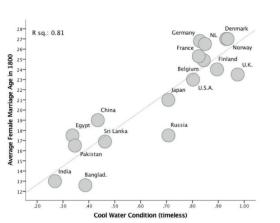
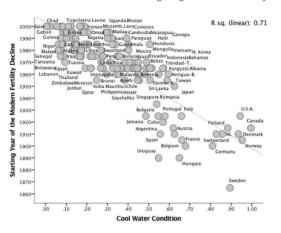
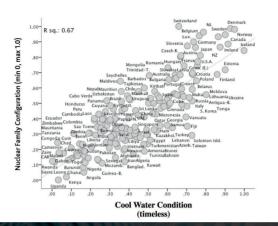
The Cool Water Condition and Female Marriage Ages in 1800 CE



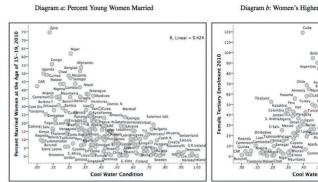
The Cool Water Condition and the Beginning of the Modern Fertility Drop



The Timeless Condition and the Nuclear Family Configuration in 1800



The Cool Water Condition and Female Marriage and Education in 2010



# Putting Cool Water at the heart of industrial history

\* \* \* \* The Industrial Revolution began in the Protestant West, yet many of these countries had been technological backwaters for much of human history. Cool water conditions were an important factor behind the region's pioneering role in industrial history, believes **Professor Christian Welzel**, the Principal Investigator of the Cool Water Effect project.

The countries of the Protestant West were among the first to industrialise, developing new technologies and mechanised processes that revolutionised society and laid the foundations for the region's economic prosperity. However, this prosperity was not pre-ordained, as for much of human history the countries of Northern Europe had been technological backwaters in comparison to other regions. "China was much more advanced than northwestern Europe before the Industrial Revolution, and within Europe, the South developed much earlier," outlines Christian Welzel, Professor of Political Science at Leuphana University. As the Principal Investigator of the Cool Water Effect project, Professor Welzel is looking at the underlying reasons why countries in northwestern Europe industrialised first; emancipatory dynamics are a major factor in this. "We can look at the history of the West as a history of struggles for rights. As one group conquers a set of entitlements then the other groups who are still discriminated against take this as an example and feel encouraged to then step up for their rights," he explains.

A prime example is the struggle for the vote. Historically in the Protestant West the

franchise was limited to certain sections of the population, yet over time previously marginalised groups demanded the right to vote, which Professor Welzel believes was an important factor in the region's economic development. "I believe there's an intricate, reciprocal relationship between economic and political development," he says. It is well established that there is a close correlation between the income level of a country and

that there is no causal link between the two and that there is another background factor that causes both to go together," says Professor Welzel. "We think that cool water conditions were an important background factor."

#### The Cool Water Effect

This means in particular cool summers and mildly cold winters combined with

We don't want to be misunderstood as people who rigidly believe in **geo-climatic determination.** In one part of the project – that we're still working on – we've shown that the explanatory power of this cool-water condition has loosened over the past 20-25 years, **in parallel with rising globalization.** 

the strength of its democratic culture – with the exception of some resource-rich nations – yet there is still a degree of debate over the question of which came first and the precise nature of the relationship. "The standard interpretation is that in most cases income caused democracy more than the other way round. This relationship has been called into question however - some researchers argue continuous rainfall over all seasons and permanently navigable waterways. These are all major factors in considering why it was the Protestant West that led the Industrial Revolution, starting with the nature of the climate. "If you are outdoors in a cold climate, you need to do something to keep yourself warm. Like working on a field, or building a house," points out Professor Welzel. Living

patterns in areas with cold climates are also markedly different from those in warmer climates. "In colder climates we have a much stricter separation between private and public, because the walls that form our houses are a clear boundary. Inside is our private land, and outside is the public realm," explains Professor Welzel. "Around the Mediterranean, people spend more time outdoors on squares and so on, so the public realm has more importance. That means that in these colder climates people become more individual in outlook, the focus is more on the nuclear family than the extended family. That also leads to a socialising pattern where kinship is not as important as in more southern climes."

The land-to-labour ratio in cool-water areas is another major point of interest to Professor Welzel. In cool-water areas it was possible to have a mixed approach to agriculture, where farmers not only grew crops, but also kept livestock. "This was land-intensive but not very labour-intensive. So you didn't need an army of labourers to cultivate an acre of land in cool water conditions, which meant there was less need for cheap mass labour, including children," explains Professor Welzel. This was one factor which reduced pressure on women to reproduce as early as possible; Professor Welzel says that another relates to the nature of the environment in cool water areas. "Child mortality was naturally lower in cool-water areas, as fresh water is usually not infested with microbes," he outlines. "Also, some of the diseases that are prevalent in hotter areas do not occur in cool water areas. So that lowers child mortality - then you could afford lower fertility to maintain the required workforce. If you have lower fertility pressure on women, that allows for later marriages with the consequence of more egalitarian gender relations."

There are other significant differences between cool-water areas and warmer parts of the world. One important characteristic of areas with cold climates is that they have distinct seasons over the course of a year, so it's important to prepare for periods when it's not possible to grow crops. "That means that there is more emphasis on planning and food storage. There is also evidence that in colder climates people's time orientation is different," says Professor Welzel. As longterm planning is more important in these areas, people are more likely to prepare for the future, for example by developing new skills. "People think more about investments with delayed gratification - which is the case for instance with education, because you earn the reward after building up your skills. These are important factors," continues Professor Welzel. "Another major consideration is access to water. When you have continuous rainfall throughout the seasons, everyone will have access to freshwater resources. No-one can constrain this "

This removed a vital means of control from elites. In more arid zones elites could take control over the water supply and so enforce control over the population in that way; however, this was not possible in rainy areas. "Water is a very diffuse, democratic resource, because it's available for everyone," stresses Professor Welzel. Relatively easy access to water meant people were more independent and less reliant on a central authority, while Professor Welzel

says the existence of permanently navigable waterways in the Protestant West also helped spur economic development and facilitate trade. "Western Europe is unique in terms of this capillary system of smaller rivers. Rather than having one central stream that dominates the continent, we have a system of smaller rivers connected to each other that creates a web of exchange," he explains. "That means people could leave an area where a tyrant ruled the territory and settle somewhere else. People could also join forces more easily and pool their resources for private purposes."

The wider point here is that an autocratic, hierarchical and controlling centralised state was unlikely to emerge under cool water conditions, leaving the space for individual initiative and enterprise to flourish, both of which were essential to the Industrial Revolution. The structure of society in the Protestant West also militated against the emergence of an autocratic or despotic state. "Marriage was strictly consensual for example. The consent of the woman was needed to marry, it was not pre-arranged," says Professor Welzel. The family is the fundamental social unit, from which bigger organisations then evolve, so the principle that alliances are formed by consent then filtered throughout wider society. "This consensual principle transplanted itself into bigger institutions that started building up, such as state beaurecracies, big companies, local assemblies, and city administrations," explains Professor Welzel. "These institutions all worked on this consensual principle. This meant there was a contractual orientation

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#### **Contractual orientation**

This also acted as protection against authoritarianism as the institutions of the state began to develop. A monetised economy is a key step towards building a nation state, as then taxes can be raised to build a bureaucracy, establish a civil service and raise an army. "In Europe, the barter economy lasