to assess how literary texts make the inconceivable experience of the Holocaust comprehensible to the reader.

Professor Solte-Gresser compiles literary texts about the Holocaust that use dreams as their method of expression, and then compares them, paying particular attention to their functions and various literary forms. She analyses texts of real



Primo Levi: *If this is a Man (Se questo è un uomo),* 1947

dreams in autobiographical writing as well as in fiction. For example, she studies concentration camp dreams from narratives, stage plays, poems, reports, music and films, across different languages.

Initial Findings

In her analysis, Professor Solte-Gresser found that there is a broad range of motifs, themes, and narrative styles that are deployed to approach the Holocaust through literature, and that these are present in both autobiographical and fictional dreams. Through her compilation of literature and analysis, she found that there is broad ambiguity and inconsistency in presenting the dream. However, the dream is presented in such a way that it condenses perceptions and experiences of the Holocaust, making it an essential way of exploring its unimaginable horror.

Professor Solte-Gresser finds that some of the texts describe the reality of the concentration camps, 'where the fine line between life and death becomes so fragile, the hallucinations, delirium, and agony of it all dissolve the boundaries between waking and dreaming.' For other survivors, dreaming was an escape from the reality of the concentration camps, and for later generations dreams are sometimes regarded as a way to reunite with the dead and to give them a voice. Recurring nightmares also feature in Holocaust texts, and Professor Solte-Gresser interpreted this to mean that for many survivors, 'life after the concentration camps turns out to be a harrowing delusion.' The omnipresence of the trauma of the Holocaust in dreams also is an indication that, as Professor Solte-Gresser explains, 'occasionally the survivors even perceive their liberation as a dream and see their imprisonment as the only true reality.'

Keeping the Legacy of the Holocaust Alive

As a society of storytellers, and given that there is no 'sense' to the Holocaust, we need to examine the testimonials and various literary memories, and use them as a vehicle to bring about a better society. The Nazis wanted to erase Jewish culture and memory from the world, and it is society's duty to prevent this from happening. Keeping the memory of the Holocaust alive is now more important than ever before, because most Holocaust survivors are either reaching the end of their lives or have already died. This is why literary and even fictional preoccupations with our past are so indispensable.

Professor Solte-Gresser's critical reflection on the untellable aspects of the Holocaust and her decoding of dreams, recovers and passes on knowledge of the Holocaust. She explains that this knowledge is not accessible in any other way. Her research helps to personalise the Holocaust and to establish individual experiences amid a sea of facts and statistics.

The Future of the Research Training Group

Professor Solte-Gresser is continuing her work on the cultural and media history of the dream in Europe, and has ambitious plans lined up for the European Dream Cultures Research Training Group. Among many other projects, Professor Solte-Gresser and her colleagues have set up a Wiki page called 'Traumkulturen', which outlines their analyses of examples – from literature, film, theatre, painting, comics, computer games and music – mentioning dreams, such as texts written by Holocaust survivors. Although still in its infancy, Professor Solte-Gresser hopes to expand the range of entries on the website and welcomes interest from researchers who want to read the contents or contribute their own material.

In addition to the joint dream Wiki, numerous books and articles on European Dream Cultures have already been published or are in the works. These attest to the Research Training Group's research achievements and serve as a comprehensive and unifying overall structure for individual research approaches. The Research Training Group also intends to continue publishing its newsletter about their activities, which is typically available each semester.

As spokesperson for the European Dream Cultures Research Training Group, Professor Solte-Gresser aims to continue the group's current activities, such as conferences, meetings, cultural projects opened to the general public, and workshops. These forums provide researchers with the space to discuss their findings with peers and wider audiences. Professor Solte-Gresser and her colleagues also incorporate their research findings into their teaching curricula, which 30 PhD students and postdoctoral researchers currently benefit from.

Meet the researcher

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After graduating in Germanic and Romance studies in Bremen and Paris, Professor Christiane Solte-Gresser obtained her PhD from the University of Bremen. Before transferring to Saarland University, she served as Associate Professor of French and Italian Literature at Goethe University in Frankfurt, and visiting professor at Aix-Marseille University in France. Professor Christiane Solte-Gresser is currently a Professor of General and Comparative Literature, and the Chair of Comparative Literature, at Saarland University in Germany. Here, she is also the spokesperson for the European Dream Cultures Research Training Group. Her main research interests are in narrative research, such as the aesthetic representation of everyday life and of dreams, the relationship between literature and philosophy, the history of autobiography and literary theory.

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FUNDING

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NOVEL SOFTWARE FOR CLEANSING DIGITISED HISTORICAL TEXTS

A fortune in historical information lies in archives and library basements around the world. Now, research by **Dr Klaus Schulz**, **Dr Florian Fink** and their colleagues at Ludwig-Maximilians-Universität in Munich is helping to bring this important information to light.

Digital Textual Archaeology

The traces of the past can be found everywhere – in buildings, in the rings of trees, in layers of ice. Yet the most useful traces are those that were deliberately made – documents written by those in the past to record their daily lives and momentous experiences. Much of this information lies in archives and the cellars of libraries, hidden away from the sunlight and from those who would most like to read it.

Yet this is changing. The ability to scan and digitalise documents means that this precious information can be taken from the archive and sent around the globe with the click of a button. Researchers can track information, correlate discoveries, and identify unexpected variations in the historical record – all from the comfort of their own offices. This has been described as digital (textual) archaeology, in which those who explore texts of the past are more often found at their laptops than in front of old books in library cellars.

The technology underlying this digital archaeology is known as optical character recognition, or OCR. OCR is the process by which a printed text is scanned as an image and then converted into a computer-legible format – a process that involves automated detection of the 'shape' of the letters in the image and cross-referencing to a database of letters. By comparing one to another, the computer can make an accurate guess as to the letters and words present in the scanned text.

This sounds simple enough, and indeed is comparatively easy when scanning printed documents or those documents with a standardised layout and clear writing. Unfortunately, most historical documents are not clear – they are handwritten, have various degrees of damage or discoloration, and often use cursive loops or unusual handwriting styles. This problem is not confined to handwritten text alone – even printed books show a surprising amount of variation in fonts and legibility. Thus, historians have been somewhat abandoned by the technological advances possible by OCR, and indeed it is only in recent decades that the technique has truly caught on in the field.

The rush into OCR has led to reams of documents that need to be accurately digitised. This has spurred other researchers to develop tools that allow

this digitisation to proceed in a rapid and efficient way. Dr Klaus Schulz and Dr Florian Fink of the internationally renowned Ludwig-Maximilians-Universität in Munich have set out to support those who are involved in the digitisation process. 'We are developing user-friendly web-based systems,' says Dr Schulz, 'allowing interactive and automated post-correction that takes into account the immense range of spelling variations typically found in historical texts.'

Post-Correction

Modern algorithms and programs for OCR are exceptionally good, often able to accurately identify individual characters 95% of the time. This is enough for many purposes, but often a historical researcher will need perfect accuracy – a text that they are certain has been encoded with 100% fidelity. This is a far more difficult process and requires that the encoded text be updated after the scan – a process known as post-correction. Unfortunately for researchers, fully automated post-correction tends to be ineffective. Minor mistakes in the software's judgement will lead to the incorporation of even more errors – often at a higher rate than the removal of the previous errors.

To avoid this, the majority of post-correction is performed by humans, usually in conjunction with some sort of software assistance. 'By using OCR, all printed materials available in historical archives can be transformed into web-searchable text, but results from historical documents are often unsatisfactory, and thus intelligent systems for post-correction are needed to help restore original documents and reach the quality needed,' notes Dr Schulz.

One area in which this is particularly challenging is that of spelling – modern spelling is significantly different to that used in the past. This is particularly noticeable when looking at documents from previous centuries, at which time the language was both very different and far more heterogeneous than the modern equivalent. This can easily be seen by comparing a bible passage: *'Jesus went throughout every city and village,'* to the Middle English equivalent *'Jhesu made iorney by citees and castelis'*. Similarly, studies of old texts show that authors used *befor, beforn, bifor, biforn, byfor, byfore* and *byforn* where we would now simply write 'before'.

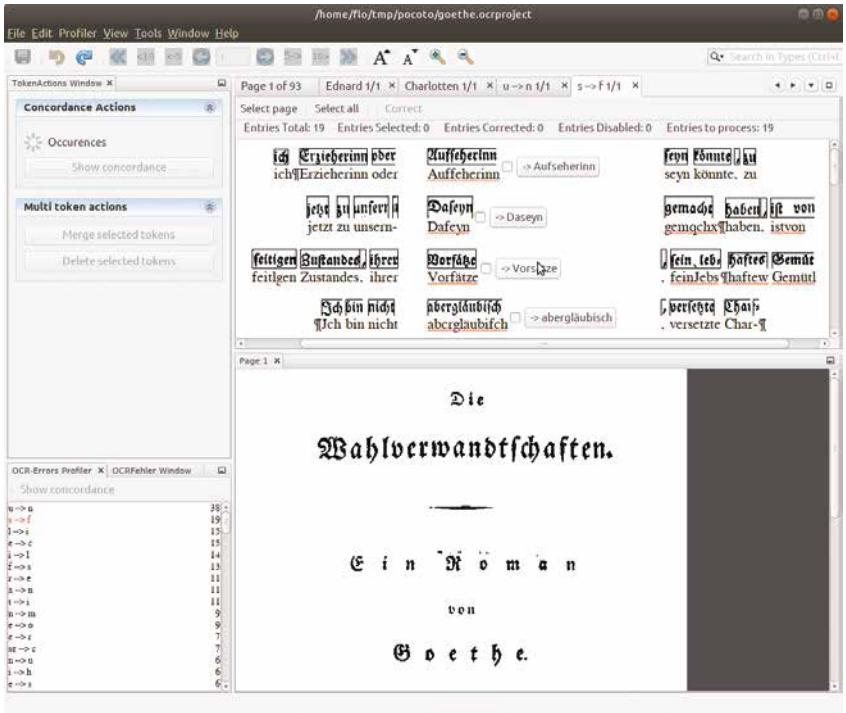
To help solve these problems, Dr Schulz, Dr Fink and their colleagues have developed an intelligent assistant. As Dr Schulz explains, this post-correction software intelligently analyses OCR-output by using a technique that provides a statistical profile of words and word series that are likely to be OCR-errors. Their software thus notes these likely errors and is able to provide suggestions that take historical spelling variation into account.

Intelligent Software

This sounds rather complicated, and indeed it is. At heart, however, the team's software can be thought of as assessing two interacting models as the document is digitalised and checked. These two models, known as the global and the local profile, provide an intelligent process for determining just what words are being scanned. More importantly, they do this in a highly automated and efficient manner.

One part of the software develops what is referred to as a global profile – one that covers the entire document or series of documents being analysed. This includes several important factors that help to improve overall accuracy, of which two are highly important. First, the typical recognition errors that are seen in the document are listed, by frequency, to give an approximate idea of how likely any particular mistake would be. Second, the typical variations in spelling observed in documents of that era are listed, including the number seen in that particular document, to help define when an occurrence is an error and when it is a spelling variation.

The other part of the team's software is known as the local profile, which is



specific to each token, or 'chunk' of text being analysed. This local profile consists of a ranked list of possible interpretations for the section that is being assessed – a smudged word may be considered to probably represent 'boat', but may also represent 'boot', 'bode' or 'beat'. The computation of the local profile combines rule-based lexicographic methods with statistical adjustments.

The combination of the two profiles allows the software to intelligently adjust assessments based on the characteristics of the document. In other words, a document that is known to consistently contain a certain spelling variant (stored in the global profile) will be able to adjust the ranking of possible interpretations in the local profile to favour this variant (or, vice versa, to ignore an unlikely variant).

Further improvements come when feedback from the user is incorporated into this learning approach. Each document is checked manually by an experienced reader, usually focusing their attention on areas that have been flagged by the software as somehow standing out of the normal next. These are often errors or incorrect assignments of words. By checking the document scan itself, the user is able to determine what the correct word should be and manually correct the digitalised version to fix the mistake.

This information is then fed back into the software and allows 'batch correction' of errors. For example, the same word may be consistently recognised as another – this occurrence can be flagged and corrected throughout the document with a few mouse clicks. Even more usefully, it is also possible to correct similar errors of the same type within different words. For example, the letters 'u' and 'n' are often confused when scanned from older texts, particularly those in heavily stylised fonts. The software allows these errors to be batch corrected, using a best-estimate guess of which words are misspelled.

The team's software also allows implementation of automated learning behaviour. In other words, the software flags potential errors and these are corrected by the human reader. This leads to an update in the global profile, noting that a particular error is more likely to occur within the document. This information feeds back into the local profile, providing an increased 'confidence' that one interpretation of the text is the correct one.

Why is this so important? The combination of profiling and machine learning means that a scanned text can be encoded to a high level of quality within a very short period of time. Indeed, as Dr Schulz notes, the software 'directly indicates conjectured errors and can efficiently correct complete series of OCR errors, offering excellent features for machine-learning-based automated correction.' This allows for the rapid digitisation of historical texts, thus bringing this once-hidden information to the world.

Reading the Words of Tomorrow

Where do the researchers intend to go from here? One potential area is that of automated categorisation. Although converting a document into machine-readable format is comparatively straightforward, actually *understanding* that text is a much harder job. Thus, the next frontier is the ability to assess the content of the historical document and assign categories and other useful metadata without human intervention.

The work of Dr Schulz, Dr Fink and their colleagues is the foundation for the spin-off company TopicZoom, which has commercialised technology for extracting information from unstructured documents (reports, articles and most of the other documents we deal with in daily life). By using this technology, in combination with their OCR software, the team was able to automate the identification of relevant topics even within old and corrupted documents.

This naturally opens up a whole new vista of automation, a true 'digital textual archaeology' in which computational linguistics performs the grunt work while the researchers can focus their limited time and energy on the important work – that of posing hypotheses, finding data and solving problems.

Meet the researchers

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Dr Klaus Schulz began his career in the traditional university town of Tübingen, where he gained his PhD in mathematics in 1987, while at the same time working in computational linguistics. After working as a visiting professor in Rio de Janeiro, he moved back to Tübingen to complete the post-doctoral qualification known as a *habilitation*. In 1991, he started his current role as a Professor of Computational Linguistics in the prestigious Ludwig-Maximilians-Universität (LMU) in Munich. A research career spanning over 30 years and more than 100 publications has eventually led him to his current focus – that of digital libraries, improvement of document analysis, and semantic search algorithms.

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Dr Florian Fink was awarded his Master of Arts in Computational Linguistics at the Centrum für Informations- und Sprachverarbeitung (CIS), Ludwig-Maximilians-Universität Munich, in 2012. He subsequently went on to pursue a PhD degree under the supervision of Dr Klaus Schulz at the world-renowned Ludwig-Maximilians-Universität (LMU) in Munich, which he completed in 2018. Alongside his PhD research, he also worked as a teacher in Computational Linguistics at the Centrum for Informations- und Sprachverarbeitung at LMU. He currently works as a Scientific Assistant at the same institution, where his research interests include digital libraries and improving the analysis of historical documents.

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FUNDING

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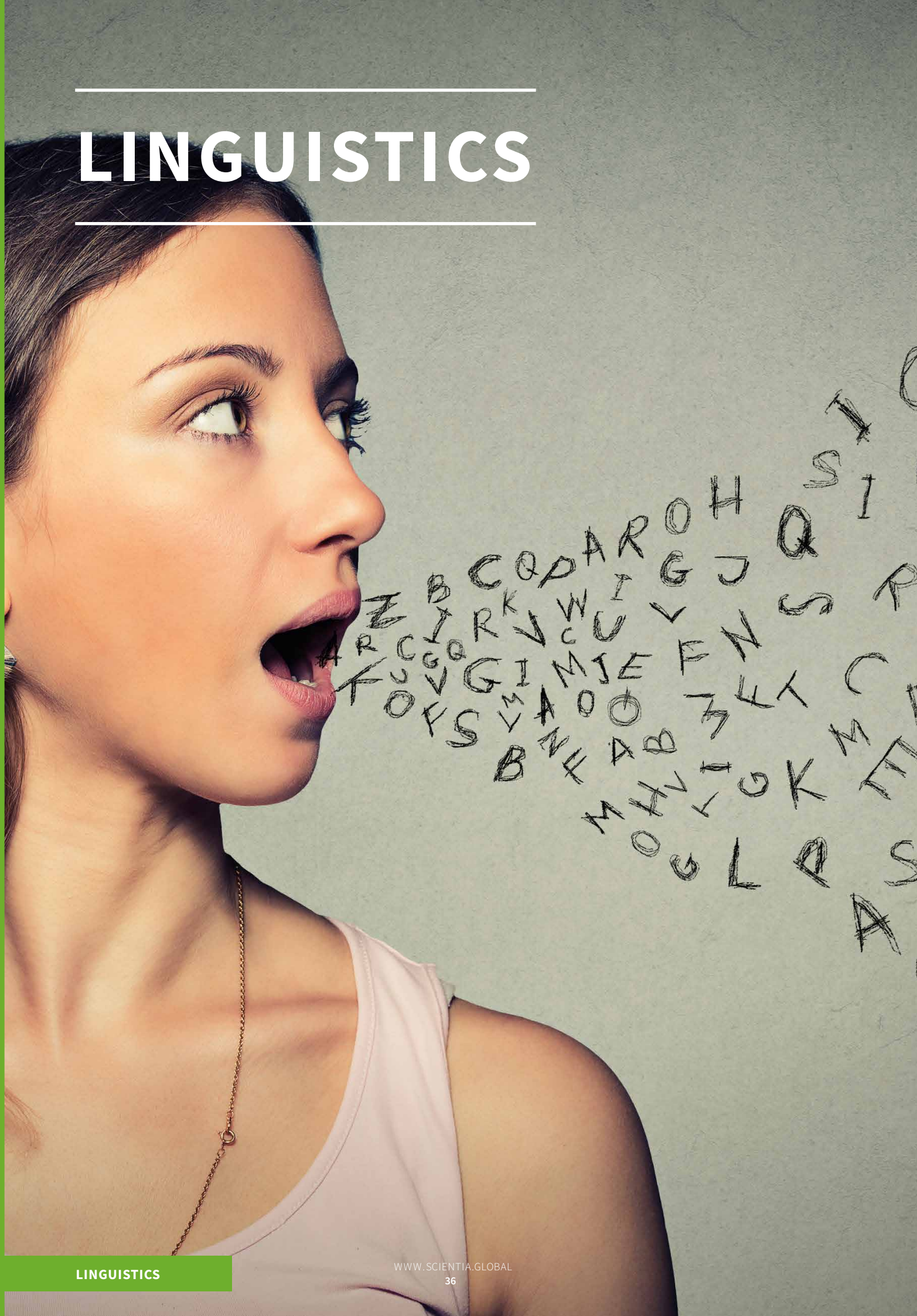
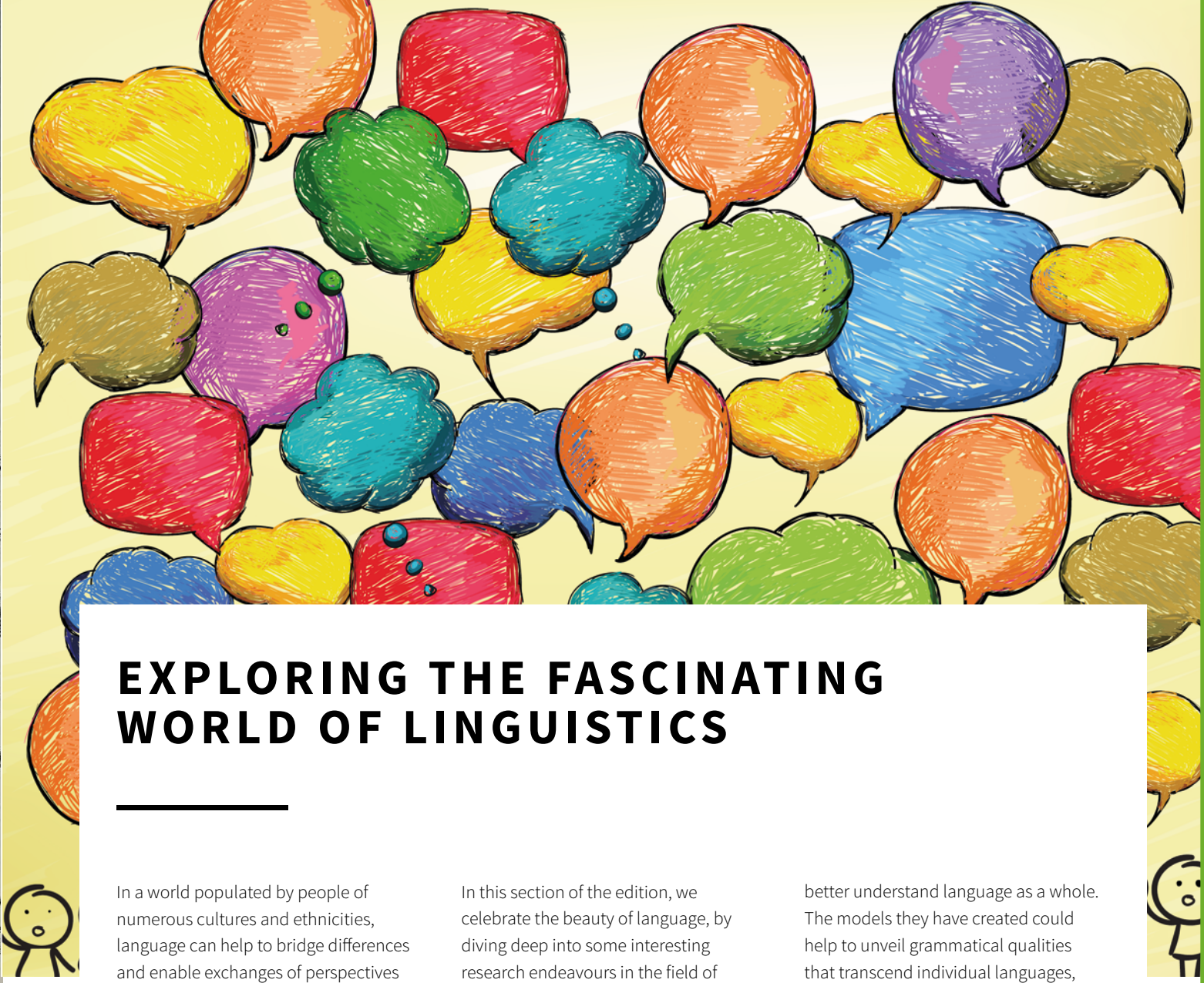
LINGUISTICS





EXPLORING THE FASCINATING WORLD OF LINGUISTICS

In a world populated by people of numerous cultures and ethnicities, language can help to bridge differences and enable exchanges of perspectives or knowledge. Throughout history, language has allowed humans to interact and cooperate with one another, creating alliances, mitigating conflicts, and fuelling innovation. It has done this while constantly evolving, as a result of interactions between different groups, and the introduction of new ideas.

Linguistics is the scientific study of the structure, evolution and meaning of language, both as a whole and in its different forms. Research in this field is of key importance, as it can unveil the peculiarities and origins of different languages, while also developing new theoretical constructs and tools to enhance communication and technology.

In this section of the edition, we celebrate the beauty of language, by diving deep into some interesting research endeavours in the field of linguistics. Firstly, we focus on the universal significance of linguistics, featuring the work of a variety of experts and researchers who have dedicated their lives to the study of language.

To open this section, we have had the privilege of speaking with Professor Penelope Eckert, President of the Linguistic Society of America (LSA) – a world-leading organisation with the mission of supporting linguistics research and highlighting its value to society. In addition to sharing some of the recent efforts in the field, Professor Eckert explains how the LSA continues to promote research into human language.

We then introduce the work of Dr Gerhard Heyer and Dr Michael Richter, two researchers at the University of Leipzig who have developed models to better understand language as a whole. The models they have created could help to unveil grammatical qualities that transcend individual languages, ultimately informing the development of tools for quantitatively understanding language.

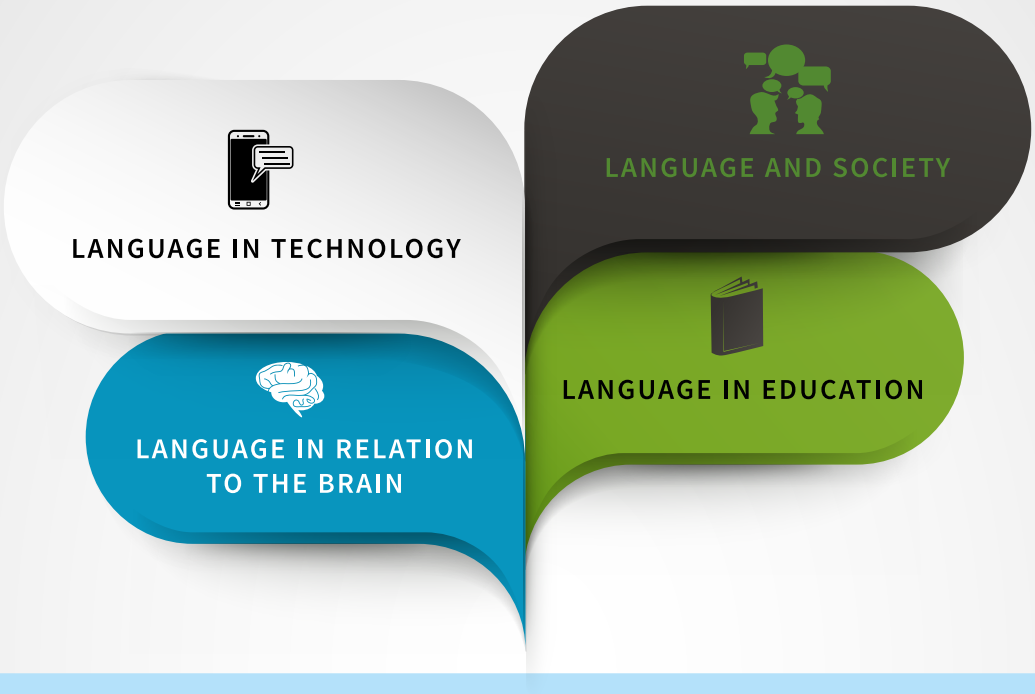
Can mathematics enhance our understanding of language and how do we teach machines to understand human speech? These intriguing questions are at the core of the next article in this section, where we consider the application of linguistics within highly scientific disciplines. Here, we present Inquisitive Semantics, a new mathematical framework for analysing linguistic meaning, developed by Dr Floris Roelofsen at the University of Amsterdam's Institute for Logic, Language and Computation. Dr Roelofsen and his colleagues have essentially introduced a new way of representing sentence meanings, which considers both statements and questions in an integrated way.

Subsequently, we ponder on one of the most widely discussed topics of the past decades, artificial intelligence, and discuss some impressive accomplishments in the area of speech recognition. Here, we highlight the work of Dr Harald Baayen and his colleagues at Eberhard Kaarls University Tübingen, who have been exploring ways in which we can train machines to listen and understand human language, while also enhancing our current understanding of how the brain works. Their work lies at the intersection between linguistics, psychology and computational data science.

Next, we reflect on the challenges and wonders of multilingualism, by featuring research that explores what happens when different languages meet, both in children from multilingual households and in encounters between people from different cultural backgrounds. In this section's fifth article, we showcase the work of Dr Natascha Müller from the University of Wuppertal, who investigates the advantages and difficulties associated with growing up in multilingual environments. Her research explores language development in multilingual children, how they learn to speak different languages in different settings, and how their communication skills compare to those of their monolingual counterparts.

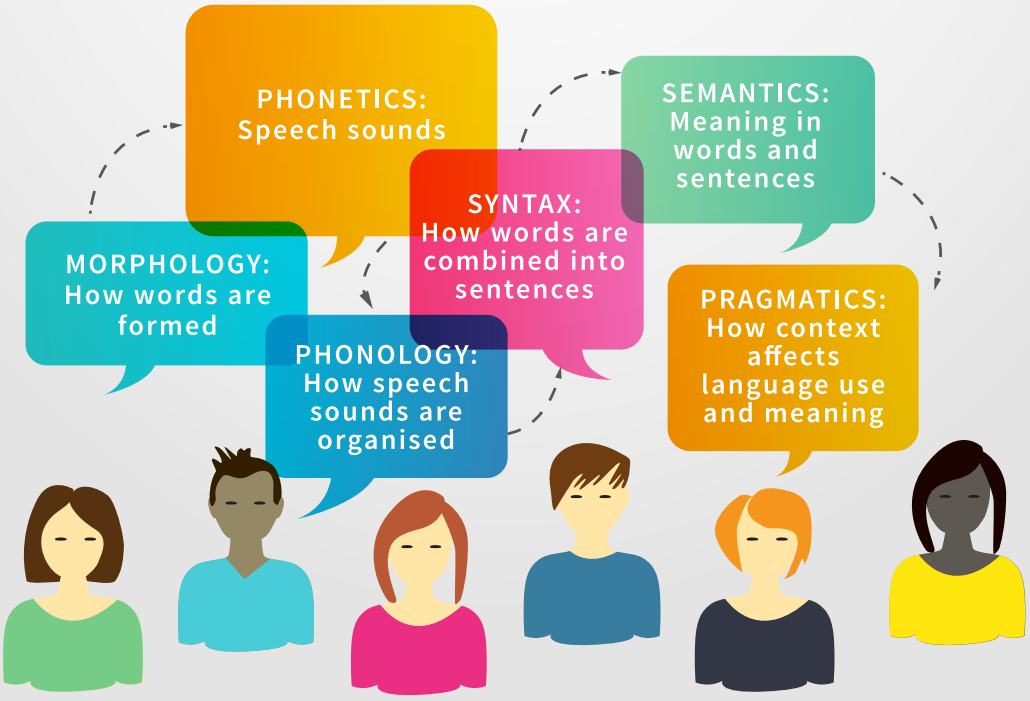
Finally, we take our readers on an inspiring journey to Japan, by sharing the story of Lafcadio Hearn, a Greek-Irish writer who coined an 'interlanguage' that is now referred to as 'Hearn-san Kotoba'. The interlanguage coined by Hearn, who later became known as Koizumi Yakumo, is an emblematic example of what can happen when one tries to acquire a complex language, such as Japanese, at a later stage in life, simply by continuously trying to communicate with native speakers. Akemi Kanazawa, a former professor of Mejiro University in Tokyo, has carried out extensive research into the unique language coined by Hearn, exploring its influences, its peculiarities, and the relevance of such an interlanguage in the context of Japanese language education.

WHAT IS LINGUISTICS?



LINGUISTICS IS THE SCIENTIFIC STUDY OF LANGUAGE

ASPECTS OF LANGUAGE STUDIED BY LINGUISTS



THE LINGUISTIC SOCIETY OF AMERICA

Almost a century ago, the Linguistic Society of America (LSA) was founded with the aim of advancing the field of linguistics – the scientific study of language. Since then, LSA has played a critical role in supporting linguistics research and highlighting its value in society. In this exclusive interview, we have had the pleasure of speaking with LSA's President, **Professor Penelope Eckert**, who discusses the important work of linguists across the globe, LSA's goals and the ongoing ways in which the Society continues to promote and facilitate the science of human language.

Why is linguistics research valuable?

Linguistics is the scientific study of language. It goes without saying that language is fundamental to human life, and understanding how language works is an essential part of human science. Linguists examine the rule-governed structures of languages, asking such things as how languages can differ and what they have in common, how language changes, how it is acquired, how it is processed in the brain, how it functions socially. Because of the central role of language in social life, linguistics offers many essential applications in the areas of human rights, politics, law, education, technology, language development, the treatment of language-related disabilities and more.

When and why was the Linguistic Society of America established?

In 1924, linguists were scattered among departments and professional societies, where empirical work on language was ancillary. Many linguists were in Anthropology departments, where linguistics was one of four subfields, particularly carrying out empirical studies of the indigenous languages of America. This work was yielding rich data, methods and theories, yet those engaged in such work had few opportunities to meet and know each other.

‘Because of the central role of language in social life, linguistics offers many essential applications in the areas of human rights, politics, law, education, technology, language development, the treatment of language-related disabilities and more.’

The LSA was founded in 1924 with the purpose of bringing linguists together – to create, and support, a unitary discipline. Departments of Linguistics began to appear very slowly over the following decades. The first volume of the LSA’s flagship journal, *Language*, appeared in 1925, and in 1928 the first summer Institute took place at Yale University. At the time, this was the only way for linguists to get together and for many students to have access to linguistic training.

The Linguistic Institutes have remained a key feature of our field, taking place on different campuses – yearly until 1987 and biennially since then. Often called ‘linguistics summer camp’, the Institutes bring together faculty and students for an extended period in the summer for courses, workshops and other activities, supporting not only learning but a sense of community in the field.

What are the Society’s current goals and vision?

We are currently in the process of updating our Strategic Plan, which includes a statement of the LSA’s vision and goals. The proposed vision statement is that we aspire ‘…to a society which respects, values and appreciates: the centrality of language to the human experience; communities and the languages they use; and the role of science in advancing knowledge.’

Our goals are to:

1. Foster inclusiveness and community among those who share an interest in language.
2. Expand public awareness about linguistics through education and outreach.
3. Promote the development and presentation of linguistic research.
4. Advance the interests and meet the needs of linguistics professionals.
5. Advocate for the value of science, including linguistics, in serving the needs of society.

Explain the connection between linguistics and human rights, and tell us about the LSA’s work in this area.

One of the hardest things for linguists to get across to the public is the fact that all languages and dialects are equally systematic. As linguists are fond of saying, a language is a dialect with an army and navy. Yet linguistic discrimination is rampant around the world. Derogating a linguistic variety is a thinly veiled way of derogating its speakers, and languages are being forced out of existence every day.
Linguists and the LSA work on a variety of fronts to improve and secure language rights. At both the national and the international level, linguists work to protect people’s right to use, and be educated in, their own language. They also support these rights through the development of language materials. They testify in cases where language discrimination has played a role, and call out cases in which language discrimination enters into official proceedings themselves.

At a policy level, the LSA is working with UNESCO and other allied organisations to plan for the observance of the International Year of Indigenous Languages in 2019, and we partner with other organisations to advance human rights.

Linguists work with communities to document and revitalise endangered languages. Explain why this work is so critical, and discuss what the LSA does to support linguists working towards this goal.

Today there are 5,000 to 6,000 languages spoken in the world,

‘At a policy level, the LSA is working with UNESCO and other allied organisations to plan for the observance of the International Year of Indigenous Languages in 2019.’

and at the rate they are disappearing, there could remain only hundreds a century from now. As we lose languages, we lose essential evidence required to understand the limits of linguistic diversity, hence of human cognition, and to reconstruct linguistic, hence human, prehistory.

Furthermore, the humanitarian cost of language loss is tremendous. Language is central to the maintenance of community, to its cultural, spiritual and intellectual life. A language dies because a more powerful language has come to replace it, sometimes bringing economic, educational and political opportunity. But it also commonly brings stigma to the less powerful language and its speakers, and negative consequences for speaking it ranging from ridicule to violent oppression. Language documentation and revitalisation can not only preserve language as a scientific resource, but counteract the moral devastation of language and culture loss.

Increasingly, language documentation and preservation is a collaborative effort, with linguists supporting the initiatives of indigenous communities. One inspiring example is work done by the Kotiria, a people numbering some 2,000, who live in the borderlands between Brazil and Colombia in remote northwestern Amazonia. In 2000, a group of Kotiria teachers founded the *Khumuno Wʉ’ʉ Kotiria* Indigenous School, with the goal of preserving their language and culture. They recruited Kristine Stenzel of the Federal University of Rio de Janeiro as a linguist researcher-collaborator. Kristine worked with the school association, composed of teachers, students, families, elders and leaders of ten Kotiria village communities, integrating the documentation of their language and culture into the curriculum.

In the years since 2002, they have developed a practical writing system, teaching materials, a multi-media dictionary, a pedagogical grammar and an archive of documentation materials including audio and video recordings of Kotiria oral literature and cultural practices, diverse speech genres and documentation materials. Thanks to their work, Kotiria continues to survive as the language of everyday life.
Of course, language documentation was at the origins of American linguistics, and linguistic theory grew up in this country in the context of this practice. But as linguistic theory has grown and subfields of linguistics have multiplied, work with undocumented languages is less at the centre of the field.

The LSA, therefore, has passed two resolutions in support of the recognition of language documentation work in hiring, promotion and tenure cases, encouraging the development of appropriate means of review of work in support of language documentation and preservation (such as the development of corpora, instructional materials and software). We also have two awards for excellence in language documentation – the Kenneth Hale Award honours scholars who have done outstanding work on the documentation of an endangered language or language family, and the Excellence in Community Linguistics Award recognises the outstanding contributions by members of language communities (typically outside the

‘Justifying steady or increased funding often means pointing to deliverables, such as technological innovations, curricular programs, or strategically important languages. It’s harder to make the case for basic research on linguistic theory or language documentation, even though these are the foundation on which more applied research is built.’

academic sphere of professional linguists) for the benefit of their community’s language.

Finally, we have a Ken Hale Professorship to support a course in field methods at our summer Institutes. The LSA is also a sponsor of the Institute on Collaborative Language Research (CoLang), an independent collaboration of academic and community linguists dedicated to the ethical and holistic documentation of endangered languages. CoLang meets in alternate summers with the LSA’s summer Institute.

What other fields does linguistic work interact with?

Many linguists are interdisciplinary and the list of fields we interact with is quite long. Linguists work in the cognitive, social and biological sciences as well as fields in the humanities, engineering, medicine, education, law and more. This is evident in the prominence of interdisciplinary subfields such as Psycholinguistics, Sociolinguistics, Neurolinguistics and Computational Linguistics.

Psycholinguists study psychological and neurological factors involved in language acquisition and processing. Linguistic expertise is crucial to technology, enabling computers to process language at the phonetic, semantic and discourse levels – and advances in this technology in turn allow us to create and work with larger and larger speech corpora. Linguistics has applications in clinical fields and education, from work on language-related disorders to first- and second-language learning, and reading. Linguists also study language interaction, interfacing with sociology and anthropology and with important applications in settings such as classrooms, workplaces, policing and courtrooms.

Finally, given recent cuts to research funding in the US, what challenges are currently facing the field?

Funding for linguistics research has mostly held steady in recent years, which is a serious problem since the cost of research has increased considerably. Linguistics funding has already been at lower levels than many other scientific disciplines, including the other social sciences. Yet our work is becoming increasingly engaged with high-cost methods, involving equipment for phonetic and brain research, the creation of large corpora and databases, experimentation, to say nothing of fieldwork. As experimental methods are growing and can cut across sub-fields, supporting the new generation of scholars in their research involves investing in their labs, technical support and equipment.

One of the challenges for research funding in linguistics is that visibility is everything. Linguistic research informs a lot of other areas, including technology, education, clinical, socio-cultural fields and the humanities, so some of it is funded through mechanisms for those domains. As a result, a lot of the general public and even legislators aren’t fully aware of the work we’re doing. Another challenge is that justifying steady or increased funding often means pointing to deliverables, such as technological innovations, curricular programs, or strategically important languages. It’s harder to make the case for basic research on linguistic theory or language documentation, even though these are the foundation on which more applied research is built.

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MODELS FOR UNDERSTANDING LANGUAGE

Languages are filled with unexplored quirks that can be attributed to more than their mere design. The way we use words has an interdependent relationship with the rules of that language. **Professor Gerhard Heyer** and **Dr Michael Richter** of the University of Leipzig have been working to create models that help us to find grammatical universals that transcend any one particular language.

A Tool to Deepen Understanding

The verbs we use in everyday speech are used for different purposes. The verb 'run' can denote two different possibilities of completion. 'I ran' is different from 'I ran to the store' in that the first use gives the verb the trait of being unbounded in time (imperfective), whereas the second use indicates a completed activity (perfective). These two different temporal structures are due to different verbal or sentence *aspects*. In some languages, verbs can be overtly marked to indicate their aspectual load – they can be marked to indicate duration, repetition, completion or quality.

In comparative language studies, there are a number of areas involving statistical data that enhance our knowledge of the nature of language. Such research can provide language models based on algorithms.

Professor Heyer and Dr Richter of the University of Leipzig have recently been focusing their studies on verbs with quantifiable, binary aspectual distinctions, such as perfective and imperfective. To a great extent, this research topic was instigated by world-leading typologist Professor Martin Haspelmath, senior researcher at the Max Planck Institute for the Science of Human History, and Head of the ERC-funded research project *Grammatical Universals*.

Dr Richter and Professor Heyer are currently endeavouring to collect data on verbs with aspectual distinctions in order to establish new algorithms. The purpose of these algorithms will be to predict certain 'asymmetries' that these verbs are coded with across languages.

The project focuses on the asymmetry between verbs aspectual coding forms. As Dr Richter and Professor Heyer point out, non-default coded verbs tend to be longer. For instance, a verb with default imperfective aspect should be longer when used with a non-default perfective aspect. Note however, that verbal aspect marking is not obligatory in natural languages: English and German for instance exhibit barely overt marking while Slavic languages have a rich aspect marking morphology.

Through establishing a connection between cross-linguistic patterns that form language and general trends of language use, the team is creating a universal model that can account for grammar across languages. This has implications for understanding language that go beyond the rules of one specific language.

A product of this project will be the creation of an analysis software tool, available to anyone, for quantitatively understanding language. The tool will be based on an evaluation and interpretation of the team's results.

Further, this technology will approach boundaries between disciplines, using predictive statistical techniques based on entropy (a gradual increase in disorder due to a large number of variables) and probability. The tool will equip linguists with the means for testing hypotheses and explanations, for example, the hypothesis that the established forms of verbs are impacted by tendencies in their usage to defer to more efficient sentence structures.

Trends in Words

It has been established that the most frequently-expressed meanings tend to be expressed by short words or phrases across different languages. Professor Heyer and Dr Richter are contributing to a new area of research that builds on this and involves attributing these tendencies to phenomena that transcend specific languages.

In the history of typology (the study of the structural and functional features of languages), statistical methods have rarely been used for examining universal governing phenomena. The team is employing special software for this project, because of the sheer volume of information required to understand trends with such scope. Only computational models are capable of validating typological universals (such as asymmetries between specific aspects of verbs) through statistically significant statements. The software tools created as a result of this project will provide linguists with a much deeper understanding of how usage tendencies create recurring grammatical patterns.

Prior research has found that the 'rules' of a language both influence and are influenced by the words speakers choose to utter. This premise will be used by Dr Richter and Professor Heyer to build on the information-theory-based approach named after the linguist George Kingsley Zipf.

Zipf's theory purported that the use of words was largely influenced by their inherent meaning – words of higher magnitude (having meanings that are employed frequently) tend to be shorter. In this view, the effect of predictability that emerges from the use of language across time was not explicitly integrated. The team's recent work seeks to address this. To achieve this, they have been utilising data of both the inherent design of asymmetries across languages and the usage tendencies across languages to establish models for prediction.

Zipf argued for a principle that states speakers of a given language will tend to favour words that require the least effort. 'Information', for example, is gradually abandoned in favour of 'info'. Serving this principle, Professor Heyer and Dr Richter are in the process of identifying a general mechanism of 'usage-based language change' that will help to create and maintain efficient language systems that centre on ease of use. They envisage that through these systems, words and phrases that communicate meaning most readily will be able to characterise language.

The Universals of Grammar

Professor Heyer and Dr Richter are in the process of documenting and explaining their concept of a model that accounts for universals in grammar across languages. The pair plans to achieve this through demonstrating a link between cross-linguistic patterns of language form and general trends of language use. Essential components in the analysis of this universal are being carried out by the software tool that is being developed during the course of the project.

There has been a tendency to examine the relationship between form and meaning to the exclusion of that between form, usage patterns and economic motivation (a tendency to use

words that are shorter and easier to say). The team has been addressing this discrepancy. Professor Heyer and Dr Richter seek to prove the idea that frequently-expressed meanings tend to be expressed by short forms. The quantities 'frequency' and 'form' are components of Zipf's law that will be pursued by extending the *frequency-form* relation to a *frequency-form/function* relation. In this way, implications for the ways in which meaning is structured in phrases can be incorporated.

Collecting Corpora

Research investigating the nature of grammar has improved considerably since the turn of the millennium. A movement to fully document the peculiarities of language has only been facilitated by database technology and digitisation's effect on the quick availability of information. This has meant that data can be collected, organised and published with drastically increased effectiveness.

Professor Heyer's team has crawled language-dense websites including Wikipedia, online newspapers and others. With the data acquired, the team is working to provide the corpora (large and structured sets of text) publicly through various forms of access so that future language technology can build on the data. In their research, the languages covered and size of resources provided by the team are constantly expanding. By providing the corpora in a uniform way for widespread use, the project is contributing to a much-improved understanding of language usage in everyday life.

In this fairly new type of research, the pair has studied the relative usage frequency of patterns in corpora between diverse languages. Through this, they are building models that establish the asymmetry in forms that exists between grammatical meanings at a universal level. There are limitations, however, on the simultaneous access to corpora from multiple languages. These place restrictions on available sample sizes.

Nonetheless, the background meanings that grammar is coded with are known to be universal, and Dr Richter and Professor Heyer hypothesise that the corresponding frequency distributions are similar across languages. As a result, smaller sample sizes should not impact the statistical value of the data to studying frequency asymmetries.

A History of Language

Diachrony concerns the ways in which languages evolve over time. The patterns that have been found in diachronic paths are the fundamental basis of Professor Heyer and Dr Richter's investigation. Diachrony is limited, however, in that usable data only extends back in terms of decades.

As such, the emphasis of their project focuses out of necessity on European, Western Asian, East Asian and Egyptian languages. It also must employ reconstructed language histories (which are available for a few additional language families). The result of these limitations is that the project focuses on present-day aspects of structure and usage, as opposed to including a long-term historical perspective.

Technologies of Prediction

Programming the team's analysis software tool will establish a degree of predictability in asymmetry for use in other research. The tool provides multiple statistical techniques based on entropy and probability so that new linguistic theories can be generated with a basis in relevant statistical data.

Statistical research has already shown that certain forms tend to be asymmetrical. There are length asymmetries between words denoting plural meanings and singular ones, and between first person and third person forms. With this software, linguists will be provided with further and more specific insight as to the patterns that coding asymmetries follow.

Future Research

In their upcoming research, Professor Heyer and Dr Richter will apply new lenses to the project's topics through diversifying approaches into further disciplines. These will include formalisms such as stochastic optimality theory (which states that language forms arise from a balance between conflicting constraints) or evolutionary game theory (the study of mathematical models of conflict and cooperation between organisms from an evolutionary perspective).

In this way, they will endeavour to explain linguistic phenomena and linguistic behaviour in a broad theory frame that captures human development and behaviour in general. This research can potentially provide us with insight into not only what informs language, but what language tells us about the world of meaning that we live in.

Meet the researchers

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Professor Gerhard Heyer holds the Chair on Natural Language Processing at the Computer Science Department of the University of Leipzig. His field of interest is focused on automatic semantic processing of natural language text with applications in the area of information retrieval and search, as well as knowledge management. Until he moved to Leipzig, he was responsible within the Olivetti Group for establishing research and development in electronic publishing and natural language processing. Professor Heyer has published numerous papers on natural language processing, including the well-known book *Text Mining – Wissensrohstoff Text* by W3L/Springer. He is currently conducting several research projects funded by the EU, the German Research Foundation (DFG), and industrial funding.

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Dr Michael Richter earned his PhD in 2000 in linguistics in verbal constructions in German. Having previously had a background as a music teacher, he switched to linguistics and finished his study as MA at the Katholieke Universiteit Nijmegen (now Radboud University, the Netherlands). Dr Richter worked at universities in Germany and the Netherlands before joining the Natural Language Processing group at the Institute of Computer Science at Leipzig University. He works as researcher in the project *Actionality classes and cross-linguistic coding tendencies: typological research and development of an analysis software tool*, which was founded by the German Research Foundation.

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INQUISITIVE SEMANTICS: A NEW MATHEMATICAL FRAMEWORK FOR ANALYSING LINGUISTIC MEANING

Semantics is the linguistic and philosophical study of meaning in human languages. **Dr Floris Roelofsen**, Professor at the Institute for Logic, Language and Computation (ILLC), at the University of Amsterdam, has been collaborating with some of his colleagues on a long-term research project called Inquisitive Semantics. This project is aimed at developing a new mathematical framework for representing the meaning of both informative and inquisitive sentences.

Semantics and Studying Meaning in Language

Language is the primary means of human communication, allowing people to exchange information, perspectives and knowledge. It is an incredibly powerful tool, as it can be used by human beings to interact, reason and cooperate with one another.

Semantics is the field of study that explores meaning in language from linguistic, logic and philosophical perspectives. Linguistic expressions have been extensively investigated over the years, with researchers developing numerous theoretical frameworks that outline the meaning and function of different types of language expressions.

Results derived from semantics studies can have a number of practical applications, for instance in computer science, where they can offer insight for the development of new programming languages, dialogue systems, automated reasoning, and other technological tools.

So far, most semantics research has focused on exploring a particular aspect of the meaning of statements, known as their truth-conditions, which specify under what circumstances a statement is true and under which it is false. This notion of meaning has proved particularly useful both in linguistics research, which tends to primarily explore the use of language in communication, and logic, which focuses on language in the context of reasoning.

However, this truth-based theoretical principle has a fundamental shortcoming: while it is helpful in analysing assertions, it does not apply to other types of sentences, such as questions. Therefore, Dr Floris Roelofsen and his colleagues at the University of Amsterdam have been developing a new framework that can adequately represent the meaning of both declarative and inquisitive sentences.

‘Everyday people hear sentences that they’ve never heard before, and usually, they effortlessly decipher the meaning of these sentences,’ says Dr Roelofsen. ‘This is because they know the meaning of the words that the sentences are made up of, and they know, subconsciously, how to construct the meaning of complex sentences from the meanings of its individual pieces. One of my main interests is to come to a better understanding of this process by developing a mathematical model of it.’

‘Over the last couple of years, we have developed a new way of thinking about sentence meanings, and of representing them within a mathematical framework, which can deal with statements and questions in an integrated way.’

A Framework that Applies to Questions

In truth-based semantic theories, the meaning of a statement is taken to lie in its truth conditions. In other words, one knows the meaning of a statement if he/she knows when it is true and when false. While this principle can easily be applied to the analysis of declarative statements, such as ‘Peter is home’, it is not suitable for questions, such as ‘Where is Peter?’.

‘Questions are not normally thought of as being true or false,’ explains Dr Roelofsen. ‘Therefore, the scope of truth-based semantic theories is severely restricted.’ This limitation of truth-based theories has led most semantics researchers to treat statements and questions as two different things, each with distinct notions of meaning.

Dr Roelofsen’s research, however, is based on the idea that questions and statements cannot be adequately understood in isolation. One of the reasons for this is that the meaning of a declarative statement often depends on the question that it addresses.

For example, the statement ‘I only read the newspaper’ would have different implications if the question asked to the speaker was ‘What did you do this morning?’ than if it was ‘What did you read this morning?’. In the first instance, it would also imply that the reader did not go to the supermarket, watch TV, or perform any other action, while in the second it would merely be concerning her reading activities.

The inability of truth-based theories to address the meaning of both questions and declarative statements inspired Dr Roelofsen to develop a new framework in which the two can be analysed together, in an integrated way.

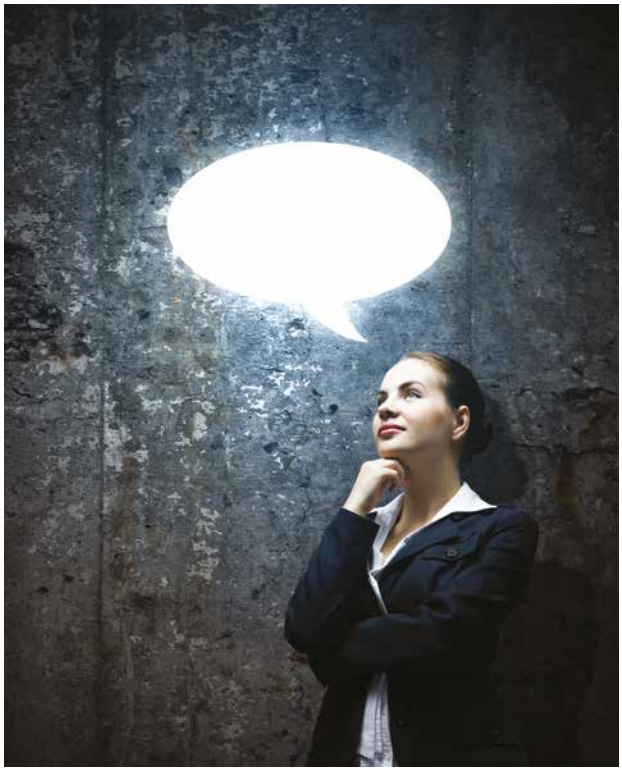
Inquisitive Semantics

Inquisitive Semantics is a semantics framework based on a new idea of meaning, which can effectively be applied to both informative and inquisitive content. ‘Over the last couple of years, we have developed a new way of thinking about sentence meanings and of representing them within a mathematical framework, which can deal with statements and questions in an integrated way,’ says Dr Roelofsen.

In Inquisitive Semantics, understanding the meaning of a sentence is not limited to understanding in which instances it is true or false, but entails understanding by what information it is supported. ‘For instance, the statement ‘Amy left’ is supported by all pieces of information that establish that Amy left, while the question ‘Which girl left’ is supported by all pieces of information that establish for some girl that she left,’ explains Dr Roelofsen.

Dr Roelofsen’s new framework considers a sentence as expressing a proposal to update the information established during a conversation in one or more ways. If a sentence offers two or more alternative updates it is ‘inquisitive’, awaiting a response from other speakers to establish at least one of these updates in information. On the other hand, ‘informative’ sentences express a proposition that contains only one possible update.

In other words, the proposition expressed by a sentence is regarded as a set of possibilities, each of which holds the potential for an update to the information exchanged in the conversation. For instance, if two people



are having a conversation about who will be attending a social event, each sentence they speak will hold the potential for one or more updates to the pool of information currently shared in their conversation. The sentence 'Will Anna be there?' proposes two alternative updates, 'Yes' or 'No', while 'Anna will be there' proposes only one.

Further Steps for the Framework's Development

Dr Roelofsen has started developing the new mathematical framework over the past few years, in collaboration with other researchers from the University of Amsterdam and other universities.

However, to attain a fully-fledged theoretical model for analysing linguistic information exchange, the researchers still need to take several important steps. Firstly, they need to gain a better understanding of how the inquisitive content of a sentence is built step-by-step from the meaning of individual words contained within it. Dr Roelofsen is currently addressing this aspect of the framework in a project called 'Inquisitiveness below and beyond the sentence level', funded by the Netherlands Organisation for Scientific Research (NWO).

In a document summarising the purpose of this new study, he says: 'We now have a new way of thinking about sentence meanings. But how are such sentence meanings derived from the meaning of the words that the sentence is made up of? This requires us to look at meaning composition below the sentence level.'

As part of the NWO project, Dr Roelofsen and his colleagues are also trying to better understand how the meaning of one sentence can affect the meaning of another, by investigating the dynamics of meaning beyond the sentence level.

The Inquisitive Semantics framework has also added new concepts relevant to the field of logic, which traditionally focuses on relations between different sentences. In a project called 'Quantification and Modality in the realm of Questions', funded by the European Research Council (ERC), the researchers are also looking to further examine the meaning of specific 'logical' parts of a sentence, using the new framework they developed to broaden the scope of existing linguistic and logical theories.

The ERC project particularly looks at the meaning of connectives (for example: and, or), quantifiers (for example: every, some), and modal expressions (for example: must, might). 'Work on Inquisitive Semantics has led to a better understanding of connectives, capturing their role in statements and questions in a uniform way,' states Dr Roelofsen. 'Quantifiers and modal expressions, however, have not yet received much attention. I think that in this area, too, Inquisitive Semantics has the potential to lead to substantial new insight.'

A Promising Theory of Meaning

With his work on Inquisitive Semantics, Dr Roelofsen has largely contributed to the study of semantics, developing a new mathematical framework that allows for deeper and richer analyses of information exchange through language. Unlike truth-based theories, which have so far been used in most semantics research, Inquisitive Semantics provides a notion of meaning that captures both informative and inquisitive content.

The new framework also changes some perspectives commonly adopted in the fields of logic, linguistics and pragmatics, giving rise to new concepts that differ from those presented in prior semantics theories.

'Since this simple shift in perspective happens at such a basic level, it has repercussions for all scientific disciplines that are concerned in one way or another with meaning,' says Dr Roelofsen. Among other things, Inquisitive Semantics could pave the way for new computational applications, for instance database systems, where it could lead to the development of techniques that support a wider range of queries than current systems. The framework could also be applied in communication and multi-agent computer systems, which are generally built on logical theories.

'Over the next couple of years, we will further develop the Inquisitive Semantics framework and use it in a number of concrete case studies to come to a better understanding of the meaning of questions, quantifiers, modals, conditionals, and anaphora,' says Dr Roelofsen.

Meet the researcher

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Dr Floris Roelofsen is an Associate Professor of Logic and Semantics at the Institute for Logic, Language, and Computation (ILLC), which is part of the University of Amsterdam. Dr Roelofsen holds a BSc in Mathematics and an MSc in Artificial Intelligence from Twente University, in Enschede, NL, as well as an MSc and PhD from ILLC. In recent years, Dr Roelofsen has been working on a long-term research project termed Inquisitive Semantics, which explores the meaning of questions and other inquisitive sentences. He has received multiple grants for his studies, was interviewed by Dutch and international media, and has over 35 publications in his name, including scientific papers, book chapters, and edited volumes. Dr Roelofsen has been invited to give talks and masterclasses at several prestigious academic institutes in Europe, the US and Asia, and has contributed to many conferences and workshops around the world. He is currently an Associate Editor of the *Journal of Semantics*, and has also been Chair of numerous international semantics conferences.

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ARE YOU LISTENING? TEACHING A MACHINE TO UNDERSTAND SPEECH

In the past few years, speech recognition has become a new standard for state-of-the-art technology. We now talk to our phones as much as we talk on them. How can helping machines learn to listen improve our understanding of how our own brains work? **Dr Harald Baayen** at Eberhard Karls University Tübingen and his collaborators work at the intersection of linguistics, psychology, and computational data science to illuminate elegant solutions for processing speech.

What's So Hard About Speech?

We've all been there. You say something to Siri or Alexa or Google, and what she repeats back is a baffling far cry from your original statement.

'Hey Siri, what's the weather in Denver today?'

'Ok. Calling Mom.'

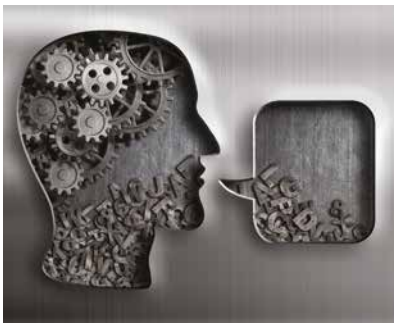
Why do even our most advanced versions of speech recognition software struggle so much with understanding simple requests? It turns out that listening isn't as simple as it might seem. When your digital assistant is trying to figure out what you just said, it has a lot to parse out. The unique way you pronounce the letter O, the subtle shift between 'then' and 'than', the two different ways you say the 're' in 'record' when talking about recording a record. Scientists are just beginning to scratch the surface of how the brain processes speech and how we might train computers to do the same.

Breaking Down Words

In introductory linguistics, students learn that words can be broken down into various units depending on what you are aiming to study. Phonemes are the units of sound that compose words in a particular language. For example, the word 'at' has two sounds, 'ah' and 't', which are both phonemes in English. Lexemes are units of meaning, a word and all of its related forms. For example, the lexeme 'jump' includes the forms 'jumped', 'jumps', 'jumping', all of which indicate that someone or something leapt or will leap into the air.

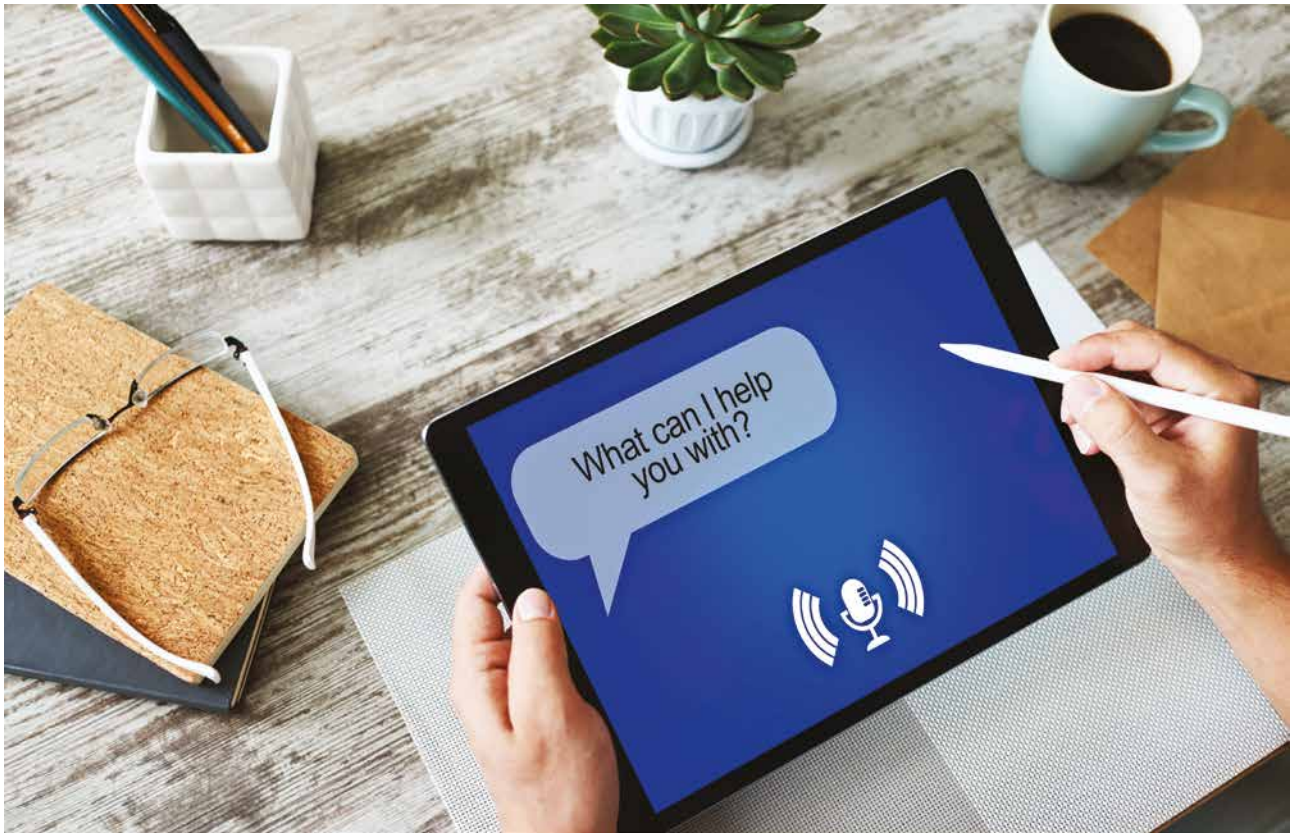
Morphemes are the smallest units of words that still carry meaning. Many of the morphemes in a language are words themselves, but prefixes and suffixes that modify the meaning of a word can also be morphemes. For example, the word 'dogs' contains two morphemes: the word 'dog', which conveys a domestic canine, and the word modifier 's', which means there's more than one of them.

Many studies have posited that morphemes are natural units of all languages, with evidence for morpheme



processing areas in the brain. Some schools in linguistics focus on the morpheme as an important component of language processing. Many computational models of language processing focus on morphemes as critical units, creating complex systems to parse meaning out of complex words that the human brain identifies with ease. These models typically require a lot of manual input – researchers need to set up complex rule systems, define morphemes and their alternative forms, devise mechanisms for dealing with exceptions, and give up on irregular forms that are not well predictable by rules.

Computational psycholinguist, Dr Harald Baayen of Eberhard Karls University Tübingen and his colleagues recognised that there had to be a better



way. Utilising a much simpler algorithm, dubbed the Linear Discriminative Learner (LDL), the research team focuses on modelling triphones (sequences of three phonemes) rather than morphemes. Within a given language, triphones are the possible combinations of three sounds. For example, in English, 'kin' ('k-ih-n') is a possible triphone, but 'kni' ('k-n-ih') is not. It is important to note here that triphones focus on sounds and not spelling – the English word 'knife' consists of the triphone 'n-eye-f'. An LDL of English words would include 'kin' but not 'kni'. LDL is not concerned with the morphemes present in a word, just its sound components.

'A crucial part of my model is that form and meaning are represented by numerical semantic vectors, and simple linear transformations between these vectors turn out to work surprisingly well for modelling comprehension and production,' explains Dr Baayen. In his model, semantic vectors quantify to what extent a given word makes one think of any other word. 'Ship', for example, might make one think primarily of 'sea', 'captain', 'cargo' and 'waves', whereas 'pasta' may lead to thoughts of 'Italy', 'spaghetti', 'pesto' and 'tomato sauce'.

The team's LDL model yields surprisingly elegant results. With relatively simple calculations, it is able to map word form to meaning, and vice versa, without hundreds of rules for morpheme forms necessary for a typical language processing program. Further, it may provide evidence that morphemes aren't as natural a component of language as thought. Triphone maps naturally organise into clusters similar to morphemes, without the complex computations needed to generate the same maps from morphemes. Language processing that focuses on sound patterns rather than whole words offers a simpler way to get to the same solution. Dr Baayen comments, 'One thing that is becoming increasingly clear is that these classical symbolic approaches severely underestimate how very rich our speech is, and how informative this richness is.'

Tracking Speech Sounds

Sounds could be a simpler focus for the machine processing of speech. However, relying on sounds can be tricky too. Frequently used words tend to be shortened in speech, to form what linguists call 'reductions'. Syllables get dropped, vowels get shortened, and the words in commonly used phrases begin to blend together. If you've ever said 'ain't' or told anyone to 'c'mon', you've participated in this phenomenon. 'One of the most striking aspects of reductions is that if you listen to them out of context, you have no idea what is meant,' notes Dr Baayen. Understanding reductions is essential for creating computer programs that can recognise the words in a sentence correctly.

Dr Baayen and his colleagues recognised that multiple factors are at play when predicting how a person will say a given word. Theories of why common words get shortened often focus on reduced effort but miss a critical point: most people have more practice saying common words. How many times have you said the word 'the' in your life? The team predicted that words we say frequently may be shorter because we are better practiced in the mouth movements necessary to form them in different contexts. For example,

the muscles in your mouth and tongue must go through different transitions to say 'the' when you're saying 'touch the screen' versus 'to the moon'. However, since you have so much practice saying 'the', it is likely that your mouth can rely on muscle memory to quickly say either phrase.

Dr Baayen and his collaborators tested this prediction in an experiment with native German speakers. Participants were recorded saying similar words that vary in frequency in the German language. The team focused on two factors, clarity and smoothness. Clarity indicates that syllables were spoken correctly, while smoothness indicates that sounds were shifted to make the transitions between words easier. The researchers found that the vowels of infrequent words were spoken clearly, with a lowered jaw, and that for medium frequency words the jaw was lowered less, with somewhat reduced tongue movements favouring smoothness. Interestingly, high-frequency words were able to cater to both clarity and smoothness, not lowering the jaw by much but at the same time articulating with large articulatory gestures. The researchers posit that the practice in saying these words allows speakers to more quickly transition the muscles of the mouth without losing clarity.

It is not only the frequency of a word that influences how it is said. Even the same word said by the same person can sound quite different across situations. For example, think of the difference in your speech when you are very excited versus when you are very tired. The rate, annunciation, and pronunciation of each phoneme in your words would vary dramatically, even if you were speaking the same sentence. Despite this variance, we typically have no problem understanding words that have shortened or alternatively pronounced phonemes – we often don't even notice.

A Simple Solution

Historically, most linguistic theories have assumed that speech comprehension is phoneme based, requiring complex neural networks to interpret variations in phoneme pronunciation. Dr Baayen and his colleagues have developed computational speech recognition algorithms that recognise speech within the human range of accuracy, without using phonemes at all. Instead, the program focuses on changes in sound frequency with each word, using a simple but wide network that has numerous acoustic features as inputs. The success of the program offers hope for advanced iterations of digital assistants that can understand speech better without the need for complex processing systems. 'We are exploring what can be done with much simpler networks, but networks with lots of units, hence "WIDE" learning networks, combined with smart features.'

In an expansion of this work, Dr Baayen and his colleagues have developed a computational network that can recognise isolated words with greater accuracy than many of the more complex speech recognition programs on the market today. Using acoustic features that summarise patterns of change in the different frequency bands that the cochlea in the human ear is sensitive to, the native discriminatory learning (NDL) system was trained to learn words by watching hours of TV news broadcast. Using a layered wide network framework, the system excels at recognising single words without the computational complexity of standard speech processing software. Further, it is capable of improving accuracy the longer it learns from a speaker. The elegance of the team's findings suggests that neural networks for speech recognition in the brain could be far simpler than previously thought. However, the team has more work to do, as they have not yet shown that their system can be expanded to understanding words in running speech.

Appreciating the Experienced Mind

The team's speech recognition work ties research from the fields of linguistics, psychology, and computational data science to both improve technology and illuminate how neural networks in the brain may work. His experience in these arenas has led him to investigations of another aspect of the human experience – aging.

It is commonly held that aging is associated with cognitive decline. Older individuals often demonstrate slower reaction times during memory tests, that is assumed to be the result of neuron deterioration in the brain. Dr Baayen and his collaborators have come to a different conclusion – these slower times are not the result of decline, but of the limits of information processing speeds in the brain. Older adults have accumulated a lifetime of knowledge that they must sort through to get to a particular fact. It takes longer for the brain to search these vast memory stores, slowing reaction times. Dr Baayen and his colleagues have harnessed their knowledge of the brain and computational prowess to build simulations of this phenomenon that predict performance results seen in real life.

The team's research is shifting our view of how the brain handles information, accelerating our understanding of how speech is processed, and improving our technology's ability to understand us.

Meet the researcher

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Dr Harald Baayen began his linguistics career at the Free University of Amsterdam, obtaining a bachelors, masters, and PhD in General Linguistics. He went on to join the scientific staff at the prestigious Max-Plank Institute for Psycholinguistics for eight years, before joining the faculty at the University of Alberta, Edmonton and then Eberhard Karls University, Tübingen as a Professor of Quantitative Linguistics. His work focuses on human speech, both how it is generated and how it is processed by the brain and machines.

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MULTILINGUALISM – A BARRIER OR A BLESSING?

Many children grow up in a multilingual environment, and they need to learn and use these languages in different settings. In some cases, they even need to learn and use a new language to confidently engage with their community and to grow within it. **Dr Natascha Müller** from the University of Wuppertal has been researching how multilingual children negotiate this situation, and how they stack-up against their monolingual counterparts in terms of language proficiency.

The Emergence of Multilingualism

Advancements in transport systems and communication technology have made it easier for people to relocate. Many move to a new country to flee disaster, to study, to work or simply to seek a better life. Others marry citizens of other countries. As a result, multicultural, multilingual societies are common.

In most cases, members of a multilingual family will speak one or two languages at home. But they will often need to learn and use a new local language outside the home. As far as children are concerned, this local language is needed to engage effectively with schooling and their peers. As they get older, their second and third mother tongue will be called on in other contexts, such as to gain employment. Of course, this presents a challenge. There is a lot to negotiate and the stakes are high.

Understandably, many focus their efforts on the language needed most, seemingly at the expense of another. If the disregarded language is their new language, then their success in their new local community could be jeopardised. By the same token, disregarding their first language, or that which is spoken at home, could negatively impact their personal or cultural identity.

Dr Natascha Müller from the University of Wuppertal has devoted much time to understanding how children acquire languages, particularly in multilingual environments. And interestingly, while it has been suggested that trying to master two languages negatively impacts upon language proficiency, she has found that it's not that 'cut and dried'. In fact, in cases where a child learns three (or more) languages in early childhood and thus becomes a trilingual speaker, acquisition of a second or third mother tongue can be accelerated, even though the time of exposure is divided across three (or more) languages.

Questions in the Study of Multilingualism

Recent research into multilingualism has focused on how bilingual children acquire their two languages from birth. As a result, the information available focuses on that specific setting. From this research, linguists make assumptions about how children typically learn and use languages in their environment, and the potential barriers to becoming competent in the language used by society at-large. One

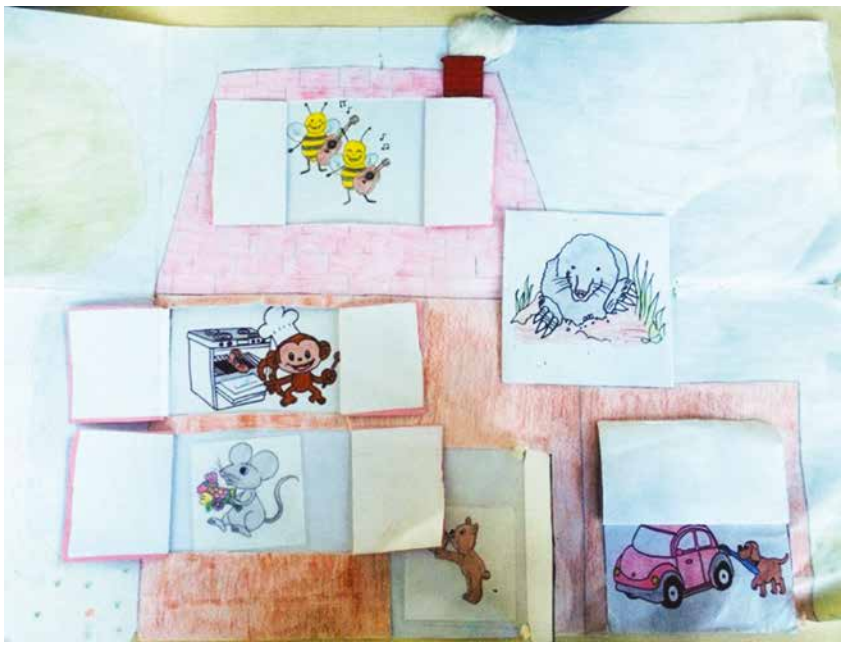

Figure 1. The Crazy-House Test. Story: A mole was introduced to the child. Moles live under ground and have poor eyesight. A house was introduced that hosts crazy animals. The child was asked by the experimenter to open the windows one after the other and describe to the mole what the animals do (play the guitar, kiss a ball, eat a bouquet, bake a shoe, clean a car).

of the main conclusions is that with bilingual children, the learning and use of one language can delay the learning of the other.

However, Dr Müller suggests that limiting research to settings of bilingualism could be giving us a false impression. So, she decided to extend the scope of the research to include instances of trilingualism – where a child, due to their circumstances, has learnt three (and sometimes more) languages. By moving the goalposts, as it were, she has gained new insight. In a nutshell, she has observed that learning three or more languages helps children to more readily acquire and use complex language structures in comparison to their monolingual counterparts. The focus of Dr Müller's work has been combinations of languages that include the so-called 'Romance languages'.

Combinations Involving Romance Languages

The Romance languages are those historically derived from Vulgar Latin; forming a subgroup within the Italic branch of the Indo-European language family. The common languages within this subgroup are Spanish, French, Italian, Portuguese, Romanian and Catalan.

In one study, published in 2018, Dr Müller and her colleague examined multilingual children's use of complex grammatical structures in German (see Fig. 1). German is not a Romance language, and is instead what's known as a 'V2' language. This means that, in general, the verb follows the first part of the clause. Romance languages, on the other hand, are non-V2. Generally, the verb follows the subject, like it would in English. Through a series of tests, Dr Müller examined how multilingual and monolingual children were able to correctly make this distinction in spoken German. Interestingly, they concluded that in comparison with monolinguals, multilingual children have advanced skills in this area.

In another article published in 2018, Dr Müller and her colleague tested whether skills in other Romance languages could speed up the acquisition of French (see Fig. 2). To do so, they tested the proficiency of 62 multilingual children living in Spain and Germany in using a certain complex grammatical structure in French, in comparison to monolingual French speaking children. In this instance, both the bilingual children and the children who acquired more than two languages were accelerated with respect to using that grammatical structure.

Yet another 2019 study carried out by Dr Müller and her colleagues sought to investigate language mixing in multilingual children (a phenomenon known as code-mixing). Previous studies have claimed that multilingual children often mix their languages, and that they do so in order to fill competence gaps in their less proficient language from their more proficient language. In Dr Müller's study, 122 multilingual children were tested in a monolingual setting, meaning that the interacting adult spoke with the child in her or his mother tongue and signalled that mixing of languages was not desired. The researchers observed that the children accepted the monolingual setting and behaved monolingually while communicating with the interlocutor.

'Among the tested children there were children who were less proficient in the vocabulary of at least one of their languages as measured on the basis of a receptive vocabulary test. Notwithstanding, they used the language of the interacting adult throughout the testing,' says Dr Müller. 'This shows that multilingual children are well able to use the language desired by the communicating partner and that they can behave monolingually in all of their languages, even in their less proficient ones.'

The Use of the Spanish Verbs 'Ser' and 'Estar'

Another one of Dr Müller's areas of study has been investigating how children

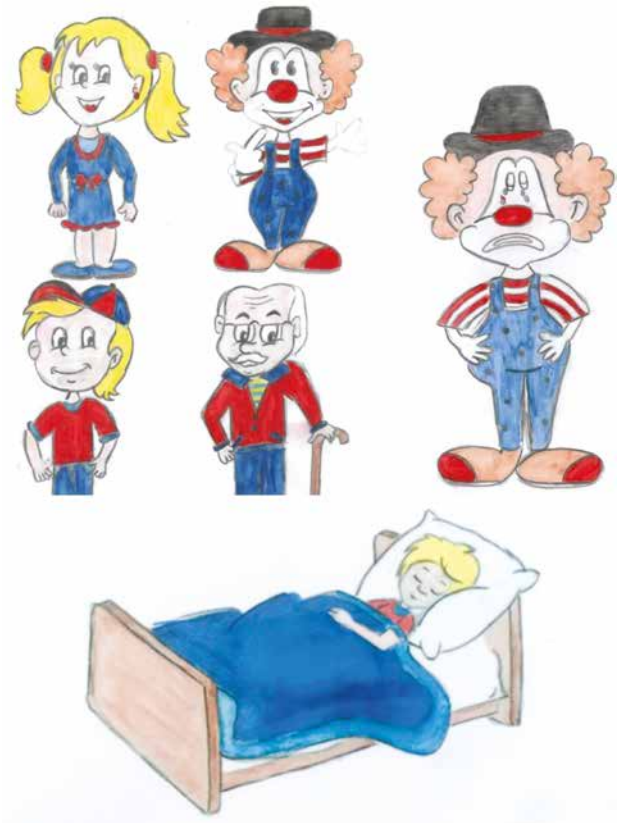

Figure 2. Story: A clown, boy, girl and grandfather were introduced to the child on separate cards before the test began. The child was shown a card by the experimenter and was asked to describe what the clown (cry), the boy (sleep), the girl (jump) and the grand-father (laugh) do.

use the Spanish base words 'ser' and 'estar' – derivatives of the verb 'to be'. In summary, 'ser' is used when the object being described is in a permanent or near permanent state, while 'estar' is used when the object described is in a temporary state. For example, forms of the verb 'ser' would be used to describe someone who is married, short in stature or thin. Forms of the verb 'estar' would be used to describe someone who is ill, or lost, for example. Using these verbs in the appropriate context is a challenge for adult language learners, let alone children.

In this particular research project, Dr Müller examined the use of 'ser' and 'estar' derivatives by 72 different children. While most children found using 'ser' derivatives to be far more difficult, Dr Müller found that children who have acquired another language with similar grammatical nuances (in this case, Portuguese and Catalan), were more adept at using 'ser' derivatives when communicating in Spanish. This was yet another example of multilingual children performing better than expected.

Summing It Up

Dr Müller's research projects have analysed language production and comprehension skills across different grammatical domains in French, German, Spanish and Catalan, focusing on children from trilingual backgrounds. Dr Müller has found that trilingual children perform extremely well in particular grammatical domains, including the position of subjects in French, the position of finite verbs in German, the choice of the verbs 'ser' and 'estar' in Spanish and Catalan. In fact, for some grammatical domains, the multilingual children outranked monolingual children, although the latter have more input in the respective language. This is true even for multilingual children who master the respective language to a limited degree.

In conclusion, as Dr Müller wrote in a research summary, 'early child trilingualism does not necessarily delay acquisition in relation to monolingual and bilingual children; on the contrary, acquisition can be accelerated. It is accelerated although the time of exposure has to be divided across three or more languages and although some children use the minority language(s) less frequently in their everyday life.'

This deduction challenges the assumptions made in current research, that is, that learning two languages side by side will limit proficiency in one or both of the languages. It also shows how the scope of studies into multilingualism in children may need to be broadened. In one research paper Dr Müller and her colleague concluded, 'our research highlights the need for more studies in the field of multilingualism beyond bilingualism with the tools used in longitudinal studies of spontaneous child speech. Furthermore, cross-sectional studies of bilingual, trilingual, and multilingual children should include comparisons with monolingual children.'

The Need to Promote Active Multilingualism

Active multilingualism has often been seen as a hindrance, and in many cases, discouraged. However, as Dr Müller's research has shown, it need not be. In fact, it is something that children should embrace. Remembering that languages are used to function in society and are integral to developing identity, the benefits to active multilingualism are clear. But how can it be promoted?

Many people feel that if their children attend a bilingual kindergarten or school, then this can, through use, keep their languages alive. However, Dr Müller's most recent research very much points to family input and cultural elements as having the greatest impact on promoting active multilingualism. These, therefore, need to be the focus. This includes the creation of a linguistically stimulating environment through cultural contact within the family.

In conclusion, it is a challenge to learn a new language and adapt to a new community. Proficiency in the local language is a must – it affects one's employment prospects, and one's ability to acquire basic necessities and to feel contentment and belonging. It is vital, therefore, that we understand how children learn and adapt to these changing circumstances.

CREDIT: Ramona Petrolle

Meet the researcher

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Dr Natascha Müller received her PhD in Linguistics from the University of Hamburg in 1992. Her thesis considered word order acquisition by bilingual German-French children. After her PhD, she stayed at the University of Hamburg for some years. She then relocated and was appointed as Professor of General and Romance Linguistics (French, Italian, Spanish) at the University of Wuppertal. She has also since taught and conducted research at many universities throughout the world, in countries including the US, Norway, Austria, Spain and Canada. She has also worked with many other professionals in the field to develop learning resources for studies in linguistics, especially the Romance languages. The focus of Dr Müller's recent research has been the accelerated acquisition of languages by children in multilingual environments in comparison to their monolingual counterparts.

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THE LANGUAGE OF KOIZUMI YAKUMO – FROM THE STANDPOINT OF JAPANESE LANGUAGE EDUCATION

Koizumi Yakumo, formerly known as Lafcadio Hearn, spent his final decades in Japan, a country that fascinated and inspired him. As he was unable to fully acquire Japanese language, he coined an interlanguage referred to as 'Hearn-san Kotoba'. **Professor Akemi Kanazawa**, a former professor of Mejiro University, Tokyo, has carried out studies exploring this language and its peculiarities, particularly in the context of Japanese language education.

'Hearn-san Kotoba'

Lafcadio Hearn (1850–1904), who later became known as Koizumi Yakumo, was a Greek-Irish writer, renowned for his books, stories and letters. During his life, he settled in various places around the world, including Greece, Ireland, the United States and the West Indies.

Hearn spent his later life in Japan, where he wrote several books about the Japanese culture. His late works, such as *Kwaidan: Stories and Studies of Strange Things*, introduced folklore and ancient Japanese legends to the Western world. As he was never able to fully acquire Japanese grammar, Hearn communicated with his wife Setsu Koizumi and other locals using an 'interlanguage', which he called 'Hearn-san Kotoba'.

In one of her notes, his wife Setsu wrote: 'Being fond from my girlhood years of old tales, I began telling him long Japanese old stories, which were not easy for him to understand, but to which he listened with much interest and attention. He called our mutual Japanese language "Hearn-san Kotoba" (Hearn's language).' Initially, Hearn communicated with his wife in broken Japanese, while Setsu tried to adjust her language so that he could understand it. Hearn's unique 'interlanguage' was a product of several years of communication with Setsu.

In linguistics studies, the process through which this language was established is referred to as pidginization. Pidginization occurs when a language is transformed into a simplified form of speech, characterised by a rudimentary grammar and vocabulary. This simplified speech is typically used as a means of communication between individuals with different native languages.

From a linguistic point of view, 'Hearn san Kotoba' is an interesting topic of study, as it essentially stems from continuous interactions between two foreign individuals. Fascinated by this language and its peculiarities, Professor Akemi Kanazawa has carried out a series of studies, analysing it from a Japanese language education standpoint.

Hearn's Letters and Setsu's Memoirs

In her studies, Professor Kanazawa analysed extracts from Hearn's letters and from his wife's written memoirs. She observed that Hearn's Japanese was highly influenced by English, his native language. 'Judging from Hearn's letters in which written Japanese remains and Setsu's memoirs *Omoide no ki*, in which spoken Japanese remains, it can be inferred that Hearn's Japanese is much interfered by his mother tongue English, in both aspects of syntax and expression,' Professor Kanazawa wrote in one of her papers.

When Hearn taught English to his son, Kazuo, the Japanese he used was often a literal English translation. For instance, he translates the sentence 'It is a dog' as '*Sore desu ichi-inu*' ('*Sore desu*' → It is; '*ichi inu*' → a dog). However, in standard Japanese, this would be translated as '*Sore wa inu desu*'.

'Hearn-san Kotoba' also removes redundancies associated with standard Japanese grammar. Professor Kanazawa found that Hearn used a total of approximately 150 verbs without conjugating them, as a Japanese speaker would. In his letters and verbal communication, Hearn used verbs in their 'dictionary form', without conjugating them, but instead adding a '*desu*' auxiliary verb to show polite nuance. According to Professor Kanazawa, Hearn's frequent use of polite expressions could have been an influence of his wife Setsu, as her family had samurai antecedents and would have often communicated using such expressions.

Setsu's letter to Hearn, August 23rd, 1904. Koizumi Toki 'Hearn and I' Kobun-sha 1990.

Japanese verbs fall into three main categories: I-group, II-group and III-group. III-group verbs only include the verbs '*suru*' (to do) and '*kuru*' (to come). Professor Kanazawa observed that Hearn often used these verbs improperly, for instance adding a variety of improper nouns before '*suru*', like in standard Japanese (e.g. '*benkyo-suru*' → to study), and coining entirely new expressions. He also used '*aru*' (there is), which Japanese speakers only use when referring to inanimate objects, to refer to animate things. He also used it as a word with many different meanings.

Setsu's Foreigner Talk and Writing

'When we, Japanese people, talk to non-native speakers of Japanese, we make effort to simplify the language as much as possible for smoother communication, such as non-conjugation of verbs and adjectives,' Professor Kanazawa wrote. When Setsu communicated with Hearn in person, she used a simplified version of Japanese, which is linguistically referred to as 'foreigner talk'. She also used a simplified written version of Japanese, referred to as 'foreigner writing'.
In her studies, Professor Kanazawa observed that Setsu's foreigner writing had greater peculiarities than her foreigner talk. For example, in her foreigner writing, Setsu often simplified the structure of her sentences and yet expressed their content in great detail. For instance, she often used onomatopoeia and mimetic words to better convey the details of a given scene.

'Setsu's expressions in her letters are full of colour and music, and form her own unique world,' Professor Kanazawa wrote. 'In her letter dated August 23, 1904, as an expression to make the reader feel colourful, Setsu wrote about flowers of morning glory. To make the reader feel the sounds, she wrote that all who were there were women and they were all noisy, *hohohohohoho*.'

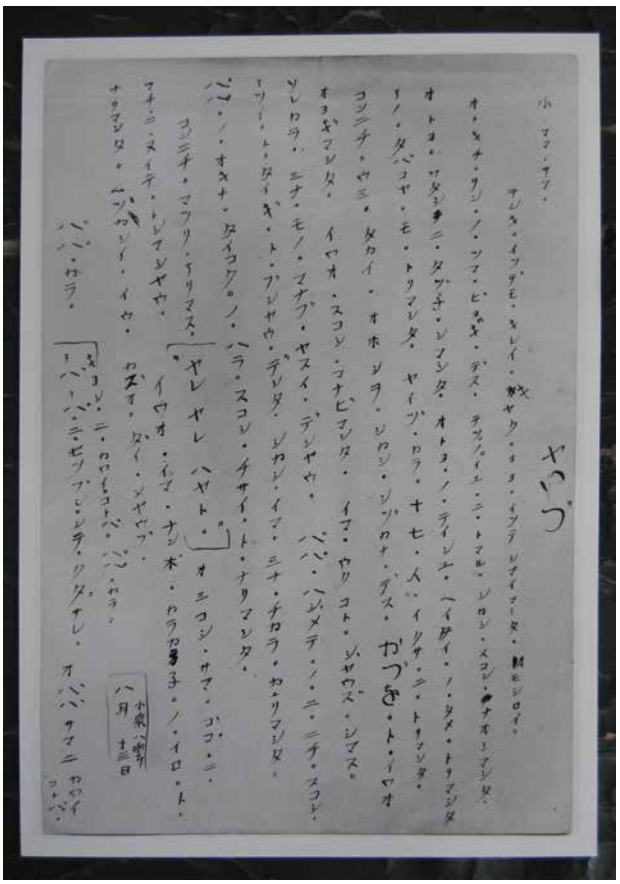
According to Professor Kanazawa, Hearn drew inspiration from Setsu's use of onomatopoeia and mimetic words. In their writing, they both used mesmerising expression that conveyed rich feelings. As Hearn could not read Japanese books by himself, Setsu would often tell him tales and legends, some of which became the inspiration for his works.

Both Setsu's foreigner talk and foreigner writing differ greatly from simplified versions of Japanese that are used in today's education system. In a sense, it appears that she adjusted her language to match Hearn's own 'version' Japanese.

Creole Influences

For two years of his life (1887–1889), Hearn lived on the island of Martinique, in the French West Indies, where he grew fond of the Creole language and culture. As he spoke fluent French, he most likely acquired knowledge of Creole, which is essentially a hybrid version of French. According to Professor Kanazawa, Hearn's time in the West Indies might have influenced how he later approached the Japanese language.

On the 4th of April 1890, when he had just arrived in Japan, Hearn sent a letter to Basil Hall Chamberlain expressing his wish to learn Japanese and to



Hearn's letter to Setsu, August 13, 1904; Property of Yaizu Koizumi Yakumo Memorial Museum

understand its emotional nature. On the 25th of July 1891 he wrote another letter, expressing doubts about whether he would ever be able to learn such a complex language.

'From the letter dated 25th of July, Hearn seems to have given up on studying Japanese,' Professor Kanazawa wrote. 'Hearn must have tried to acquire Japanese in the same way as he acquired French and French Creole (aural-oral method), which resulted in a sense of frustration due to a linguistic issue of chaos of various sentences styles of Japanese in the Meiji era.'

Hearn's Teaching and Translation Methods

Hearn's work '*From the diary of an English teacher*' suggests that Hearn had acquired Japanese systematically, as he understood that it was very complex and differed greatly from western languages. In his Japanese writing, he consistently omitted long vowels, for instance writing '*kawai*' instead of '*kawaii*', which shows that he most likely learned Japanese by listening to it.

Hearn's son, Kazuo, expressly stated that his father's Japanese was not truly Japanese; rather, it was a form of Japanese that almost nobody could understand. When he taught English to his son, Hearn used a textual translation method, often asking him to read sentences aloud until he pronounced them correctly. This method, also referred to as 'Audio Lingual Method', gained popularity in Japanese language education between the 1960s and 1980s.

In his teaching, Hearn used two main translation methods: literal and free translation. An example of literal translation is 'gallop-a-trot', which he translated as '*tobasu* (gallop) *ichi* (one) *jinori* (trot)'. Free translation, on the other hand, reproduces the general meaning of a given text without retaining its original form.

Both literal and free translation methods have been proposed by other academics as techniques for language learning. For instance, Heinrich Gottfried Ollendorff published a grammar exercise book that included both literal translation and free translation examples. In Japan, literal translation was first used in education by Nakahama Manjirou.

An Intriguing New Language

Professor Kanazawa's research into 'Hearn-san Kotoba', a pidginized Japanese language coined by Lafcadio Hearn, offers valuable linguistic insight that could inform Japanese language education. Her studies suggest that Hearn acquired his own version of Japanese orally, by listening to native speakers and interacting with them. Professor Kanazawa found that 'Hearn-san Kotoba' has both English and Creole influences, yet it is also stylistically attuned with Hearn's wife's foreigner talk and foreigner writing.

'Hearn's Japanese is a kind of pidginized Japanese and deviated from standard Japanese, abandoning redundancy of Japanese to be simplified and producing a new unique language system,' Professor Kanazawa wrote. 'It is an interlanguage with possibility of influence from Hearn's most favourite Creole language.'

Although some academics have criticised the use of simplified and pidginized versions of Japanese, in 1994 Kikuo Nomoto and the team of the National Institute of Japanese Language published a 6-year long research on '*Creation of Simplified Japanese and development of teaching materials*'.

Earlier, in 1956, cultural anthropologist Tadao Umesao proposed that Japanese language is no longer for Japanese people only. Umesao wanted Japanese people to be generous with Japanese language used by foreigners, and to try to understand their unusual expressions and vocabularies. He asked for people to think seriously about opening the Japanese language to the world, and accept the existence of Pidginized Japanese. In view of the above, Professor Kanazawa believes that there are mutual ideas and thought between the efforts of Setsu and Hearn, and academic work including that of Umesao and Nomoto.

Meet the researcher

Professor Akemi Kanazawa
Retired Professor of Japanese Language Education
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Professor Akemi Kanazawa, a former professor of Japanese Language Education at Mejiro University, Tokyo, studies the relationship between foreign Japanese language learners' interlanguage and its pidginization process. Professor Kanazawa was also involved in establishing the 3-year Japanese diploma course at National North Sumatera University. She has carried out extensive research in the fields of linguistics, comparative teaching methodology and Japanese education history, published books and papers and taught a variety of subjects. Her research has included studies into Koizumi Yakumo's pidgin Japanese, and the 'Yokohama Dialect', a typical pidgin used in Yokohama settlement. Professor Kanazawa has given presentations at various institutions, conferences and symposiums, the latest being at The Matsue International Symposium, commemorating the centennial of the death of Koizumi Yakumo.

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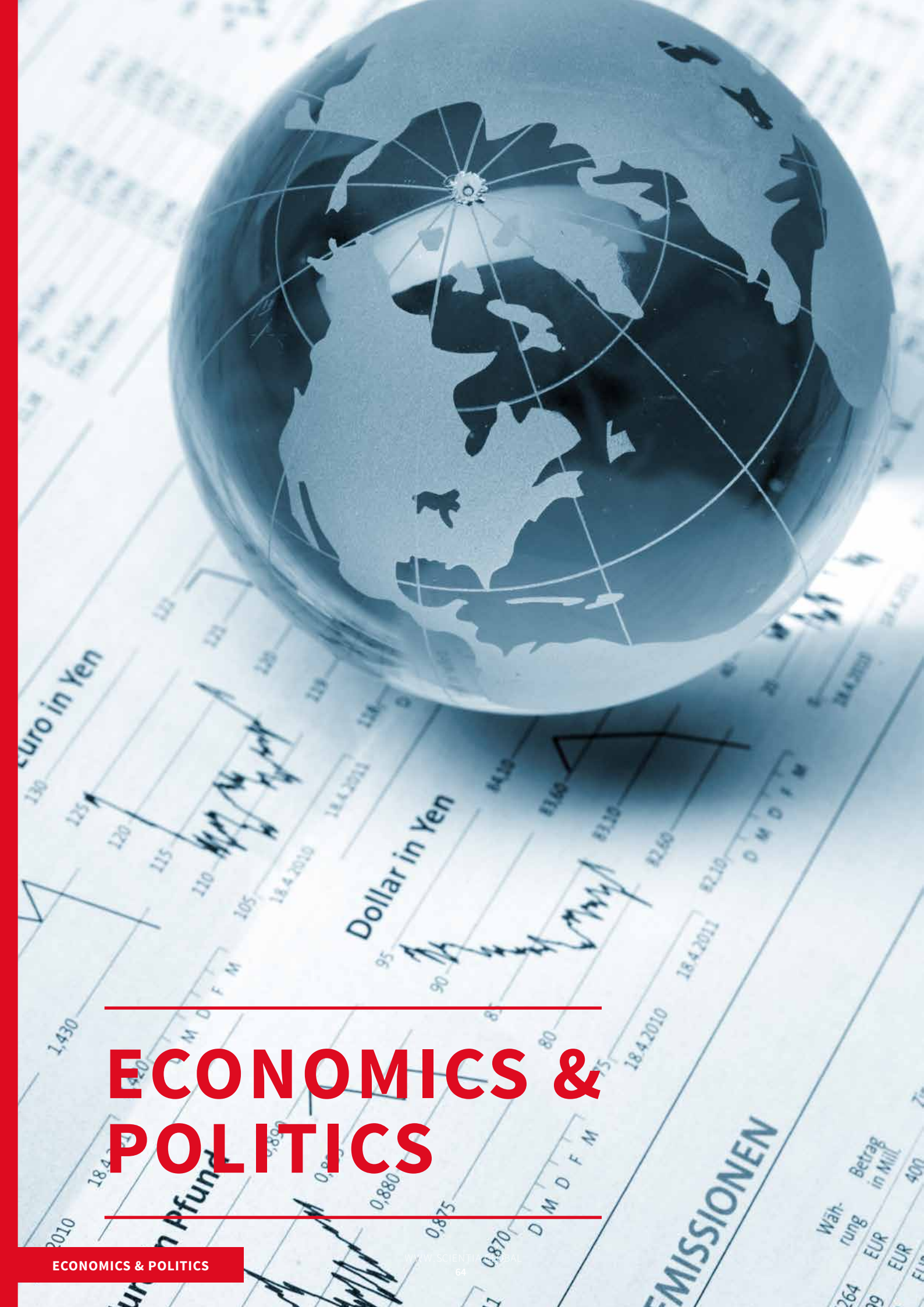
FUNDING

Mejiro University



ECONOMICS & POLITICS

BUILDING A BETTER FUTURE THROUGH POLITICAL AND ECONOMIC RESEARCH

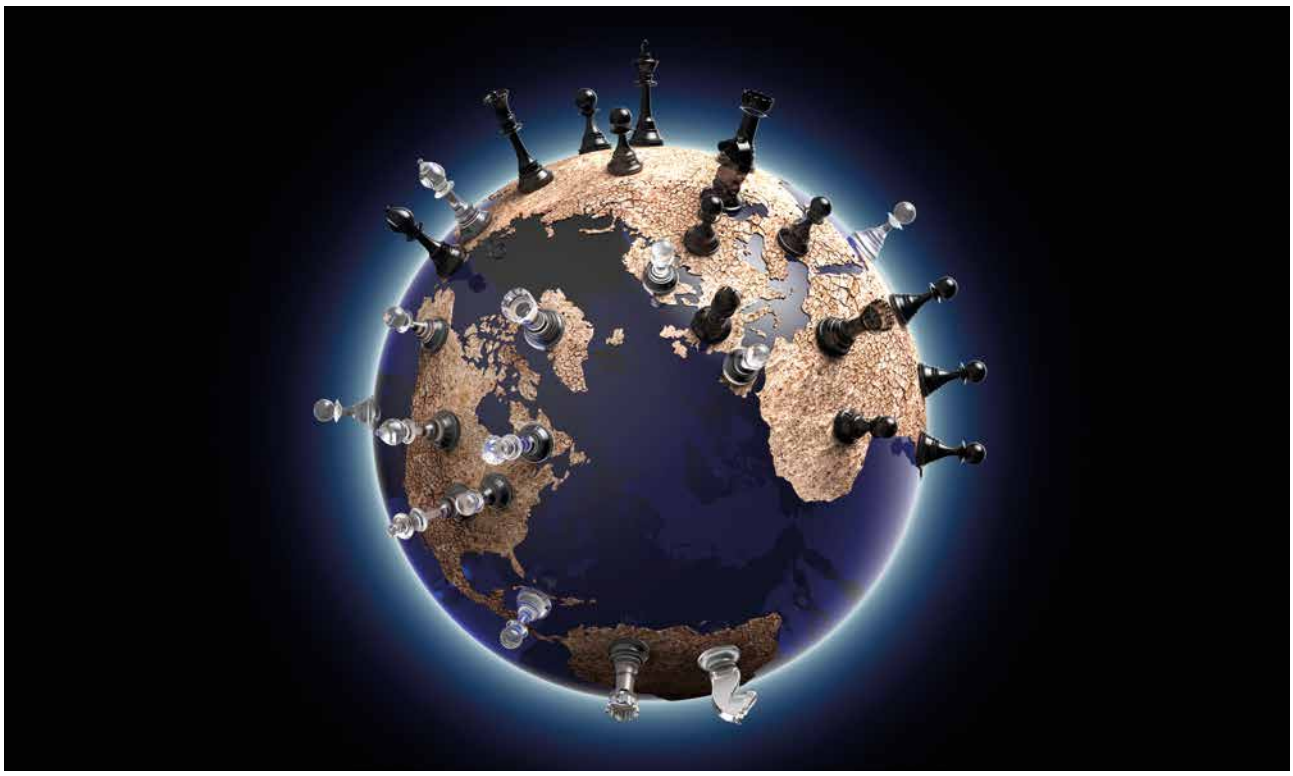
The past decade can be characterised as a period of economic disruption, political upheaval, social strife, and environmental chaos. The Global Financial Crisis in 2008 created dramatic effects that were felt across the globe, such as rising unemployment and poverty rates, as well as severe political consequences, but the tidal wave of change didn't stop there. Turning on the news today, you are likely to be confronted by a range of ongoing issues, such as the fragmentation of the European Union, rising incidences of racism and violent crimes, the onset of climate change and conflict between nations.

While the scale and significance of change today can be daunting, it is also a period of immense opportunity. Throughout history, one thing has been constant, and that is the effort by academics and researchers to confront the challenges of their time and to develop mechanisms to bring about change. In this section of the edition, we introduce several social scientists from across the globe who are pushing the frontiers of our knowledge in economics and politics, with the goal of improving the functioning of our economies, institutions, and societies.

First up in this section is Dr Francesco Audrino and his team at the University of St. Gallen in Switzerland, who are utilising online data to improve predictions about risk in our financial systems. By transforming vast amounts of social media and search engine data into measures of investor emotion, the team has gained novel insights that hold the potential to prevent financial institutions from entering bankruptcy, and even prevent the next global financial crisis.

Since the financial crisis, legislation in corporate markets has been a large focus of attention for many academics, in order to avoid future catastrophes. In this next article, we showcase innovative research by Dr Katja Langenbucher of Goethe University and SciencesPo, who assesses the potential usefulness of economic theory for legislators faced with a lack of democratic accountability. Dr Langenbucher delves into the differences in legal and economic thinking and the implications of concepts taken from the economic into the legal world. Her research could prove invaluable in reforming financial market legislation.

In today's media headlines we are inundated with reports of corruption in financial institutions, among police officers and even among government officials. Even though governments have a mandate to improve the quality of life of their citizens, corruption often occurs when governments give preferential treatment to some groups and not others. Corruption erodes public trust and society cannot function to its best ability. At the forefront of this research is Dr Bo Rothstein at the University of Gothenburg, who has helped to articulate the nature of corruption and



has come up with tangible steps that can be taken to address it. Dr Rothstein's research could be instrumental in helping to shape corruption-proof institutions of the future.

Public attention has recently been drawn to police corruption and racism in the US, particularly police violence against unarmed African Americans. In the fourth article of this section, we showcase the work of Dr Byron D'Andra Orey and his team at Jackson State University, who provide remarkable insights into the physiological responses of African Americans to racially charged events. The team hopes that their research will improve the lives of black Americans, by drawing attention to their traumatic experiences, and the urgent need for the US government to reform the legal system.

Next, we turn our attention to the role of identity in shaping people's economic and political decisions. Here, we introduce Dr Kai Sebastian Gehring of the University of Zurich, who has conducted research to improve our understanding of how group dynamics drive major political movements, using advanced statistical methods. His research improves our understanding of the trade-offs and effects of important policy decisions.

According to game theorists and economists, if a political cause is being furthered through the extra attention that protests bring, the best response from non-protesting supporters is to join the crowd. In other words, the choices we make in various situations have collective effects on the patterns of overall movement in conflict and cooperation. At the forefront of this research is Dr Tarun Sabarwal at the University of Kansas, who investigates the ways in which individual and group

behaviours can be predicted through mathematical models of game theory. A powerful potential implication of his research is utilising game theory to help solve climate change and the problem of achieving global cooperation.

The emergence of climate change and other forms of human-induced environmental degradation calls for an urgent and rapid reduction of our impact on the planet. In the last article of this section, we introduce Dr Henning Kroll of the Fraunhofer Institute for Systems and Innovation, who has found ways for companies to cut costs and reduce resources, allowing them to create inexpensive products with a low carbon footprint and minimal waste. Alongside his collaborators, he explored the potential for these so-called 'frugal innovations'. Efforts to support smart and responsible frugal innovation may help towards building an alternative proposition to cheap mass production, thus helping to shape environmentally-friendly economies.

USING BIG DATA TO IMPROVE FINANCIAL FORECASTING

Economists, business leaders and policymakers need good data to make accurate predictions about the future. New sources of powerful data are emerging from social media websites, search engines and other companies, which accumulate vast amounts of information every second. Alongside his colleagues, **Professor Francesco Audrino** of the University of St. Gallen in Switzerland is transforming this real-time data into economic indicators that will help predict levels of risk in a financial system.

The Importance of Accurate Forecasts

When people think about the stock market, it often conjures up an image of a room crammed with frantic traders. Central to an investor's trade, is their feeling about how risky a given investment is. There is a level of risk involved in most transactions, because an investor cannot know with absolute certainty what will happen tomorrow, next month, or next year.

However, investors still want to feel somewhat comfortable when putting their wealth at risk. They pay close attention to changes in the price of a financial product and economic conditions, as well as what might happen to them in the future. For example, investors may feel anxious buying cheap stocks in a company with yearly profit losses, because the company is at risk of bankruptcy. On the other hand, investors may feel comfortable investing a large sum of money in a technology company, if current forecasts project growth in the sector.

Investors keep a watchful eye on the many forecasts produced on products, sectors and the economy to guide their investment decisions. However, forecasts do not describe the future – they simply predict it. Therefore, they have the potential to be right or to be very wrong.

It is now a decade since the Global Financial Crash in 2008, which plunged advanced economies into economic turmoil. Although many eminent voices foresaw the financial crisis, the predictions coming from the financial figures and economic models that were used at the time failed to create an accurate forecast of the future. Since the crash, economists, business leaders and policymakers have been busy finding ways to improve the accuracy of forecasts, so that events leading to the next crash can be foreseen and prevented before they come to pass.

The Role of Big Data in Forecasting

Often, financial crises are collective phenomena in which investor emotions (or 'sentiment') and herding behaviour play a key role. For instance, if an investor hears enough good news stories from friends who are making successful investments by entering a market, then their fear of entering that market turns into a fear of missing out. The stories of good returns diminish the investor's perceived risk of a future loss, despite the fact that the market now has the furthest distance to fall.

'We found that sentiment and attention variables constructed from social media and search engine data, respectively, contain additional predictive information for future volatility after controlling for a wide range of financial and economic variables.'

The accuracy of forecasting the future of a financial market or product relies on analysts being able to quickly extract emerging trends from data. Social media websites, search engines and other companies collect vast amounts of data every second that can be used to create measures of attention and sentiment. For example, if there is growing uncertainty about the legitimacy of a financial product, we can expect to see more Google searches on the product and more tweets mentioning the issue, as investors seek information and discuss strategies with each other. Although it is possible to collate and transform this data in real time, the question remains as to whether the resulting data will actually improve financial prediction tools.

The SentiVol Project

In recognition of this, Professor Francesco Audrino, in the Faculty of Mathematics and Statistics at the University of St. Gallen in Switzerland, set out to investigate whether the recent availability of new sources of huge amounts of data from social media and from online users' web queries can improve financial predicting tools. 'Thanks to the proliferation of the internet and social media, it is, arguably for the first time in human history, possible to broadly monitor public opinions and moods,' explains Professor Audrino.

Specifically, he and his research team wanted to explore whether they could use this data to assess how investor sentiment and attention impacts volatility in the financial markets. To do so, the team measured investor sentiment using social media data from platforms including Twitter, and evaluated investors' attention, using web queries in Google and Wikipedia.

A further goal of their 'SentiVol' project was to understand the mechanisms through which investors' opinions and activities on the Internet influence financial prices and volatilities. The team hopes that this new approach to volatility estimation will lead to a better understanding of the risk behaviour inherent in a given financial product.

Transforming Web Data into Financial Data

Professor Audrino and his colleagues built a novel and extensive dataset of investor sentiment and activity in the financial market everyday over a five-year period from 2012 to 2016. They started by gathering a large amount of online data from social media, financial news and web queries.

Firstly, the team gathered posts from Twitter and StockTwits – a social media website exclusively for investors. Secondly, they retrieved sentiment scores for a large number of stocks and for 200 economies from RavenPack News Analytics. Finally, they collected data on information consumption from Wikipedia and search volume data from Google Trends – for example, the number of Wikipedia page views and the number of search queries on Google.

In the next step, the researchers transformed the vast amounts of collected data to create measures of

investor sentiment and activity, with the goal of constructing a dataset that is analysable using statistical regression. They constructed several variables from the dataset, including the total number of messages per day about a certain company and the number of messages expressing positive and negative investment sentiments about a given company.

Analysis and Initial Findings

In the first round of analysis in the SentiVol project, the research team applied a regularised statistical regression to investigate the effect of investor sentiment and attention on volatility in the stock market. For stock market measures, they included US companies that are listed on either on the New York Stock Exchange or on the Nasdaq Stock Market, such as Microsoft, Coca-Cola and General Electric, as well as using the Dow Jones Industrial Average Index.

'We found that sentiment and attention variables constructed from social media and search engine data, respectively, contain additional predictive information for future volatility after controlling for a wide range of financial and economic variables,' says Professor Audrino. Such variables include the exchange rate between the US dollar and Euro.

Professor Audrino and his colleagues found that the effects of investor sentiment and attention on volatility generally last one or two days. However, they also revealed that the predictive power of micro-blogging, search engine and news article data is particularly large during periods of market turbulence. The team found that both general and company-specific investor attention are the most relevant factors – for example, references to a specific company on Twitter and general mentions of the stock market online. The results confirm that the new approach developed by Professor Audrino and his team represents a significant improvement in financial forecasting.

The Broader Impact

Economists, business leaders, and policymakers are always striving to improve the accuracy of volatility predictions in the financial market. The consequences of financial market volatilities impact individual investors but can also affect the entire global economy, as evidenced by the 2008 Global Financial Crisis.

'Understanding and anticipating such high volatility phases is therefore crucial, not just for financial market participants but also for the society as a whole,' Professor Audrino explains. It is his earnest hope that his team's new approach to volatility estimation provides novel insights and tools for achieving this. Indeed, a model capable of providing reliable volatility prediction holds the potential to prevent financial institutions from entering bankruptcy and avoid a global financial crisis.

Unlocking the Potential of the Team's Approach

Having collected and analysed vast amounts of useful data, Professor Audrino and his team have an ambitious future planned out. They are now reasoning about the feasibility to set up a website called 'Open Observatory for Sentiment in Volatility' that performs real-time volatility prediction based on their results. The team's observatory will serve as an early warning device for market turbulence and crises, thus providing an invaluable source of information to investors, financial institutions and economists.

Furthermore, the team is educating students by putting their findings into the curriculum at the University of St. Gallen. They are also considering the possibility for a follow-up project with industry participants, financed either by a potential partner or the Commission for Technology and Innovation, which will allow them to see their results transferred from science into practice.

Meet the researcher

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Professor Francesco Audrino is Professor of Statistics at the University of St. Gallen in Switzerland, where is also in charge of the PhD programme in Economics and Finance. He earned a diploma in Mathematics and a PhD in Statistics and Finance at ETH Zürich. After his postgraduate studies, he moved to the University of Lugano, where he served as a scientific researcher, and later as an Assistant Professor in the Department of Economics. In St. Gallen, he constantly receives awards for outstanding publications. The Swiss Society of Economics and Statistics also awarded him the young economist award in 2007. Professor Audrino's current research interests include the development of new models for the analysis of univariate and multivariate financial time series, with a particular focus on approaches to handle large quantities of heterogeneous data.

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FUNDING

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FNSNF
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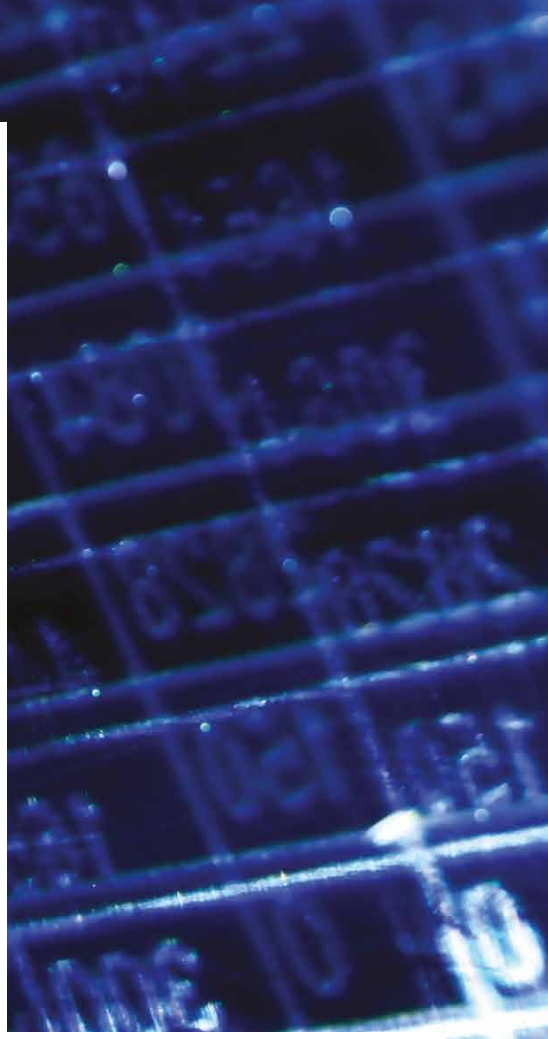
PRODUCT
PROFILE
6546-76
68%
INDUSTRIAL
453 537 687 795 831 862 972
OFFICE
SERVICE
EXCELLENCE
SUCCESS
ENTERPRISE
COLLABORATION
PARTNER
BUSINESS

MAKING THE LAW MEASURABLE: 'ECONOMIC TRANSPLANTS' IN THE LEGAL WORLD

How can jurists hold people legally accountable for their actions if there is no one, certain and 'objective' way of reading the law's rules? How can we award monetary damages or send people to prison if legal rules have multiple meanings and numerous ways of being interpreted? **Professor Katja Langenbucher** of Goethe University's House of Finance, Frankfurt, and SciencesPo, Paris, has explored to what extent economics may be useful when guiding legislative and judicial decision-making towards more measurable and predictable results.



Economic Transplants

Legal systems will typically have two answers to the challenge of vague rules, claims Professor Katja Langenbucher of Goethe University. *Internalists* will argue that interpretation guides us towards the answer, even if the rules are vague and cases hard. *Externalists* will look elsewhere, pointing to support from other disciplines, with more hard and fast methods.

In her book, *Economic transplants – on lawmaking for corporations and capital markets*, Professor Langenbucher makes extensive use of the term 'reasonable investor', which is common throughout securities law. A reasonable investor can be interpreted in many ways. She could be a trader, looking at the fundamental value of a stock or instead interested in arbitrage opportunities. She could also be a fictional person, aggregating all kinds of empirically measurable trades. She might of course also be an unsophisticated retail investor.

Instead of going through the pains of an *internalist* interpretation, an *externalist* may offer jurists clear guidance: a 'reasonable' investor can be interpreted as the 'rational' investor that the Efficient Capital Markets Hypothesis relies upon. This is an example of what Professor Langenbucher calls an 'economic transplant' – developed in a neighbouring discipline and ready to be inserted into law. Temptingly, this discipline is not only neighbouring, but also similar to a 'hard' science with more rigid methods than those of the law.

Law, Economics and Differences in Methodology

In her book, Dr Langenbucher's argument proceeds as follows. There are a number of obvious reasons why measurability has fascinated jurists, especially in the area of corporations and financial markets. But, firstly, there are significant differences between legal and economic methodology to keep in mind. If taken into account, they usually make for much less measurability than

one might think at first glance. And, secondly, the focus on measurability and objectivity has important implications for the intricate balance of power between political actors, involving lobbyists, jurists and experts.

The Externalist vs. Internalist View

The *internalist* jurist understands his endeavour as participation in a common legal enterprise. Any legal question will start with a legal text. By interpreting such texts, he will try to establish what his legal system's answer looks like. This will entail suggestions of how different rules fit together and what their underlying principles and values look like – a quest for 'justified belief' and a 'reasoned justification'.

The *externalist* is not concerned with participating in a common normative endeavour. Rather, he observes legal rules 'from the outside'. Rules, for him, are 'signals', allowing for predictions on human behaviour. Observing the workings of rules in this way has led to two fundamentally different reactions among externalists.

Some, which Professor Langenbucher has called 'externalist sceptics', have been lamenting the vagueness of most rules, claiming that it is impossible to predict the decisions of courts. Others, which she calls 'externalist scientists', offer help. They single out rules that do not work efficiently if benchmarked against a specific, measurable goal or standard, such as liquid capital markets and shareholder rights.

An externalist might suggest to replace the vague term 'reasonable investor' by the concept of a 'rational investor', introducing an economic transplant. The somewhat elusive legal concept of the 'reasonable investor' profits from the rigid methodology of economics. The 'rational investor', being a clearly defined concept, brings clarity and precision to an otherwise painstaking process of coping with vagueness and weighing different rules and principles. This shortcut, Professor Langenbucher argues, lies at the heart of the promise of measurability – one of three promises of economic research that she explores in her work.

Making the Law Measurable for Legislators?

Such a shortcut will appeal to legislators and judges. For the legislator, Professor Langenbucher explains, shortcutting comes in the form of slimming down political debate. Public discourse on why and how to regulate will be streamlined. Certain arguments will be deemed to not work, while others will be singled out as the relevant ones.

Professor Langenbucher uses the regulation of CEO compensation in financial institutions as an example of something that has occupied lawmakers for a number of decades. Legislators face numerous lobbyists and interest groups from many backgrounds. In this situation it might seem tempting to have a shortcut argument ready. Management remuneration, one might suggest, is not a political problem, but one of measurement. At its core, compensation would appear to be about aligning the interests of shareholders and managers. We are then facing an intriguing math problem: how can we structure a remuneration package that will make management work towards rising share prices, allowing them to be rewarded and at the same time shareholders to profit?

Stock options have long provided the answer to this question. Rising stock prices have allowed managers to cash in options at an attractive price, while shareholders have profited from an increase in the value of their shares. Managers' pay, suddenly, became a technical issue. Experts could be

called upon to deliver a 'scientific', measurable answer. Rules on management pay were not about fairness, redistributive justice or inequality, but about incentives. The best rule was the one allowing for the most efficient alignment of interests of principals and agents.

Making the Law Measurable for Judges

But what about the judiciary? Doubtlessly, judges are not facing the political pressure a legislator is exposed to. There are no expert hearings on what the law prescribes and, typically, there are no political activists, lobbyists or interest groups heard in a courtroom. Rather, the judge is the paradigm internalist. She has a participatory role to fill, applying her country's law to what the parties in her courtroom claim.

Continental judges, Professor Langenbucher concedes, will often not be drawn towards promises of measurability at all or only use such arguments here and there, as support for decisions they have reached on other grounds. However, sometimes judges may understand a case at hand as calling for deferring to another discipline – such as economics – for understanding the 'reasonable investor'. If judges imported a version of the 'rational investor' used in models on the efficient capital markets hypothesis, an economic expert could set up a model and propose a seemingly neat, quantifiable answer.

Measurability and 'Economic Clichés' in Political Discourse

Looking closer, most economists would hasten to add qualifications, Professor Langenbucher explains. They would point to differences in measurement, and to the need to differentiate and make careful distinctions. But political discourse is often adamant to subtle tones and prone to using 'economic clichés' instead of more differentiated theories. The more objective or scientific an argument that is presented, the more powerful its impact. There is less need to reach agreement on a political level, if 'exact benefits', as the EU Commission often puts it, can be identified. The state appears as rational, ordering merely what can be measured and proven.

The Role of Experts in Political Discourse and Legal Decision-Making

Professor Langenbucher has identified an interesting link between the promise of measurability and power structures in political processes. If large parts of legal regulation are about measuring and quantifying, so she suggests, are they not best entrusted to experts who can do this job best?

The European 'Lamfalussy' process, introduced to answer to specifics of lawmaking for financial markets, is a prime example of how experts take over, Professor Langenbucher shows. The core concept underlying this process is a separation of framework directives and delegating or implementing measures. Only the framework directives follow the rules on procedure and competences, involving both the EU Commission and Parliament. As to delegating and implementing directives, Parliament does not participate. Delegating directives are passed by the Commission. Implementing directives are too, but heavily draw on input by the European Securities and Markets Authority, an expert committee.

One consequence of involving experts in lawmaking processes is the danger of crowding out the participation of a broader political audience. Technical knowledge is produced by specialists in their field, which results in high entry barriers for political actors who do not have a similar expertise. The technical language of experts discourages the public from engaging in political discourse. Professional arguments will seem non-negotiable to those who are not in a position to take part in 'expert talk', Professor Langenbucher shows, because they lack technical training. Thus, large parts of the law risk being drafted behind closed doors.

Measurability and Capture

Behind closed doors, we are likely to find problems of 'capture'. This term refers to the risk of regulators being captured by those who are regulated. Capture, Professor Langenbucher explains, will usually take the form of intense lobbying, leading to different effects on the side of the captured agency. Scholars have identified effects such as identification with the regulated industry, sympathy with problems the regulated entities encounter and lack of tough enforcement.

Measurability and Artificial Intelligence

In her most current research, Professor Langenbucher explores whether artificial intelligence will lead to ever more comprehensive promises of measurability. Artificial intelligence may be able to deliver an assessment of outcomes based not only on statistical probability but also on machine learning. It will deliver legal services, approve loans, manage assets, check credit worthiness, assess risks or replicate market movements for any given situation. It will be the legal world's challenging task to understand the extent of measurability that artificial intelligence entails and the place where normative decisions are called for.

Meet the researcher

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Dr Katja Langenbucher received her PhD in Law from Ludwig-Maximilians University, Munich, Germany in 1995. Since 1995 she has held tenured and visiting positions at universities in Germany, the US, the UK, Austria and France. She is currently serving as a Professor for Private Law, Corporate and Banking Law at Goethe University, Frankfurt, and is a Member of Frankfurt University's House of Finance. She is also an affiliated professor at SciencesPo's école de droit in Paris. Her research focuses on corporate and financial markets law and on legal theory, with an emphasis on corporate governance, securities law and theoretical issues of law and economics. She has recently published a book entitled Economic Transplants – On Law-making for Corporations and Capital Markets. The book explores the effects of integrating economic concepts into the legal system.

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GOETHE UNIVERSITÄT FRANKFURT AM MAIN

THE CORE OF CORRUPTION

Corruption in governments affects all aspects of daily life. A society's health, prosperity and even trust in others are all impacted by the integrity of administrations. **Professor Bo Rothstein,** co-founder of the Quality of Government Institute at the University of Gothenburg, has helped to articulate the nature of corruption and has come up with tangible steps that can be taken to address it.

Reimagining Corruption

In giving our governments a mandate to administrate our various geopolitical regions, we also entrust them with a great deal of responsibility for the quality of our lives. There are many obstacles facing humankind, including poor healthcare, low levels of public trust and low subjective wellbeing, that persist despite the presence of government power. Professor Bo Rothstein and his colleagues have conducted research that evidences quality of government as the salient factor perpetuating these aspects of society.

Along with Professor Sören Holmberg, Professor Rothstein founded the Quality of Government (QoG) Institute, the University of Gothenburg's organisation dedicated to research about and increasing our understanding of government corruption. The institute was the largest research group involved in ANTICORRP, a research project consisting of 21 groups in 16 European countries. Running from March 2012 to February 2017, the project investigated trends and appropriate European responses to corruption. Through this project, Professor Rothstein and his colleagues produced the basis for a more fact-oriented set of guidelines for dealing with corruption. The institute also maintains a newsletter, a visiting scholars program and a project through which the institute reaches out to schools.

'If you would summarise human misery in today's world, our findings are that most of this can be explained by the fact that a majority of world's population live under dysfunction and corrupt and incompetent government institutions,' Professor Rothstein explains. 'Why this is so and what can be done to change this are my main research questions.' This dynamic between our governments and our quality of life is not, however, determined entirely through direct or deliberate action resulting from government initiatives. As Professor Rothstein has set out, societies and governments have an interdependent relationship that creates the social conditions from which the effectiveness and contentment of a society arises.

Adding to this complexity is the finding that the depth of corruption in a segment of society is not necessarily a reflection of its values or morals. Through his research, Professor Rothstein found that corruption in society can lead to otherwise honest individuals being compelled to engage in corrupt practices. This is due to the prevalent threats to one's finances, wellbeing or family. What this means is that the effects of bad government are self-perpetuating. Professor Rothstein has found that it takes full engagement from members of a society to uproot these endemic problems.

Social Trust: Corruption's Antithesis

Without trust, there is no society. Organisations and their rules are

predicated on the idea that individuals can work under the understanding that their interests are aligned and that it makes sense to take collective action towards them. In the social sciences, the term 'social trust' simply refers to the level of trust shared between people in a society.

Professor Rothstein's research shows that civic engagement, income inequality, and ethnic diversity have negligible effects

‘If you would summarise human misery in today’s world, our findings are that most of this can be explained by the fact that a majority of world’s population live under dysfunction and corrupt and incompetent government institutions. Why this is so and what can be done to change this are my main research questions.’

on trust. On the other hand, quality of government (QoG) is supported by evidence as the overriding factor influencing trust in a society. Along with his colleagues Nicholas Charron and Victor Lapuente, Professor Rothstein conducted a large-scale survey, published in 2013, indicating that low governmental quality and high levels of corruption are distinct causes of low levels of social trust.

Conversely, while people distrust each other under corrupt governments, the team’s results further indicate that quality governments tend to promote views of society that are less self-serving. Institutions that are perceived as fair create the view of individual success as linked to the institution’s success in a feedback loop.

Professor Rothstein interprets perceptions of the nature of social trust as being formed primarily by public officials. He has pointed out that perception of law and the courts is the biggest factor influencing social trust. This aspect of his research brings attention to the social responsibility of these positions – if someone representing the government is perceived to be lacking in integrity, individuals will often conclude that corruption is institutionalised and people are not to be trusted. As Professor Rothstein has pointed out, people will make inference reasoning that if public officials are dishonest and cannot be trusted, then why should you trust ‘people in general’ in your society?

Most fundamentally, social trust is an informal institution that complements government by facilitating the transactions that can occur within a society. With greater levels of social trust, people are more likely to engage in social processes with one another, as they perceive the chances of exploitation to be less. This leads to a healthier and more productive society.

Healthcare as a Problem and a Solution

The healthcare sector is particularly vulnerable to corruption for several reasons. One is that there is an ‘information problem’ in that healthcare providers are the ones who decide how much is to be paid. Conflicts of interest such as these have the potential for patients’ personal circumstances to be easily exploited. The relationship between healthcare to basic survival also means that emotions play a large role, and impartiality can be compromised. Additionally, 80% of illnesses in the developing world come from inadequate water supply, which is closely integrated with infrastructure. In fact, 12,000 people die from water and sanitation problems daily because of inadequate maintenance, pricing and rights distribution to land and water.

Professor Rothstein’s research points out that good health generally equates to a successful society – it directly correlates with productivity, psychological wellbeing and quality of life. His findings indicate that improved social capital (a combination of extended social networks and generalised trust) is one factor that creates improved healthcare standards. Social capital has a positive impact on health in that networks of trusted people contribute to one’s wellbeing.

In his research, Professor Rothstein highlighted that quality of government

(QoG) creates healthy societies. His Quality of Government Institute found that all standard measures of QoG are strongly correlated with five important health indicators: life expectancy, child mortality rates, mother mortality rates, healthy life expectancy (expected years of good health) and subjective wellbeing or 'happiness'. Higher QoG also creates more willingness to pay taxes, which leads to greater equality in the provision of basic services. In ways like these, higher QoG has indirect positive effects.

Professor Rothstein collaborated with Professor Holmberg to present their analyses on the relationship between QoG, health and spending. They highlighted that QoG is more important to health than public spending, which is not a guarantee of effectiveness as high public spending on health is inefficient in countries with low quality governments. At the same time, a lack of publicly-funded health insurance can drive people into poverty. They also showed how QoG can actually compensate for decreased public spending when it comes to health. Further, private health spending results in an impact on health that is insignificant at best and negative at worst. Professor Rothstein's conclusion is that QoG and public money are the key to better healthcare.

The Indirect Approach

Research into corruption has increased, but the effectiveness of anti-corruption institutions has been lacking. Professor Rothstein has invited further consideration of the limitations of incentive-based institutionalised measures. Conventional thought carries over from theories in economics that people can largely be expected to act 'rationally' in their own self interests. Prior findings have discredited this assumption about human nature, showing that we actually want to act in the collective interest, but our perceptions and expectations of 'people in general' in the society in which we live may inhibit us from participating in processes that are beneficial to whole communities.

Professor Rothstein argues that approaches to corruption need to be more indirect and based on the power of collective action. He has provided evidence illustrating that reciprocity is a more fundamental motivation for our behaviour, and that this requires that the less tangible conditions of social environments are addressed. Policies against corruption cannot only focus on incentives such as harder control and punishment. What is needed is a more fundamental change of the 'social contract' between citizens and the state. Principles in people tend to be mutually reinforcing with principles in *institutions;* that is, the values present on the one side of the societal spectrum tend to manifest in the other.

Beyond Institutions

The key factor that characterises QoG is impartiality or meritocracy. Favouritism is the essence of corruption. Corruption is when institutions deal with different groups, individuals and situations unfairly. Create a context of impartiality and consistency across society, and corruption loses its power.

The process of electing individuals to administrate our societies has shown itself to be inadequate to deal with corruption on its own. The next stage for Professor Rothstein's research will be to pursue answers to this, going beyond formal measures to address corruption. He aims to 'explain why representative democracy turns out not to be a safe cure against endemic corruption'.

While anti-corruption bodies exist, these tend to approach the problem only through change at the institutional level, overlooking the power of informal methods. If countries begin to integrate the QoG standards specified in Professor Rothstein's research, they will be able to generate approaches that involve more general participation in finding solutions.

Meet the researcher

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Professor Bo Rothstein earned his PhD in Political Science at Lund University in Sweden. He worked as an assistant and associate professor at Uppsala University, before taking a position at the University of Gothenburg, Sweden, in 1995. He currently holds the August Röhss Chair in Political Science at the University of Gothenburg and is the co-founder of its Quality of Government Institute. From 2016 until 2017, he was also a professor of Government and Public Policy and Fellow at Nuffield College at the University of Oxford. His most recent book, *Making Sense of Corruption* (co-authored with Aiysha Varraich) was published by Cambridge University Press in March 2017. His other books in English include *The Quality of Government: Corruption, Inequality and Social Trust in International Perspective* (University of Chicago Press 2011) and the co-edited volume Good Government: *The Relevance of Political Science* (Edward Elgar 2012).

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RACE & WELLBEING IN THE US: THE PSYCHOLOGICAL TOLL OF A BROKEN SYSTEM

The United States government and law enforcement branches have a long history of abuse and violence towards African American people that continues into present day. Beyond the impacts to those directly affected, these traumatic events may have psychological and physical effects on those who witness them indirectly in the media. **Dr Byron D'Andra Orey** studies the physiological responses of black Americans to political images.

Biopolitics

Politics influences almost every facet of our daily lives, from what resources are available to us, to how we are treated by public servants, to who we associate and identify with, and how much we are personally impacted by national and global events.

As we foster an appreciation for the relationships between politics and human health, scientists are beginning to focus on how the two interplay. Dr Byron D'Andra Orey at Jackson State University in Jackson, Mississippi conducts research in the emerging field of biopolitics, which explores the intersection between political science and human biology. Biopolitics leverages fields such as genetics and physiology to pursue questions such as whether people carry a genetic predisposition to conservative versus liberal views, and whether socioeconomic status impacts disease rates.

Dr Orey utilises physiology to understand how racial relations in the United States impact the health and wellbeing of African American citizens.

While the field of biopolitics has grown over the past decade, less attention has been focused on race-specific effects of politics. Dr Orey and his team are working to change this.

24-7 Trauma

Prior research has shown that a person does not have to be physically present during a traumatic event to experience trauma associated with the event. For example, it is unsurprising that many New York residents who witnessed the September 11 attack on the World Trade Center showed symptoms of trauma. However, many US citizens who did not witness the attacks first-hand, but observed the horror unfolding on their television screen, also experienced psychological effects akin to direct involvement in a traumatic experience.

Media exposure to events such as 9/11, the Boston Marathon bombings, and a litany of mass shootings has been associated with increased rates of acute stress, which often manifests as anxiety and high emotionality in those affected, with the potential to develop into posttraumatic stress disorder (PTSD). Evolution has not yet caught

up to modern technology, and our brains cannot always easily distinguish between experiencing a traumatic event in real life and observing a recording of the same event. In many cases the same emotions are evoked, and the same stress response ensues.

Ongoing emotional stress can have major health consequences for sufferers. Anxiety, depression and PTSD are associated with heightened stress, particularly when the trigger is a traumatic event. Further, these psychological responses are associated with many physical health problems, such as gastrointestinal disorders, heart

disease and abnormal sleep patterns. Dr Orey's team wants to understand how exposure to racially charged stressors may carry strong consequences for black Americans.

The Psychological Toll of Racism

The primary focus of Dr Orey's current research is a National Science Foundation (NSF) funded project designed to measure the physiological and emotional impacts of racially-charged events on the wellbeing of African Americans.

In this project, his team measured participants' automatic responses to images, utilising galvanic skin responses – a standard measure of emotional arousal. The participants were shown experimental images, such as photos of police or racist symbols, alongside a standard set of images known as the International Affective Picture System (IAPS). IAPS images arouse almost universal participant responses – images, such as an attacking snake or a man charging with a knife, illicit fear responses, while control images such as cute koalas and flowers illicit positive and neutral responses for comparison.

A critical component of this research is the appreciation that African Americans do not respond uniformly to racial events, but are unique individuals whose personal views and experiences shape how they respond to the world around them. Dr Orey's team surveyed variables such as how strongly a person identifies as black, if they feel aligned with the African American community, if they carry internalised racism or negative stereotypes about other African Americans, and their level of awareness of racially-motivated discrimination and violence against black people in the US. In this way, the team hoped to provide context for variations in responses to different images.

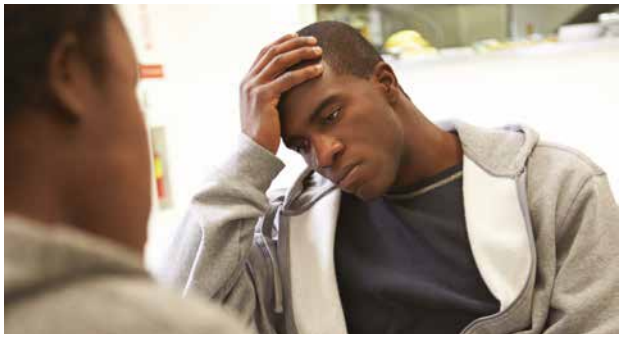
Fear of the Police

With the widespread use of cell phones with video recording capabilities and increased reach of media coverage, the abuse and deaths of unarmed black people by the hand of white police officers have become more visible, sparking nationwide outrage and protests. Dr Orey's research team classifies such events as racially traumatic stressful events (RTSE), and as with other types of traumatic events, an RTSE does not have to be experienced first-hand to have a lasting effect.

Dr Orey predicted that the experience of RTSE, whether first-hand or through the media, increases the likelihood that a black person will have a fear response when shown otherwise neutral pictures of a police officer making a traffic stop. When combined with measures of intra-racial differences, these responses show which African Americans are more likely to experience acute stress from interactions with police.

As expected, the majority of black participants demonstrated negative fear responses to images of police making traffic stops. Individuals who identify strongly as American, have a deep sense of shared fate with other black people, feel that the US legal system is unfair to African Americans, and/or believe that most people appreciate the contributions of black people to American culture showed the strongest negative responses to images of police.

Conversely, those that believe the black experience is distinct from other groups, feel that African Americans should be active participants in the current



system, and/or believe that society as a whole is unfair to black people showed less emotional response to these images. Overall, for many participants, traffic stop images generated as strong a negative response as an image of a dog attack or a man shooting himself, indicating that this is a serious problem that warrants further study.

Don't Shoot

One component of Dr Orey's recent work has focused on identifying and shifting racial biases against black people. In one of his studies, law enforcement agents engaged with a law enforcement simulation that measures how quickly they shoot black people versus white people, while also measuring their physiological response during each simulated encounter.

With increases in public attention to the shooting of unarmed black Americans by police officers, Dr Orey's most recent work focuses on the reactions of African American police officers when interacting with black civilians. Perhaps unsurprisingly, black officers who harbour resentment towards other African Americans are more likely to shoot an unarmed black person than those who do not. However, officers who believe that the American legal system and society as a whole are unfair to black people are less likely to shoot an unarmed person. As the need to decrease police shootings of unarmed individuals becomes glaringly apparent, understanding the factors that influence an individual officer's inclination to shoot could help shape training programs.

As a follow up, a portion of the participants will join educational exercises designed to increase cultural competency and awareness, in an effort to see if it is possible to reduce bias through education. Following these exercises, participants will receive another bias test to determine if those that have undergone the educational component show reduced bias compared to those that have not. Ultimately, Dr Orey hopes to design training courses that reduce the tendency for officers to shoot black people more quickly than white people in situations where race is the only distinguishing factor.

Political Disarray

Given the current political climate in the US, Dr Orey's team has grown interested in how exposure to images of the current US President, Donald Trump, and anti-black messaging and symbology impacts the psychophysiology of black Americans. Trump has made numerous remarks perceived by many as racist, and has also refused to denounce the acts of violent racist groups and neo-Nazi organisations. Though violent crimes against racial minorities and incidents of openly racist behaviour have increased during his presidency, Trump continues to use divisive language in his speeches.

At the same time, open displays of racist symbols, such as Confederate and Nazi flags, have become more common. Dr Orey's home state, Mississippi, is the only state in the US that still flies the Confederate flag and whose state flag contains Confederate imagery, despite the long history of Confederate imagery being used in campaigns to suppress and terrorise African American citizens. The Confederate flag is often flown alongside Nazi flags at neo-Nazi events and serves as a symbol for those that espouse views of white supremacy.

Dr Orey's team wished to understand how the present treatment of African American peoples in US politics and society impacts their psychological wellbeing. In addition to galvanic skin response and inventories of each participant's beliefs, the team used eye-tracking technology to understand where a participant's eyes dwelled while viewing the Mississippi flag, which contains the Confederate flag in its top left corner.

Dr Orey found that black people who were angry about something in America showed stronger emotional responses to images of Trump, while those who were ashamed of something in the US were less emotionally aroused. Those who believed that the general public held African Americans in good regard, felt a shared fate with other black Americans, and those who felt disillusionment towards the US legal system had a stronger response to the Mississippi flag than those who felt some resentment towards the African American community. Those whose eyes stayed on the Confederate symbol on the flag longer had stronger responses than those who did not.

The failure of the US political system to protect black Americans from RTSE has broad-reaching significance. In addition to a serious public health consequence, people who feel threatened by and disconnected from their government are less likely to engage in public service and participate in democracy altogether.

Moving Forward

Dr Orey and his team hope to use their findings to drive policy and practices that improve the lives of black Americans and increase sensitivity to the African American experience in the US. They will continue delving into the nuances of psychological and physiological responses to political and police stimuli, and will develop educational resources to mitigate and eliminate sources of racial bias.

Meet the researcher

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Dr D'Andra Orey began his education at Mississippi Valley State University with a BS in Business Administration, continuing on to earn a Master of Public Administration from the University of Mississippi and an MA in Political Science at the State University of New York at Stony Brook. He earned his PhD in Political Science from the University of New Orleans, following which he served in the faculty of the University of Mississippi and the University of Nebraska. In 2008 he took his current position in the faculty at Jackson State University as Professor and Chair of the Department of Political Science. He has received numerous grants and awards for his ground-breaking research into the impact of racially traumatic events on African American wellbeing.

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POLITICS AT THE INTERSECTION OF IDENTITY AND ECONOMICS

The UK's recent decision to exit the European Union has shone a spotlight on the role of identities in shaping people's economic and political decisions. **Dr Kai Sebastian Gehring** is a senior researcher in Economics at the University of Zurich, who investigates group identities and the distribution of resources, and how they affect political stability and conflict.

Resource Allocation

The size of a species' population is often only limited by the resources available to them. Given an unlimited supply of food, water and space, most organisms will experience exponential population growth. Humans are no exception, except that their desires extend well beyond the basics needed for survival. Economics investigates the forces that drive the production and exchange of human goods, services and wealth.

Traditionally, we ration resources through the price – goods that are rare or difficult to obtain or create are expensive, while those that are plentiful or easy to produce are cheap. This mechanism drives resource allocation for products from food to houses. While this may seem like a simple process, the exchange of goods is often a tedious and challenging task, marked by disagreements and conflict between interested parties. The potential for conflict is magnified when the scale of trade occurs between nations.

Dr Kai Sebastian Gehring, economist and researcher at the University of Zürich, works to illuminate the dynamics that impact resource allocation between groups by bridging economic theory with the psychology of group identity. His research seeks to attain a deeper understanding of the systems that can enhance resource allocation and co-operation among different nations. During an era of heightened nationalism and politics fuelled by 'economic anxiety', Dr Gehring's work could provide valuable insights into the factors that shape national decisions.

The Role of Group Identities in Conflict

While most people tend to view themselves as rational and practical, an analysis of even a simple shoe purchase reveals that many factors go into economic decisions well beyond the utility of a product or practicality of a trade. Modern economists use insights from psychology to understand how economic decisions are made. In recent years, 'identity economics' has emerged as a field that focuses how individuals make decisions in a social context. Understanding how identity factors into large scale trade decisions is paramount for improving our understanding of non-peaceful resource allocation and subsequent conflicts.
Social contexts have dramatic effects on human decision making. On a large

scale, individuals from the same social group are often able to coordinate their actions to obtain a common goal, while tensions between groups can incite both economic and physical conflict. Individuals can hold multiple identities, and conflicts between them are often implicated in major conflicts. For example, when regional identities are stronger than national identities, separatist movements often result. For example, in the UK, those who see themselves as predominantly Irish, Welsh or Scottish are more likely to support a united Ireland, or Welsh or Scottish independence. Meanwhile, those with British identities are more likely to support membership of the UK.

‘My hope is that through my work I can contribute my small share to provide a reliable scientific assessment that helps citizens and politicians to realise and account for the trade-offs and effects of important policy decisions.’

Understanding Society to Build a Better Future

Dr Kai Sebastian Gehring, a senior researcher in Economics at the University of Zurich, endeavours to use economics to improve our understanding of society. His academic research is informed by his work experience in business and consultancy environments. His interests are centred in political economy, public economics and economic development.

Dr Gehring explains that his research objective ‘is to better understand which formal and informal institutions and political systems are most likely to make societies function well.’ In particular, he notes that he wants to understand the ‘public finances and fiscal systems that are used to govern countries or supra-national organisations, such as the European Union, with heterogeneous members.’

Funded by Swiss National Science Foundation, his recent research investigated how the distribution of resources is impacted by group identities, and how these identities affect political stability and conflict. By combining modern economic theories with concepts from political science, psychology, history and ethnology, Dr Gehring and his colleagues have been able to provide novel insights into these research questions.

Bringing the Pieces Together

A critical component of economic research is gathering meaningful and accurate data on which to base models. Dr Gehring and his colleagues frequently leverage novel methods to obtain large-scale data about the economics of an area. For example, they utilise satellite data and geo-referenced high-resolution data to create economic indicators. Patterns of night-time light, as pictured by satellites orbiting the earth, are indicators of economic activity in a region and can be obtained for any area on the globe.

One of the most challenging obstacles for many economists is collecting historical data that provides a context for modern events. It is often cumbersome to find reliable and detailed records of past events, particularly events preceding the digital revolution. To overcome this limitation, Dr Gehring and his colleagues have worked to digitise historical sources, for example, transforming election results from old newspapers into numerical form. This allows them to aggregate data and compare sources for verification.

The key to Dr Gehring’s work is using statistical methods to tease out the underlying causes of major events. For example, his team recently investigated whether North Sea oil reserves influenced support for Scottish independence. These reserves are often hailed as a major source of wealth for an independent Scotland in political campaigns, but their potential impact had not been formally investigated. Dr Gehring’s analysis found that while support for independence is also driven by many political factors, the oil discoveries were to a large degree responsible for the rise of the Scottish National party. Using advanced statistical methods, Dr Gehring and his colleagues were able to separate the effect of oil from other entangled factors. They also document that this relationship between a region’s economic resource wealth and the success of regionalist parties holds in a much broader sample of regions across the world.

Identity and Economics Drive Politics

A common assumption is that strong regional identities can threaten national stability when a person identifies more intensely with their local community than their nation as a whole. At the same time, a sufficiently strong group identity is also a prerequisite to establish risk-sharing institutions like the modern welfare state, which require a certain degree of compassion with fellow group members. Dr Gehring and his colleagues sought to understand the origins of group identities and how they might impact a country.

They focused on the division of the French regions Alsace and Lorraine after the Franco-Prussian War, and found that historical repression strengthened the shared identity of the repressed groups. When a government is working to build a new state identity, the degree to which people are willing to accept it depends on how much it appears to be in opposition with their established identities. Dr Gehring also found that a strong regional or cultural identity does not necessarily imply a weaker national identity – people are capable of holding multiple identities as long as they are not in strong conflict with one another.

Expanding on these findings, Dr Gehring and his colleagues investigated the importance of group identities in maintaining or disrupting political stability. In the previously mentioned study of the importance of oil in Scottish independence decisions, they found that citizens take into account the value of regional resources when deciding whether or not to support secession. These findings highlight the complexities of psychology in political movements. While identity plays a large role in influencing a person's opinion about secession, economic factors play an equally critical role in how an individual weighs these decisions. Thus, multiple variables go into maintaining political stability beyond identity.

Though identity may not be the sole force driving critical political decisions, it does play a critical role in how politics and economics are handled at multiple scales. During an analysis of how EU Commissioners allocate EU funds, decisions that should in theory be driven by pragmatism and greater economic benefit, Dr Gehring and his team found that the nationality of a commissioner predicted allocations favouring their home country. The Commission is set up to be impartial, however political incentives and psychological biases often lead them to drive funds home. These results suggest that identity is a factor in motivating decisions with large scale political impacts.

Understanding What Drives Politics and Societies

Dr Gehring is driven by a deep curiosity to better understand how societies and economic systems work and to use his expertise to improve real life economic and political decisions. 'My hope is that through my work I can contribute my small share to provide a reliable scientific assessment that helps citizens and politicians to realise and account for the trade-offs and effects of important policy decisions,' he says.

His team's research is highly relevant for issues facing the world today. 'All countries or organisations like the European Union that consist of heterogeneous members need a fiscal federal system that structures the interaction between the member regions or states and the central state authority,' he explains. The importance of this knowledge is underscored by the currently uncertain future of the European Union, which is under increasing pressure to reform after the UK's decision to leave.

Dr Gehring is presently engaged in multiple ongoing projects aimed at further understanding the group dynamics that drive major political movements. For example, his team is currently involved in a project analysing the integration of immigrants in the US, which investigates in-group/out-group dynamics driving the acceptance or rejection of immigrants – a cornerstone of recent political movements in the US.

In another study, Dr Gehring is seeking to understand how the distribution and value of resources across different ethnic groups contributes to struggles in building stable coalition governments in many African nations. These projects aim to understand and inform discourse on these critical issues.

Meet the researcher

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Dr Kai Sebastian Gehring is a senior researcher in economics at the University of Zürich. He holds a PhD in Economics from Heidelberg University and the University of Göttingen, as well as a Master's degree in Business Administration from the University of Mannheim. Prior to his postgraduate studies, he studied Business and Economics at the University of Canterbury. Over the course of his career, Dr Gehring has worked as a visiting researcher at Harvard University, the University of Cambridge and CESifo, as well as a lecturer at the University of Applied Sciences in Kaiserslautern. He is also an affiliate member of CESifo, as well as an associate member of the European Development Network (EUDN), the Research Group on Development Economics of the German Economic Association and the Research Training Group 'Globalization and Development' (GlaD). His research primarily focuses on political economics, public economics and economic development. Overall, Dr Gehring is motivated by a deep interest in better understanding which institutions and political systems can aid the functioning of societies.

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THE SHAPE OF RATIONAL CHOICES IN GAME THEORY

The choices we make in various situations have collective effects on the patterns of overall movement in conflict and cooperation. **Dr Tarun Sabarwal** at the University of Kansas is investigating the ways in which the overall pictures produced by these behaviours can be predicted through mathematical models of game theory.

Different Worlds with Different Rules

In contexts of conflict and cooperation, the agents involved tend toward predictable patterns of decision-making that are shaped by the actions of their opponents and by the parameters of the system (or game) in question. Their behaviour in these systems can be forecasted using mathematical models in the discipline called game theory – the study of individual and interdependent decision-making and its collective impact. These scenarios can concern areas that include economics, political science, philosophy, psychology, logic and computer science.

In recent years, Dr Tarun Sabarwal and his colleagues have been investigating patterns that emerge in this game play and the ways in which these are applicable in varied fields such as economics, business and social sciences. Primarily, this has constituted the study of games with strategic complements and games with strategic substitutes.

Games with strategic complements (GSC) involve 'rising to the challenge' of the other side's manoeuvres. An example is speculative currency attacks in financial markets. If an increasing number of speculators attack a currency, the optimal response from other speculators is to attack the currency as well. Similarly, if a political cause is being furthered through the extra attention that protests bring, the best response from non-protesting supporters is to 'join the crowd'. Protocols used within a company are a further area in which strategic complements apply. Coordinating the use of the same tools, such as software, across different parts of the company can be in the interest of working towards the same goal.

Games with strategic substitutes (GSS), on the other hand, involve reacting inversely to the moves of the other side in a game. An example is represented in the competition for a shared resource – if resources in a region are being consumed quickly by one entity, it is in the interests of others to draw resources from a different region. A further example is traffic congestion – a large volume of traffic travelling along one route will rationally be answered with other traffic directing to alternate routes.

Games with strategic heterogeneity (GSH) feature both strategic complements and strategic substitutes. In law enforcement, for example, while an objective of police is to try to be in the same place as criminals, the intention of criminals is to be where police aren't, hence demonstrating inverse behaviour. The same principle of pursuit and avoidance applies to a goal keeper and penalty shooter, advertisers and the public, or a dictator and rebels.

The scope of these three types of systems, their movement characteristics and their applications have been at the core of the recent research of Dr Sabarwal and his team. His research has provided new insights into the ways in which rational decision-making manifests human behaviours in these situations.

‘When I first started working on GSS, researchers often commented that I was wasting my time, because we can change the order and get a GSC. Nowadays, I hear the opposite, something akin to: “Why should we believe a GSS behaves like a GSC?” I am thankful to have played a role in the transformation of conventional wisdom here.’

Equilibrium as Harmony

In the 1980s, it was found that in investment games, the best strategy depends on whether the goods of competing firms are strategic complements or substitutes to each other. This kindled interest in the mathematical principles behind this decision-making.

It was soon established that every GSC always has a ‘Nash equilibrium’, which occurs when all players are simultaneously trying to do the best for themselves and there is no tendency to change – a harmonious coordination of decentralised rational decisions. Another important discovery was that the pattern of incentives in GSC leads to ordered equilibrium outcomes, one with the least amount of coordination among players and another with the most coordination. It was found that if marginal benefit from taking a ‘higher’ action goes up, players find it in their best interest to increase coordination in both these equilibria, a phenomenon termed ‘monotone comparative statics’. These insights helped in the development of principles to steer human behaviour in desired directions.

Dr Sabarwal and his team focus on developing related principles for GSS and GSH. A challenge is the lack of applicable mathematical methods for GSS. Theorists have attempted to circumvent this by converting GSS to imitate GSC models, but Dr Sabarwal and his colleagues showed that this may not work beyond simple situations. Further, treating GSS as GSC is detrimental because incentives in GSS models exhibit two opposing behaviours and cannot be straitjacketed into the ‘increased action’ behaviours inherent in GSC. This compromises the ability to predict changes in equilibrium that are dependent on increases in the system’s environment. ‘Forcing a study of GSS in terms of GSC is like fitting a square peg in a round hole,’ concludes Dr Sabarwal.

Actions of Increase and Decrease

Games have attributes called orders, which are characterised by the choices of players, based on moves they can make. Dr Sabarwal and his colleagues found that the order properties of GSS and GSH provide statistics that can be used to develop a picture of the equilibria involved and expand our understanding of rational choices more generally.

They found that these games may not have a Nash equilibrium, contradicting the situation for GSC and documenting the necessity of alternative approaches. Further, they find that in GSS and GSH, different equilibria are not comparable, making it impossible to identify smallest and largest equilibria, or increases to these equilibria when there is an incentive to take higher actions.

Using a different approach, Dr Sabarwal and his team discovered that the orders in these games create environments of competing effects from which natural trade-offs arise. When these trade-offs

are favourable, players increase equilibrium choices, exhibiting an appropriately nuanced version of monotone comparative statics. These order conditions are easy to determine in games and provide guidelines on how to influence behaviour in particular directions. As a result of their findings, there has been a spike in research investigating GSS and GSH.

Dr Sabarwal and his colleagues also investigated the stability of Nash equilibrium in GSS. They found that in GSS, behaviour of a single *best response* dynamic is all that is needed to determine global stability of equilibrium. This is different from the case for GSC, where two best response dynamics are needed to converge to the same equilibrium. Further, Dr Sabarwal's students have recently been working to investigate the application of this principle to GSH.

An equilibrium is 'stable' if small deviations from the equilibrium guide game play back to an equilibrium state. An equilibrium is 'globally stable' if game play converges to the same unique equilibrium regardless of the starting conditions. Stability indicates that the equilibrium is a robust prediction.

Dr Sabarwal found that in GSS, the dynamic of the best response has high informational content about the game, because its limit is equivalent to global stability. This allows global stability to be analysed using a single best response dynamic, which leads to the natural and unique equilibrium of the game. The phenomenon of dominance solvability (when there is only one strategy left for each player) turns out to be logically equivalent to global stability in GSS. This means that dominance solvability can also be checked using a single best response dynamic.

An undominated strategy is a strategy that is not dominated by any other strategy. Prior research has shown that in GSC, there are ranges of undominated strategies from which all other rational strategies can be derived. By repeatedly eliminating strategies that are dominated and examining the remaining strategies, Dr Sabarwal and his colleagues have demonstrated that they can establish the conditions necessary for dominance solvability and the stability of equilibria using only one best response dynamic.

Throughout the course of their research, Dr Sabarwal and his team have found that GSS and GSH need different studies. As a result of their findings, this is now well documented among scholars. 'When I first started working on GSS, researchers often commented that I was wasting my time, because we can change the order and get a GSC,' Dr Sabarwal reflects. 'Nowadays, I hear the opposite, something akin to: "Why should we believe a GSS behaves like a GSC?" I am thankful to have played a role in the transformation of conventional wisdom here.'

Meeting New Complexities

In the frameworks used to study GSC, budget constraints that restrict decision-making are not factored into predictive models. Recently, however, research has been conducted to attempt to address this. In continuing this research, Dr Sabarwal and his team are expanding on it to determine the conditions in which a variety of budget-based decisions are possible.

Research into strategic complements in dynamic games has been thought of as a very restricted area of study. Dr Sabarwal and his student have rebutted that this may be because those models are based on standard adaptations of conditions on player payoffs, which they show are too blunt a modelling instrument. They posit that if the more fundamental definition of strategic complements is used (that is, a player's optimal choice goes up when an opponent increases their action), this holds much more generally. These results may increase the scope of applications greatly. Presently, these results are only available in the case of two stage, two player, and two action games. Dr Sabarwal's ongoing research explores more general cases.

GSC and GSS are two forms of game play that represent complex behaviours in tractable models. The work of Dr Sabarwal and his associates has aided in the expansion of theory on which these perspectives are built. By engaging in further calibration of these models, we are achieving sophisticated accounts of the ways in which rational beings interact with each other.

Meet the researcher

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Dr Tarun Sabarwal was awarded his PhD in economics at the University of California at Berkeley in 2000. Upon graduating, he worked as an economist for the Board of Governors of the Federal Reserve System. This was followed by lecturing positions at the University of Texas at Austin and Washington University in St. Louis, before he started working at the University of Kansas in 2008. Here, Dr Sabarwal is currently the De-Min and Chin-Sha Wu Associate Professor of Economics and the Director of the Center for Economics Research and Education. He is also the Associate Chair and Director of Graduate Studies, and has supervised many PhD students in economics. Dr Sabarwal was inducted into the Who's Who in Social Sciences Academia in 2009.

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SUSTAINABLE INNOVATION FOR AN EQUITABLE WORLD

Frugal innovation is the art of using limited resources and ingenuity to sell products that are affordable for more people. Alongside his collaborators, **Dr Henning Kroll** of the Fraunhofer Institute for Systems and Innovation Research explores the many benefits of this approach for achieving sustainable business success and equity.

Innovation

We live in a world of technological marvels – one in which a smartphone can have more computing power than a space shuttle, one where we are instantly connected to the world's knowledge. These are the direct result of many clever people thinking up new ideas – a complex and chaotic process that we simply refer to as *innovation*.

Most of us consider innovation in terms of high-tech, high-return products – we think of new pharmaceuticals, smart watches, electric cars and even the much-derided internet-connected fridge. Yet there is also another type of innovation, the so-called 'frugal innovation'. In this approach, the main goal is to achieve success with limited resources – limited money, limited production and limited employees. Frugal innovation requires creative solutions to problems and the subsequent sale of those solutions to many people for less money. Indeed, the well-established catchphrase is 'more value from less resource for more people'.

Frugal innovation should not be thought of as simply making cheaper things for poorer people. Instead the main aim is to make better products in the area that the customer is most interested in. This often takes the form of removing excess or unnecessary features in favour of the core use of the product, and is usually supported by approaches such as improved manufacturing efficiency, use of cheap by-products from other industries, or clever design decisions.

This idea is well-established in newer and emerging economies, where a lack of free-flowing resources has led to ingenious solutions to many problems. Yet it may also apply to European companies, which are generally situated in wealthy areas full of customers who traditionally are not averse to buying the latest piece of technology. How can this be? This is the question which Dr Henning Kroll of the Fraunhofer Institute for Systems and Innovation Research set out to answer.

A Union of Ideas and Limitations

Funded by the European Commission, Dr Kroll and collaborators from the Fraunhofer Institute and Nesta looked into the state of frugal innovation in Europe. This involved many studies, interviews, and discussions with experts from all fields of endeavour.

They were able to show that, although 'frugal innovation' as a term is relatively unknown, the processes involved have been taken up in a range of different sectors – from finance to housing and many others in between. The research

team also realised that there was no particular type of company that was more likely to innovate – they found that frugal innovation was performed by companies ranging from tiny start-ups through to major multinationals.

Dr Kroll and his colleagues found that many of these innovations came from a clever combination of previously-developed technology, and there were very few examples of completely new ideas. Most fell within the field of information technology, with the ever-more-powerful smartphone replacing the expensive, dedicated equipment

that was previously in place. However, new technological developments in materials science and 3D printing were opening up new opportunities for many firms.

This does not mean that every innovation was a good one, of course. Frugal innovations were often seen as unreliable at the start, lacking the low-cost and simplicity that would make them a tempting investment. As a result, many of the initial inventors had decided not to follow up on the idea, requiring a nudge from outside partners or investors to move things forward.

At the same time, companies found it difficult to fully access the emerging and low-cost markets, as these were outside their normal customer base and they didn't have the required contacts or knowledge. 'As long as they are of sufficient quality and actually fix problems, selling a large number of low-margin products may well be preferable to selling few with a high margin,' comments Dr Kroll. 'To succeed in this, firms need to undercut relevant price levels but also to sufficiently understand what is locally needed… these capacities are no longer commonly present among Western firms.'

Yet, as Dr Kroll's studies have shown, there were benefits for those businesses that did manage to make the jump.

There are two major advantages for companies that follow the ideals of frugal innovation. First, by creating cheaper offerings, they were able to expand into lower-income regions such as rural China and India. European companies may be rarely able to beat local firms in a race to the cheapest offering, but the combination of cheaper products and the high-quality image associated with the companies allowed them to take a large bite out of the middle-class market. Secondly, Europeans themselves are not averse to low-cost, low-frills products. Well-known discount supermarkets such as Aldi and Lidl started in Germany, and their success is primarily due to their focus on targeted, low-cost products.

This approach is not only advantageous for consumers. Frugal innovation is often also characterised by resource-efficient manufacturing coupled with clever use of resources and so-called waste products. This leads to a reduced environmental impact, while at the same time allowing poorer residents to access goods which they may otherwise not be able to afford. At least, this is the hope – Dr Kroll points out quite clearly that not all frugal innovations are environmentally sustainable, and indeed that this is an area where government policy should be involved.

The People's Party of Patenting

Frugal innovation, however, is not the only research interest of Dr Kroll. Indeed, he and his long-time collaborator Professor Ingo Liefner of the Leibniz Universität Hannover are also interested in the state of innovation in China.

Innovation itself is difficult to directly measure, but a common surrogate is the number of patents that have been filed. Patents provide legal protection for an innovative idea but require payment of a filing fee. This makes them a good indication of whether a company thinks a novel idea is worth investing in. In other words, it measures economically-supported innovation. Yet patents are not always a reliable measure, and innovation rates can be strongly affected by political pressure. One interesting case is that of China, a rapidly-growing economy that has seen immense increases in patent numbers over the last few decades. Innovation, research and development are well-established components of the Chinese government's long-term economic planning, with corresponding policies in place to encourage patenting. Do these policies have an effect on innovation and patent rates? Dr Kroll and his collaborators set out to determine if this was the case.

They achieved this by taking advantage of an interesting quirk in China's economic system. A number of companies in China are host to an official representative of the Communist Party of China, or CPC. This office helps to keep the Party's interests in mind when decision-making is being performed. Nearly a quarter of China's firms have a CPC office, predominantly in large and state-owned companies, although by most measures these companies cannot be distinguished from their CPC-free equivalents. Does the presence of a CPC office, and thus a closer connection to government policy, influence the innovation and patenting approach of Chinese firms? The answer, interestingly, is yes.

In collaboration with colleagues who had led a substantial data collection effort in China, Dr Kroll had the opportunity to examine data from almost 300 small-to-medium electronics firms in the Pearl River Delta. This area is one of the most densely populated in the world, with over 120 million people working in a vast number of factories and producing much of the world's electronics, toys, and other plastic products. The area is responsible for roughly a third of China's trade value and has an economy roughly the size of Russia. It is, in every sense of the word, an important location.

The data that they were able to examine included many different factors, such as location, size, age, and Party affiliation. They were able to show that the presence of a CPC office was heavily linked to patenting. Indeed, simply having an office within the company meant that it was 32% more likely to have patented something.

This was not the only correlation, of course. Companies with internal R&D groups were more likely to have patented something (as you would expect), while companies that produce highly-customised one-off products for single customers tended not to bother with patents. Yet these correlations were less clear-cut than the most apparent factor – that of a CPC office.

Thus, the researchers clearly demonstrated that a link to the government was a powerful factor encouraging a patent application. As patents are a long-term goal of the Chinese government, Professor Liefner and Dr Kroll concluded that government influence over business decisions is significant, even in small- and medium-sized firms.

Outside the Economic Zone

Where do Dr Kroll and his colleagues intend to take this work next? One of their current focuses is the use of frugal innovation and other methods in China – a country hosting both rapidly-industrialising high-tech zones and areas that remain resolutely lower-income. Much of the research underway has chosen to focus on the country's dynamic growth towards a technological and manufacturing hub for Asia and indeed the world. Yet fewer have chosen to look at the other side of China.

'What we seek to understand, therefore, is how the economies and "innovation systems" of regions outside of the country's high-tech centres develop at this point in time,' explains Dr Kroll. 'Our project seeks to study the common "unseen" China of less central provinces – to unveil that, besides the technological superpower, there are further aspects in China's rise that deserve our attention.'

The importance of these insights stretches from the inner provinces of China through to the business plans of European multinationals. Whether it will bring about concrete changes in innovation collaboration remains to be seen, but we can rest assured that the results of the upcoming research will help us to better understand available possibilities and options.

Meet the researcher

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Dr Henning Kroll is a senior researcher and project manager at the Fraunhofer Institute for Systems and Innovation Research in Karlsruhe. His research career began with a major in economic geography at the University of Hanover, followed by a PhD at the same university focusing on the role of innovation and university spin-off companies in China. Following this, he joined the Fraunhofer Institute in 2006 and has since lead various projects in the field of research and innovation studies. Accumulating over 30 publications on the way he continues to teach at the now Leibniz Universität Hannover as an associate lecturer in Economic Geography. His current research interests include innovation in Germany, Europe and China, policy and governance as they relate to innovation, and advanced manufacturing.

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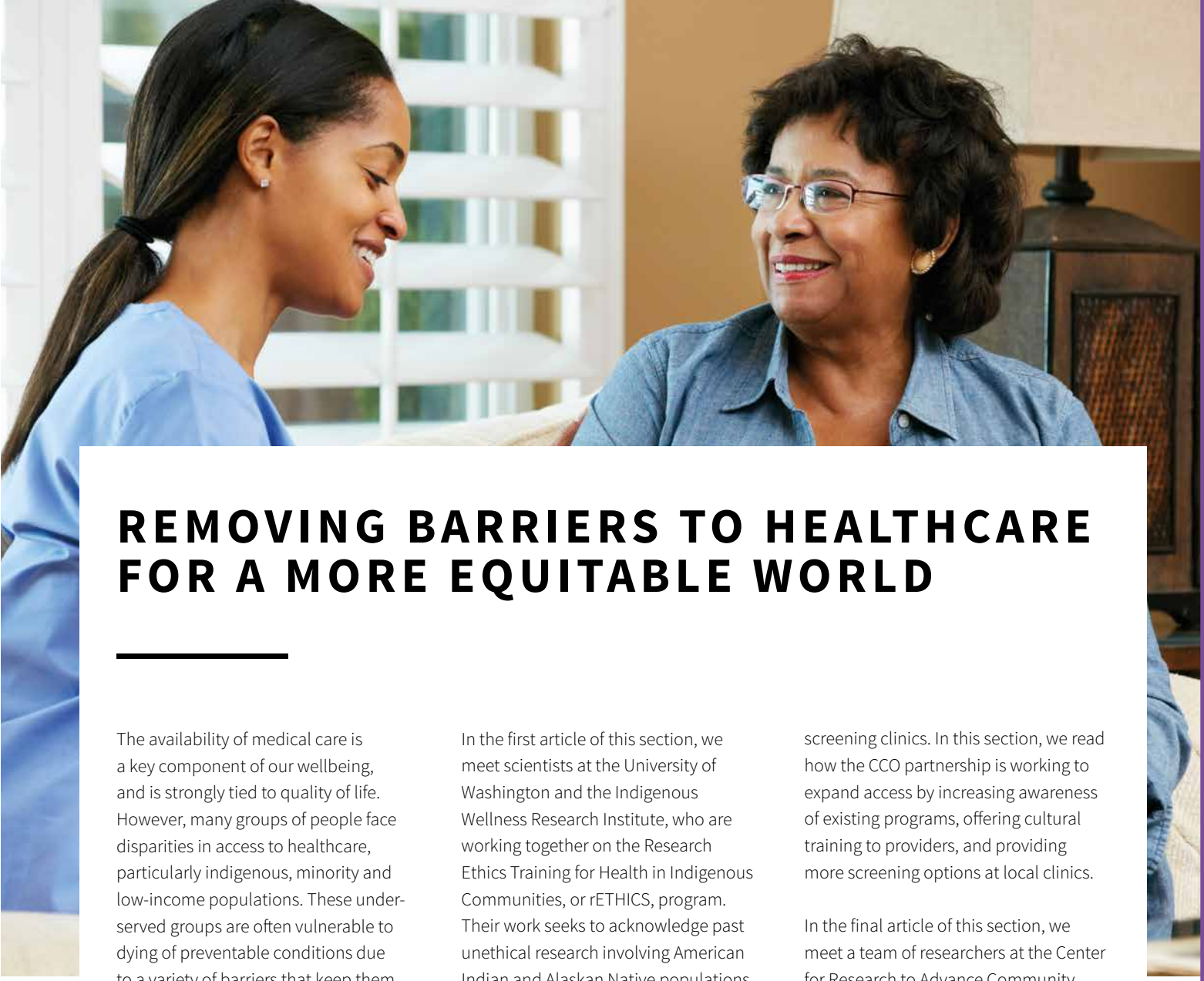
HEALTH EQUITY



REMOVING BARRIERS TO HEALTHCARE FOR A MORE EQUITABLE WORLD

The availability of medical care is a key component of our wellbeing, and is strongly tied to quality of life. However, many groups of people face disparities in access to healthcare, particularly indigenous, minority and low-income populations. These under-served groups are often vulnerable to dying of preventable conditions due to a variety of barriers that keep them from receiving accurate information, preventative care, disease screening and affordable treatments. Barriers such as affordability, proximity of clinics, awareness of risk, cultural differences and historical distrust of providers (often earned through a history of mistreatment) work together to keep many communities from getting care they need.

In this final section of the issue, we highlight research that is striving to close population gaps in healthcare by working to better understand and address the barriers that under-served groups face when seeking medical care. Through culturally sensitive provider training and accessible screening programs, the research teams featured in this section are working towards ensuring more equitable healthcare.

In the first article of this section, we meet scientists at the University of Washington and the Indigenous Wellness Research Institute, who are working together on the Research Ethics Training for Health in Indigenous Communities, or rETHICS, program. Their work seeks to acknowledge past unethical research involving American Indian and Alaskan Native populations, which has led to wariness among indigenous community members in participating in health initiatives led by colonisers. By engaging with these communities to develop culturally sensitive ethics training for healthcare providers, the rETHICS program is opening lines of communication that enable better health research and patient relationships.

In another collaboration with tribal groups, Cancer Care Ontario (CCO) is developing diverse solutions for cancer education, screening and treatment within indigenous populations in Canada. Regular cancer screening is recognised as an effective way to save lives; however, residents of indigenous territories do not always have access to screening clinics. In this section, we read how the CCO partnership is working to expand access by increasing awareness of existing programs, offering cultural training to providers, and providing more screening options at local clinics.

In the final article of this section, we meet a team of researchers at the Center for Research to Advance Community Health (ReACH), who are working to make Hepatitis C screening accessible for low-income populations. This often-silent disease can wreak havoc on the liver if left untreated but can be easily cured if caught early on. Screening is recommended for patients over 50, however many low-income patients never undergo screening or have limited access to educational and treatment resources if they do receive a diagnosis. The ReACH team is working to expand universal screening, educational resources, and treatment support for low-income patients in Texas.

By removing barriers in communication, culture, availability and cost, the researchers featured in this section are working to make healthcare available to all.

rETHICS: RESEARCH ETHICS TRAINING FOR HEALTH IN INDIGENOUS COMMUNITIES

American Indian and Alaska Natives (AIAN) face substantial health inequalities, yet ethical research addressing their health concerns is still extremely limited. **Dr Cynthia Pearson**, Associate Professor at the University of Washington and Director of Research at the Indigenous Wellness Research Institute, along with her colleagues Dr Myra Parker, Dr Chuan Zhou, Ms Catlin Donald and Dr Celia Fisher, has developed a new training curriculum for conducting ethical research with American Indian and Alaska Native communities. rETHICS – Research Ethics Training for Health in Indigenous Communities – is grounded on indigenous knowledge and values and discusses concerns as identified by American Indian and Alaska Natives related to conducting ethical research with their communities.

The Need for Culturally-Tailored Ethical Research Training Curriculums

The implementation of research and interventions among indigenous communities can be challenging, particularly due to a widespread mistrust in the scientific establishment derived from a long history of culturally insensitive, unethical, and harmful research studies.

There are several instances in history where research has well-earned distrust by tribal communities. For example, researchers of the 1979 Barrow Alcohol study published study results without representation and consent from the tribal communities that participated and were affected by the study. The community was not informed of how the findings would be presented or the context that would be shared. The researchers and media went on to misrepresent the findings, describing the Inupiat people as 'alcoholics… facing extinction'.

Another example comes from 1989, when Arizona State University misused DNA samples from members of the Havasupai Tribe, which were originally collected for a diabetes genetic study. The researchers in charge of the study permitted other researchers and graduate students to use the blood samples for non-related studies on mental illness and other topics, resulting in published papers in which the Havasupai tribe was explicitly named. The tribal council sued Arizona State University for violating the consent agreement with participants, resulting in a financial settlement won by the Havasupai Tribe, as well as the return of all blood samples.

Multiple other scientific studies have negatively affected American Indian and Alaska Native (AIAN) populations and have contributed to community mistrust in research practices. Past research has often resulted in tribal stigmatisation of AIAN communities and presenting data

‘My research focuses on collaborating with Native American communities to enhance health and wellness. We talk about the need to decolonise research and yet, we often still work within a colonised and colonising framework. The rETHICS curriculum is an effort to provide a decolonised framework for American Indians and Alaska Natives and their research collaborators to conduct ethical science with and for their communities.’

that has failed to adequately inform about relevant prevention and treatment services.

Ethics Training

Although there are several commonly used human subject research training curriculums, there have been concerns expressed that these trainings lack cultural and contextual relevance, as well as lacking specific discussions about community-level or group harms and benefits. The lack of a culturally relevant ethic guidelines for indigenous community partners is an obstacle to good scientific research.

As AIAN generally retain their tribal and cultural diversity, comprising a unique set of values, ethics and traditions, it is imperative to engage AIAN communities throughout the research process. This engagement can help reduce research mistrust, increase tribal participation, and improve the population validity of research designs and protections for the human subjects. This can lead to the sustainability of evidence-based interventions to reduce health disparities rooted in historical and contemporary systemic inequities.

To address the lack of ethical studies investigating the health of AIAN populations, Dr Cynthia Pearson of the University of Washington and the Indigenous Wellness Research Institute, in collaboration community partners, developed the rETHICS curriculum. rETHICS is a human subjects training curriculum that interprets the Code of Federal Regulation (45 CFR 46) and prioritises tribal sovereignty and cultural respect in scientific research with AIAN communities.

‘The rETHICS curriculum is an effort to provide a decolonised framework for American Indians and Alaska Natives and their research collaborators to conduct ethical science with and for their communities,’ explains Dr Pearson. rETHICS is a valuable tool to train researchers and community partners who are engaged in studies on the conduct of ethical research practices with AIAN communities.

The Development of rETHICS

rETHICS was founded with the aim of increasing the engagement of AIAN community members both as co-researchers in studies affecting their communities as well as participation of community members as research participants. Using a community-engaged research approach, rETHICS was developed by AIAN representatives across the US, while acknowledging that there is great diversity across tribal communities and highlighting the importance of local AIAN community reviews and research approval.

Three expert panels guided the development of the culturally tailored curriculum. One group was composed of American Indians and Alaska Natives (AIAN) with experience conducting research in their communities. Another comprised American Indians and Alaska Natives, along with outside researchers who worked in AIAN communities, while the third was made up of academic Institutional Review Board (IRB) members and ethicists who review AIAN-focused research.

Findings

In a randomised comparison trial, the tailored AIAN rETHICS curriculum was compared to the leading standard training among 490 AIAN people. The rETHICS curriculum resulted in significantly higher total knowledge scores and scores on individual modules. rETHICS participants also reported higher levels of trust in research and research review efficacy post-completion.

Moreover, the evaluation showed that at first attempt, about 28% of the group that took the standard curriculum passed, whereas among those who took the culturally tailored version, nearly 60% passed. These higher scores demonstrate that when the ethical principles used in these trainings are contextualised within a community setting, members increase their retention of information and their skills to implement research protections, thus increasing trust in the research process.

The rETHICS Curriculum

rETHICS comprises 10 modules that consist of information related to ethical principles and research practices, along with topics that are particularly relevant to the history, culture and values of AIAN communities:

1. Research with AIAN Communities
2. The History of Ethical Regulations
3. What is Human Subjects Research?
4. Institutional Review Board (IRB)
5. Risks and Benefits from Research
6. Ensuring Confidentiality and Managing Risk
7. Informed Consent
8. Vulnerability
9. Children in Research
10. Unanticipated Problems and Reporting Requirements in Research

The curriculum is available for open access here: https://redcap.iths.org/surveys/?s=R3EJPAYD4J.

In addition to the curriculum, Dr Pearson and her colleagues have produced a complete toolkit consisting of the curriculum, facilitator guides, informational presentations and case studies presented in six presentation chapters. Also included are quiz questions with an answer key, and a certificate of completion.

Each presentation is matched with a step-by-step facilitator guide that includes in-depth information of each human subjects training content area and a scripted guide. As part of the training, there are interactive exercises that discuss different case studies, such as the 1979 Barrow Alcohol Study and the 1989 Havasupai case.

There is also a shorter version of the toolkit that includes the curriculum, a short quiz for each of the 10 sections with an answer key, and the certificate. A non-transferable license is provided to a single trainer for each toolkit for $500 per user.

The toolkit can be obtained here. The team has also developed a package that includes the rETHICS curriculum, quizzes and answer key, which is available as a non-transferable license for $150 per user, and can be obtained here.

Meet the researcher

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Dr Cynthia Pearson is an Associate Professor - School of Social Work, Adjunct Associate Professor - American Indian Studies, and Director of Research at the Indigenous Wellness Research Institute (IWRI) at the University of Washington. As part of her work at IWRI, she collaborates with indigenous scholars on the development of research policies and directs iterative data analysis on historical and cultural determinants of physical and mental health among American Indians and Alaska Natives (AIAN). Dr Pearson's expertise is in designing tribally-based health studies from an ecological perspective, emphasising social, economic, political, environmental and historical determinants of health. Dr Pearson's work focuses on carrying out ethical research and designing culturally grounded interventions, while also exploring how the intersecting risk of substance use, historical and lifetime trauma, and HIV is buffered by culture, place and community. She is the principal investigator of rETHICS: Ethics Training for Health in Indigenous Communities Study, aimed at designing human subject certification training for AIAN community researchers. Over the course of her career, she has received numerous honours, fellowships, and awards, the latest being the UW/FHRC Center for AIDS Research (CFAR)'s Developmental Core Travel award in 2013.

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rETHICS
Research Ethics Training for Health in Indigenous Communities

ADDRESSING DISPARITIES IN ACCESS TO CANCER SCREENING EXPERIENCED BY INDIGENOUS PEOPLES IN ONTARIO

Persistent health inequities, rooted in colonialism, continue to impact Indigenous[1] peoples in Canada. The trend is no different for cancer, which has emerged as a leading cause of death among Indigenous peoples. Although cancer screening is widely recognised as an effective way of finding certain cancers early, many barriers to participation in cancer screening exist. Cancer Care Ontario is developing relationships and partnerships with First Nations, Inuit and Métis communities throughout Ontario to address cancer issues and develop diverse, collaborative solutions to promote healing and health.

As documented in detail in the 1994 Royal Commission on Aboriginal Peoples and the 2015 Truth and Reconciliation Commission (TRC) reports, Canada's history is defined by the colonisation of Indigenous lands and peoples. Although the processes and experiences vary among First Nations, Inuit and Métis (FNIM) peoples, Canadian Indigenous policy has sought to remove Indigenous peoples from their traditional territories and to destroy Indigenous ways of knowing and being, systems of governance, and cultures. This oppressive history, in addition to contemporary injustices, shape the health and wellbeing of FNIM peoples today.

However, FNIM peoples have shown and continue to show great strength and resilience in the face of these enduring oppressive forces. The TRC, which was established and completed as a result of the courage and determination of Indigenous peoples who suffered immensely as a result of Canada's residential school system, proposed 94 Calls to Action that set a clear and actionable path towards reconciliation. Eliminating the egregious health inequities between Indigenous peoples and other Canadians is an important part of reconciliation; seven of the TRC's Calls to Action focus directly on health.

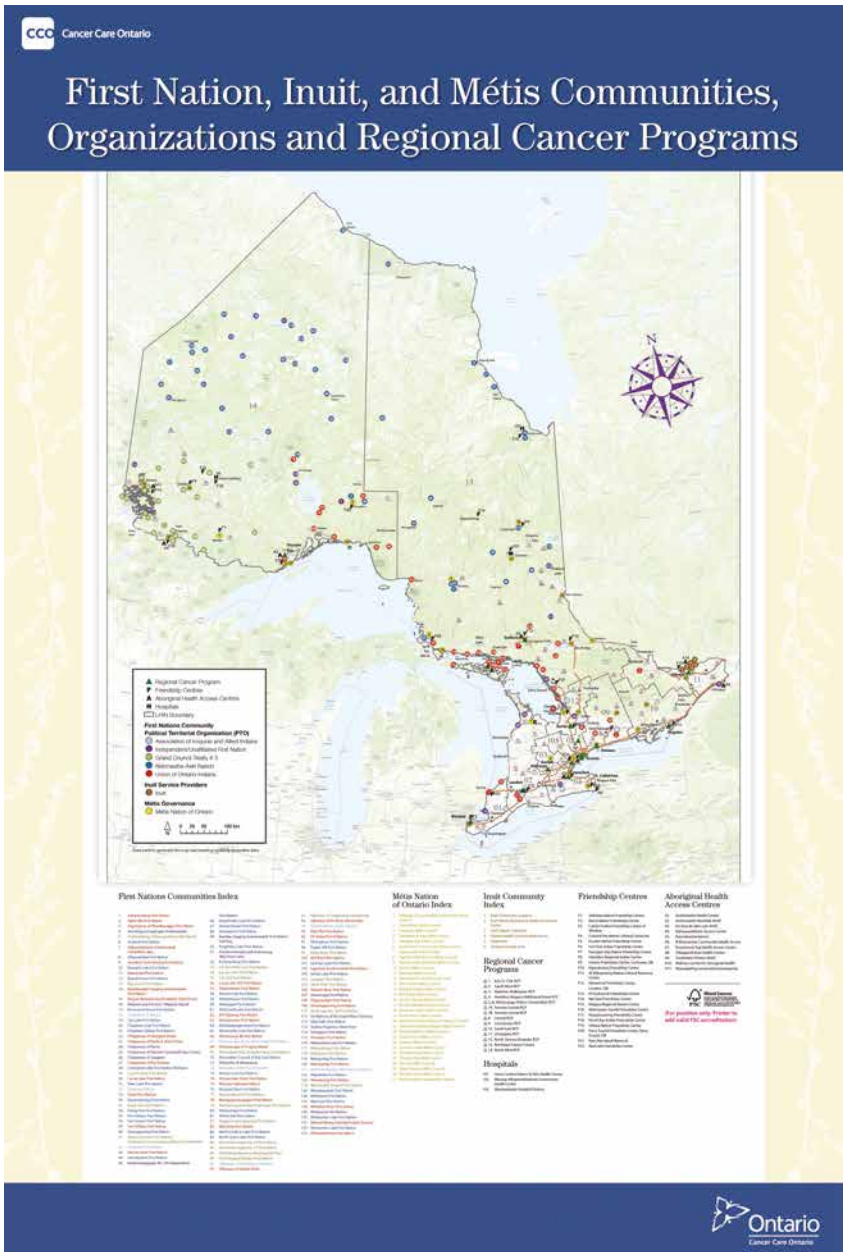
Consistent with a health equity and reconciliation-focused approach, Cancer Care Ontario (CCO), under the leadership of Alethea Kewayosh, the Director of CCO's Indigenous Cancer Control Unit, has been working over the past decade to shift its approach and engage with FNIM leadership and communities in a respectful and community-driven manner. To that end, a series successive 'Aboriginal Cancer Strategy' policy documents have been developed in partnership with FNIM leadership and healthcare stakeholders throughout the province. These strategies set the path for the work that CCO, regional cancer programs and FNIM communities and leadership conduct together, in order to improve the cancer system functioning for FNIM peoples in Ontario.

In line with this guiding strategy, CCO has partnered with Sunnybrook Research Institute (SRI) on a research project focused on improving participation in Ontario's organised cancer screening programs (breast, colorectal and cervical) among FNIM peoples. Dr Jill Tinmouth of SRI, Alethea Kewayosh of CCO, and Dr Naana Jumah of the Northern Ontario School of Medicine are leading aspects of this health research program, which is conducted in partnership with First Nations and Métis communities. In order to improve cancer screening

participation, the research team is approaching the issue from multiple angles – policy analysis, community-based analysis of cancer screening experience, and an evaluation of previously conducted regional screening interventions. With this data, the team aims to develop a comprehensive knowledge translation action plan to address barriers and improve cancer screening participation in Indigenous communities.

Kewayosh illustrates why the team has chosen cancer screening as a target: 'We have heard many stories throughout

[1] The term Indigenous refers to the original First Nations, Inuit and Métis (FNIM) inhabitants of Canada and is used throughout the document interchangeably with FNIM. The term Aboriginal is used when the document or program being referred to has used that term instead of Indigenous.



Ontario about the huge toll that cancer takes on communities – for example, community members sharing about loved ones who were diagnosed with cancer and in very short time, they are gone – sometimes in a matter of weeks. Many stories like this have been shared and these are treatable cancers that should have been detected earlier. This is where we know that screening could have made the difference to the many lives that have been lost because cancers are being detected too late.'

Understanding Policy from Every Angle

One of the initial aims of the research team was to clarify the health policy factors that impact access to and participation in cancer screening in Ontario First Nations communities. To accomplish this, the team conducted a comprehensive analysis of health policy documents that inform cancer screening participation. Building on this analysis, the team also conducted 44 in-depth key informant interviews with policy stakeholders at community, regional, provincial and federal levels. In an effort to ensure that the team gained a comprehensive understanding of the health policy implications, interviews were conducted with those who develop and implement policy, as well as those who experience the effects of these policies first hand.

The policy document review and in-depth interviews identified a complex cancer screening system shaped by health policies that frequently fail to clearly specify who is responsible for providing and supporting cancer screening in Ontario First Nations communities. Interviewees at all levels expressed this reality, making it difficult to pinpoint specific policies to target for change. The team's analysis also revealed that policies that inform cancer screening among First Nations communities were seldom developed or evaluated with input or feedback from the communities; as a result, they were not always in tune with community realities.

Community Perspectives on Barriers to Quality Care

To explore community perspectives on and experiences with cancer screening, the research team partnered with Wequedong Lodge of Thunder Bay and the Métis Nation of Ontario (MNO) to conduct two distinct community-based participatory research projects.

The Wequedong Lodge Cancer Screening Research Project focused on better understanding the barriers and facilitators to cancer screening participation among First Nations community members in Northwestern Ontario, where there are many communities in rural and remote areas. The project consisted of an equal partnership between Wequedong Lodge, CCO and SRI, and was led by a Wequedong Lodge community advisory group that guided all aspects of the work. In order to get a full understanding of the complexity of cancer screening on the ground, the research team conducted in-depth interviews with 29 First Nations community members from 19 different communities, nine community health workers from six different communities, and ten doctors and nurses who served Northwestern Ontario First Nations communities.

The community-based analysis showed that a lack of culturally relevant

screening education resources was a barrier to community members engaging with cancer screening. Persistent negative experiences with healthcare providers and the healthcare system, including discrimination and poor communication, meant that community members were often distrustful and reluctant to participate in cancer screening. The intimate nature of screening tests for breast, cervix and colorectal cancers compounded these challenges. High healthcare provider turnover in communities and a lack of integration among different health service provider organisations in the region made it difficult for healthcare providers to track screening participation and to effectively support community members with cancer screening. Limited access to cancer screening services in communities and the difficulty associated with travel to larger health centres also served as important barriers. A few of the key screening supports that were identified included: working towards a regionally coordinated screening effort; developing screening education and guidance resources that reflect the lived realities of Northwestern Ontario First Nations community members; and improving cultural competency among healthcare providers.

In the Métis Cancer Screening Research Project, the research team partnered with the MNO to identify barriers and facilitators to cancer screening uptake and improve access to culturally relevant cancer screening services for Métis citizens in Ontario. This project built on the MNO's program of participatory research, was based on an equal partnership with MNO, and was guided by an integrated MNO-CCO-SRI working group. The study combined focus group and survey methods to capture the perspectives of Métis peoples throughout Ontario. Participants included 66 Métis community members and MNO frontline staff.

The community-based analysis showed that participation in cancer screening among Métis community members was impeded by limited Métis-specific resources and supports; widespread lack of cultural competency among healthcare providers; limited access to screening services; and challenges with long-distance travel to access services. Among the key supports identified were: culturally specific information and programming; assistance with transportation; increasing provision of local screening services; Métis cultural training for healthcare providers; and integrated screening services. This research identified key service gaps and culture-based strategies for improving cancer screening services among Métis community members in Ontario.

Learning from Past Screening Interventions

Another one of the team's goals was to evaluate a large cancer screening initiative that CCO undertook in partnership with several Ontario health regions from 2011–2014, in an effort to learn from pre-exiting projects and inform the direction of future work. Through the 'Under/Never Screened' (UNS) initiatives, health regions worked with community partners to develop and evaluate community-specific interventions to engage persons who had never participated or were not up-to-date with cancer screening. In four regions, the focus was on FNIM populations.

Among the central learnings from the team's evaluation of the regional UNS projects that focussed on FNIM populations were: the importance of building a long 'run time' for the development of community partnerships and formalising these essential partnerships; using multiple approaches to targeting and engaging UNS populations; and developing a rigorous evaluation plan at the outset of the initiative to facilitate a cohesive evaluation across regions.

Changing the Narrative for Indigenous Health

Based on the findings from these projects, the research team and partners are already focusing on developing more culturally appropriate educational resources about cancer screening, supporting engagement of physicians in cultural competency training, and finding ways to simplify patient access to screening. While more work is still needed, these research findings should help CCO refine their cancer screening programs to help them save more lives. 'Our work is to ensure there is equitable understanding of and access not only to cancer services, but also, very importantly, to prevention and cancer screening services,' says Kewayosh.

The ultimate aim of this research program is to utilise the findings to work in collaboration with FNIM leaders, academics and community members to develop a comprehensive knowledge translation action plan to improve cancer screening participation among FNIM communities in Ontario. 'The current project has taught us some very important things about cancer screening and First Nations and Métis communities, and we are developing a comprehensive "action plan" to help ensure that our findings are incorporated into the work done at CCO and beyond,' explains Dr Tinmouth. 'With our partners, we would like to continue to research and evaluate this important health issue – exploring, for example, the use of culturally appropriate decision aids to engage community members in cancer screening, strategies to better communicate with community members and approaches to reporting on the delivery of cancer screening services to communities.'

The research team is working to refine and finalise the knowledge translation action plan through iterative community and policy stakeholder engagement. As Dr Tinmouth describes: 'In this project, we have learned some very important things about the policy context for cancer screening in FNIM communities, including key problematic areas; about barriers and challenges faced by First Nations and Métis community members as well as some potential ideas for facilitators; and finally, about possible locally tailored interventions. In particular, we learned that relationship building with community partners was absolutely critical.'

Meet the researchers

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Dr Jill Tinmouth graduated from Yale University with a BA in History of Art in 1988 before earning her MD from New York University School of Medicine in 1995. After completing multiple residencies, she returned to academia to pursue a PhD in Clinical Epidemiology & Health Care Research at the University of Toronto, graduating in 2004. She currently serves as the Associate Director of Health Policy, Management, and Evaluation in the Clinical Epidemiology Program at the University of Toronto and Scientist at Sunnybrook Health Sciences Centre. Her research focuses on gastrointestinal cancer screening, gastrointestinal health, and on improving access to cancer screening in indigenous populations.

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Alethea Kewayosh has been an advocate for improving health services for Aboriginal peoples for over 30 years. Growing up in the Walpole Island First Nation community, she has personal appreciation for the diversity of Aboriginal Canadians and advocates for open dialogue and cultural understanding in the development of health programs for indigenous populations. Her distinguished career has led to the creation of the National Aboriginal Diabetes Association and the launch of Aboriginal Cancer Strategies – programs that recognise the unique needs of Aboriginal groups via direct engagement with communities. She currently serves as the Director of Indigenous Cancer Control for Cancer Care Ontario, where she works to increase access to cancer screening services in disadvantaged communities.

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Dr Naana Jumah began her academic career with a BASc in Chemical Engineering from the University of Toronto, and continued on to earn her PhD in Medical Engineering from the University of Oxford as a Rhodes Scholar. She was ultimately awarded her MD from Harvard University, after which she returned to the University of Toronto to complete her residency in Obstetrics and Gynaecology. She currently serves as an Assistant Professor at the Northern Ontario School of Medicine, as well as serving as the Northwestern Ontario Lead for Colposcopy and Cervical Screening for Cancer Care Ontario.

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FINDING A SILENT KILLER: UNIVERSAL SCREENING FOR HEPATITIS C SAVES LIVES

Hepatitis C is the most common blood borne infection in the United States and a serious public health threat. It is a leading cause of liver failure and liver cancer, yet most people do not know they have it until serious liver damage has occurred. Currently, there is no vaccine against hepatitis C. Therefore, early diagnosis is critical because the disease can be cured by only three months or less of highly effective medication. Low-income populations are more likely to have hepatitis C infection and to suffer its complications but face many barriers to diagnosis and treatment in the United States. Dr Barbara J. Turner and the Center for Research to Advance Community Health (ReACH) team are working to change that in Texas.

Chronic Hepatitis C Affects Millions

According to the World Health Organization, chronic hepatitis C affects over 70 million people worldwide, causing at least 400,000 deaths each year from complications. In the United States, estimates of the number of people with chronic hepatitis C infection range from 2.7 to over 5 million. After about 20 years, 1–2 of every 10 people with chronic infection develop serious liver damage, which is called cirrhosis. These people are at great risk of developing liver failure and hepatocellular carcinoma (HCC) – the most common type of primary liver cancer – among other complications.

How Do You Get Hepatitis C?

Infection with the hepatitis C virus is acquired from blood-to-blood contact. Uninfected people can become infected through intravenous drug use (sharing needles), improperly sterilised medical equipment, blood transfusions (before 1992), being born to an infected mother, needlestick injuries, and dirty needles used for tattoos. Less commonly, it can be transmitted by sexual contact and other exposures to infected blood.

About 15–45% of people who are infected with the hepatitis C virus recover within 6 months without treatment. However, most still have the virus in their blood and can go on to develop a chronic infection as well as spread the disease to others. Despite being a serious disease, hepatitis C often goes unnoticed because it causes few, if any, symptoms for many years. Early symptoms are usually mild and common to many diseases, such as mild fever, achiness and abdominal pain. In the United States, it is estimated that over half of the people who have chronic hepatitis C have not been diagnosed and, therefore, have not received any care for this serious condition.

Fortunately, in over 90% of cases, hepatitis C is curable with highly effective, direct-acting antiviral medications. Simple blood tests can diagnose the infection and evaluate the health of the liver along with liver imaging tests. Treatment for hepatitis C benefits patients before any liver damage has been incurred because it arrests the damage, as well as at later stages when cirrhosis has developed. In all cases, it reduces the risk of infecting others.

The two worst-case scenarios for hepatitis C are liver failure and HCC. Although the liver is a remarkable organ that continues to do its work even when severely damaged, when a person develops liver failure, he or she will not survive without a liver transplant. Hepatitis C-related liver failure is responsible for about 50% of liver transplant cases in the United States, with a price tag of upwards of $300,000 each. HCC has a very poor survival rate and is the fastest rising cancer-related cause of death in the United States. In all cases, prevention is key – diagnosis and treatment of chronic hepatitis C significantly reduces the chances of liver failure and HCC.

Sadly, despite the availability of screening tests and effective treatments, deaths related to hepatitis C have increased by 50% in the United States over the past decade, with people who have chronic hepatitis C dying an average of 20 years earlier than those without. Deaths are rising because hepatitis C screening and linkage to care has not been widely implemented across the United States.

A Generational Disease

Approximately 3 of every 4 people with hepatitis C infection belong to the baby boomer generation, born from 1945 through 1965. This is because no one knew what was causing this liver infection until the virus was identified by scientists in the late 1980s. The spread of hepatitis C has dropped from over 280,000 new infections per year in 1989 to approximately 25,000 annually in more recent decades. This is because blood tests to screen for hepatitis C, safer use of needles, and sterilisation have become standard. However, new hepatitis C infections have grown to over 40,000 annually in the past few years due to increasing numbers of people injecting illicit drugs in the United States as a consequence of the opioid epidemic.

To diagnose hepatitis C infection, people in risk groups, such anyone who has ever injected drugs, need to be tested. The United States Preventive Services Task Force has also recommended that all baby boomers be tested once for hepatitis C, since most people with chronic infection belong to this age group.

Screening costs are covered for insured patients, but hepatitis C is especially common among minority and financially disadvantaged groups in the United States who receive limited healthcare services and may lack insurance, so they are often not tested. Even after being diagnosed with chronic hepatitis C, these disadvantaged patients face barriers to getting needed tests to stage the disease, specialist care, and medication to cure the infection. Additionally, primary care physicians working in practices and clinics that serve low-income populations usually have not received training or support to manage hepatitis C, limiting access to treatment when specialist care is limited.

ReACH Center Initiatives

The Center for Research to Advance Community Health (ReACH) at the University of Texas Health Science Center at San Antonio was founded by Dr Barbara J. Turner in 2010. One of its most important initiatives has been developing a comprehensive program to deliver hepatitis C education, prevention, screening, management and treatment to the general public, especially to low-income baby boomers in the state of Texas. ReACH's initial project was conducted in a safety-net hospital that provides care to low-income, often uninsured patients who have poor access to outpatient care.

With funding from the Centers for Disease Control and Prevention (CDC), the ReACH team tested nearly 4,600 hospitalised baby boomers for hepatitis C over a period of 21 months. To implement this comprehensive screening program, the team worked with hospital experts to modify the electronic medical record to identify patients who had never been tested for hepatitis C. They also created a list of patients' test results to find those who needed counselling and follow-up for chronic infection. The program offered educational presentations to the clinicians and staff, as well as information about screening to patients. Importantly, bilingual case managers met with patients diagnosed with chronic hepatitis C to educate and support them to receive ongoing care for hepatitis C.

Overall, the screening program found that 316 patients (nearly 7%) had ever been infected with hepatitis C – a rate double the national average. Of these patients, 175 (4%) had ongoing chronic infection requiring evaluation and treatment, and 50 showed signs of advanced liver disease. In all cases, these patients were unaware of having the disease.

The study also revealed differences in both infection rates and disease progression based on patient characteristics. Patients who were uninsured were nearly twice as likely to be diagnosed with chronic hepatitis C. While Hispanic patients were somewhat less likely to be infected than non-Hispanic white patients, Hispanics with chronic infection showed much higher rates of advanced liver disease at the time of diagnosis. Regardless of race, patients with obesity or a history of heavy alcohol use were much more likely to have advanced liver disease.

Addressing Patient Concerns about Hepatitis C

After the hospital screening project was completed, the team conducted focus groups with patients who were diagnosed through the program to learn more about their experiences. Many patients acknowledged that they had previously had a poor understanding about hepatitis and needed education. They described feeling shame and stigmatised by their diagnosis because hepatitis C can come from risky behaviours, such as sharing needles, and voiced fears about their health. Social concerns included needing to learn how not to infect others and how to discuss their diagnosis with family members. Healthcare concerns included poor access to care, expense of treatment and how to change their lifestyle to reduce additional liver damage caused by obesity and drinking alcohol.

Fortunately, all the participants were enthusiastic about the screening program because they would not have otherwise learned about the infection until the liver was severely damaged. Despite the general distress that accompanies a hepatitis C diagnosis, patients thought it was better to know and deal with it.

In response to these concerns, the team developed a straightforward educational program in English and Spanish delivered on a mobile app to help answer some of these concerns about chronic hepatitis C infection. In addition, the team trained bilingual case managers to offer personalised education and support to receive needed care.

Hepatitis C Screening and Treatment in Primary Care

From their early work in hepatitis C detection and management, Dr Turner and her team recognised the critical role of ambulatory healthcare in eliminating the threat of hepatitis C. In 2014, ReACH received federal funding through an 1115 Medicaid waiver to expand its program to five primary care clinics in San Antonio and six in the Rio Grande Valley, along the Texas-Mexico border. This work paved the way for additional funding from the Cancer Prevention and Research Institute of Texas (CPRIT) to expand screening and care in primary care facilities throughout rural South Texas as well as Dallas in North Texas.

The ReACH program to Screen, Treat or Prevent Hepatocellular Carcinoma and Hepatitis C Virus (STOP HCC-HCV) is currently providing care for patients across Texas. Overall, HCV screening and management has been implemented in 10 healthcare systems across Texas within 39 separate clinics. Through all of ReACH's projects, over 50,000 Texans have been tested for hepatitis C and nearly 2,000 have been found to have chronic infection.

For these projects, ReACH has developed a comprehensive infrastructure for primary care practices to implement hepatitis C screening and care. This includes training the primary care team and staff, and modifying the electronic medical record to support screening, patient education, and patient care navigation. The program also facilitates the referral of insured patients with chronic infection to specialists for care or, if uninsured, supports the primary care practice to manage and treat patients onsite.

In regions such as rural South Texas and the Rio Grande Valley, where access to specialist services is severely limited, ReACH uses program funding to pay for screening and follow-up testing in patients without insurance so that they can be treated in primary care. The team has also developed educational webinars for primary care clinicians and staff regarding hepatitis C evaluation and management as well as HCC. Once trained, ReACH offers specialist teleconsultation office hours, during which the primary care clinician uses a structured case presentation to discuss key aspects of the patient's history, the exam, and lab results with the specialist. Together, they develop a management and treatment plan for hepatitis C to be carried out in the primary care setting.

Especially when patients face many barriers to care, the ReACH team has also found that care navigation is essential, as it offers personalised education and support to receive needed tests and treatment such as immunisation against hepatitis A and B. The care navigator may be a community health worker or in some settings, a licensed vocational nurse who co-manages much of the patient's clinical care with a physician, nurse practitioner, or physician's assistant.

The navigator offers help for the uninsured, low-income patient to complete the substantial administrative paperwork needed receive treatment to cure hepatitis C, without charge from prescription assistance programs supported by pharmaceutical companies. The navigators also work to ensure that the patient takes these medications exactly as prescribed and completes the needed tests to demonstrate a cure. To date, over 9 out of 10 uninsured patients who have been treated by their primary care clinicians through ReACH programs have been cured.

As part of their STOP HCC-HCV program, ReACH has launched the www.stophepatitisc.com website to provide education and resources for community members and professionals looking to launch their own screening and treatment programs. Working with a group of healthcare leaders and clinicians throughout the state of Texas, the ReACH team is working to promote the importance of hepatitis C screening in primary care and offering unique resources for replication in diverse primary care settings.

With additional funding from CPRIT received in 2018, the program will evolve towards fostering sustainability. STOP HCC-HCV will continue to support practices to develop an infrastructure that will continue this care long term, after funding is over. It will also expand its initiatives to educate physicians about screening and treatment for hepatitis C and add education about evidence-based approaches to address behaviours that accelerate liver disease, such as drinking alcohol.

Hope for Hepatitis C

Through their innovative and multi-disciplinary program, Dr Turner and her colleagues are improving access to screening and quality care for hepatitis C patients in Texas. People from low-income populations are now being diagnosed with this potentially deadly disease before it has resulted in liver failure or cancer. ReACH aims to ultimately improve public health and add years of healthy life to the people of Texas.

Meet the researcher

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Dr Barbara Turner is a tenured Professor of Medicine at the University of Texas Health Science Center at San Antonio. She is also the founding Director of the Center for Research to Advance Community Health (ReACH), a joint initiative with the University of Texas School of Public Health. She is a practicing general internist and author of over 175 peer reviewed publications on diverse research topics addressing opportunities to improve prevention and outcomes of chronic disease, as well as reduce health disparities. Dr Turner is currently leading several research projects to implement new national guidelines for hepatitis C virus screening of all baby boomers and treat chronically infected patients. In May of 2016, she was honoured with the US Department of Health and Human Services (HHS) Viral Hepatitis Testing Recognition Award for her efforts in implementing hepatitis testing programs.

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FURTHER READING

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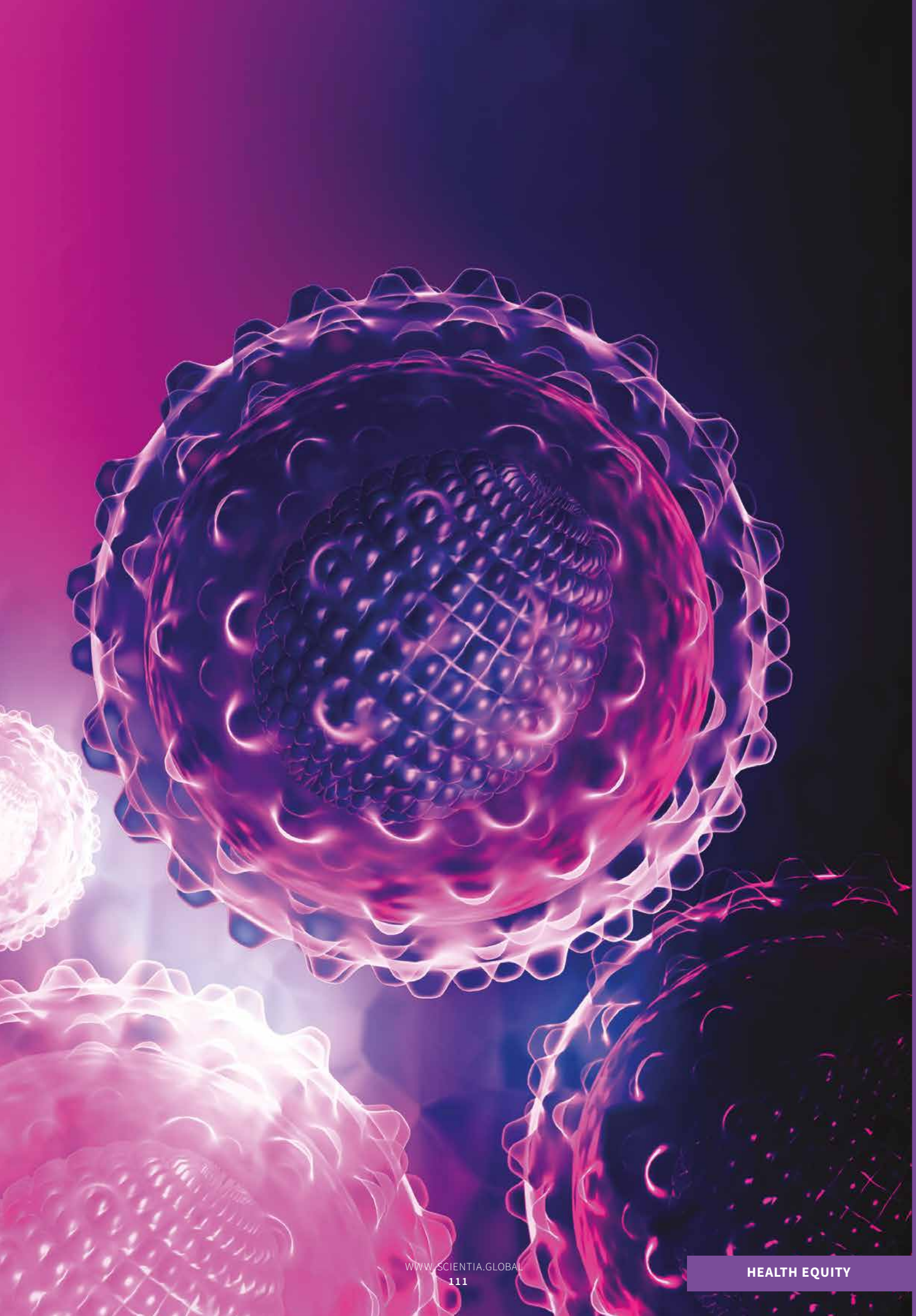

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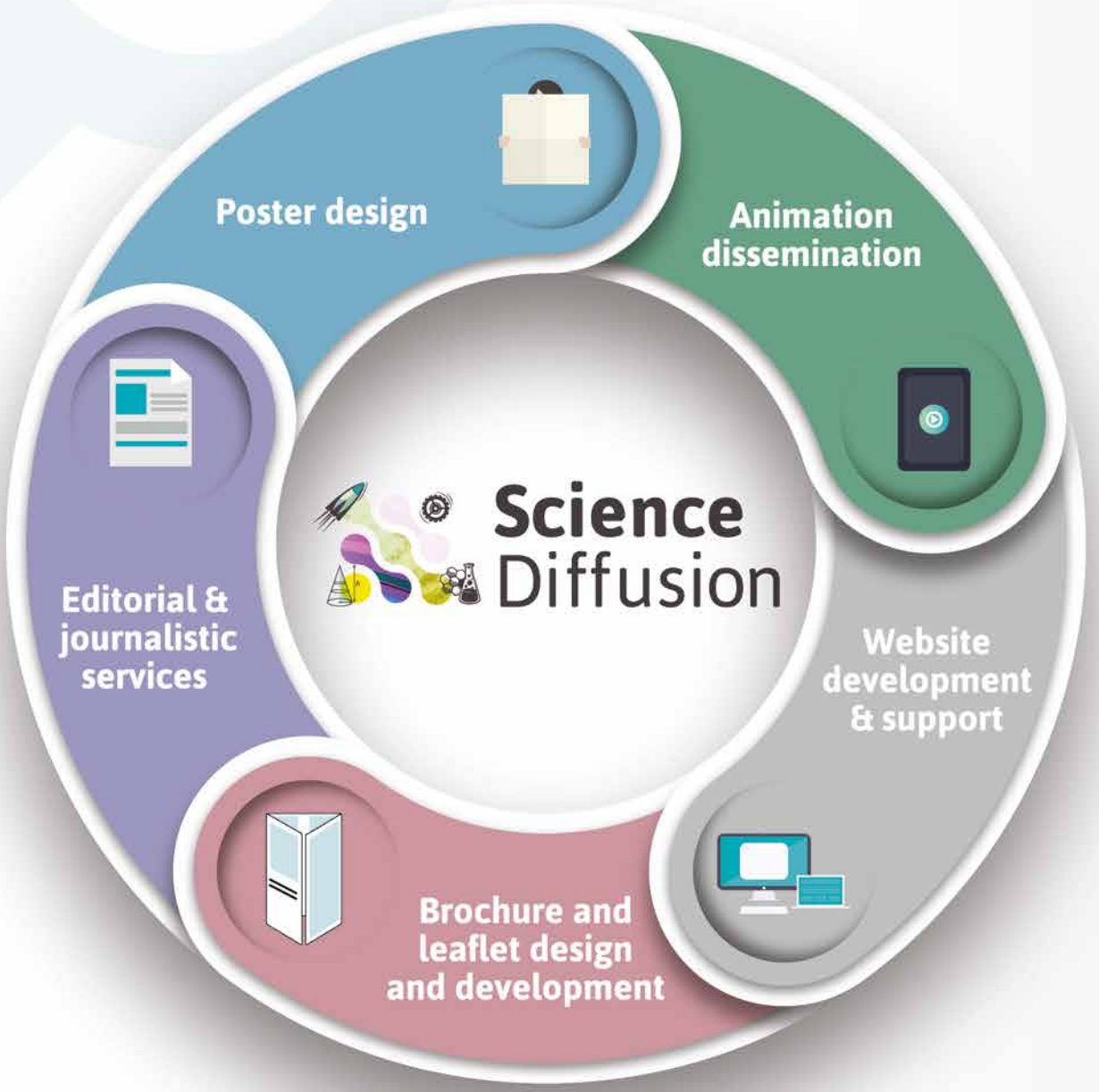

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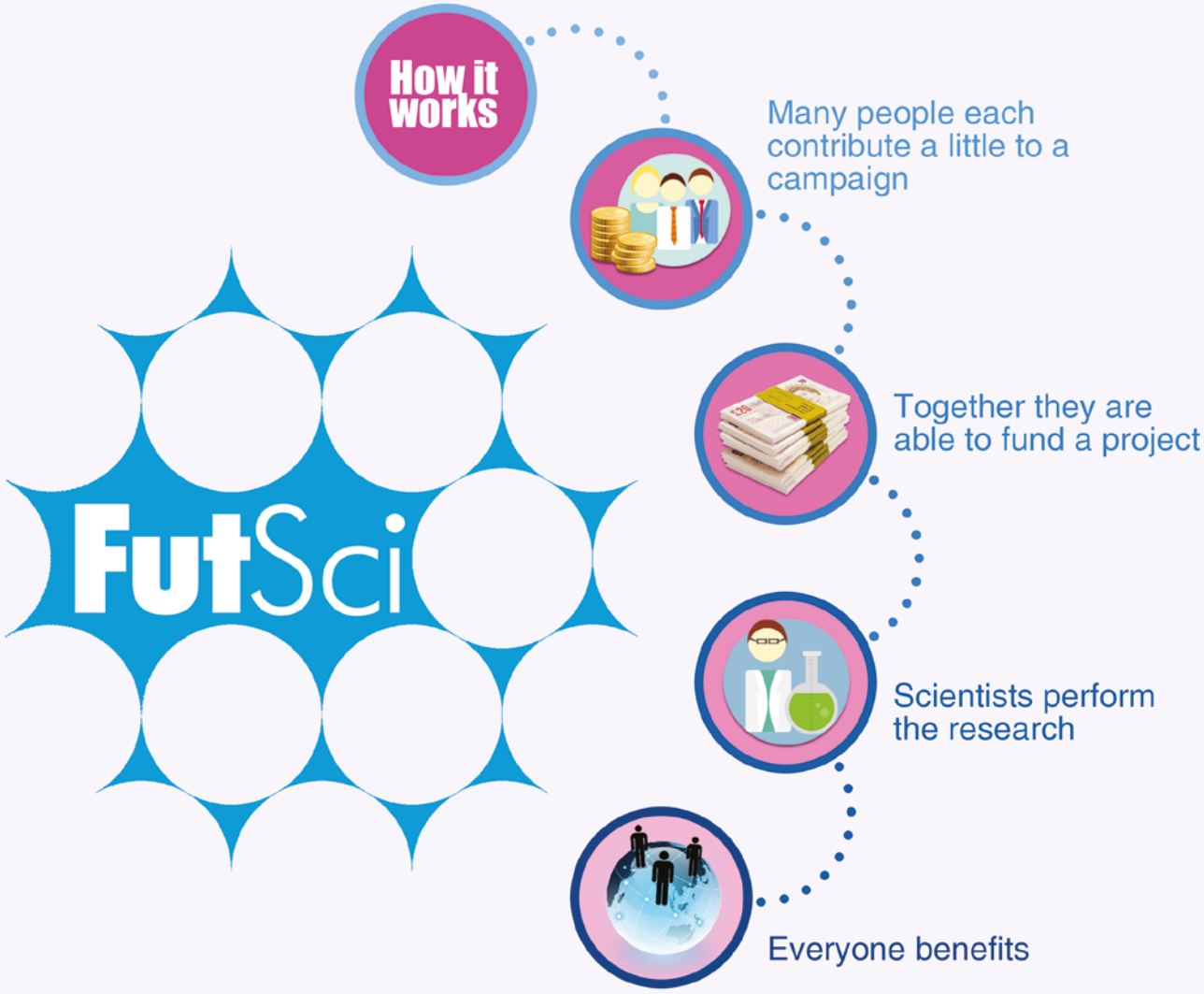

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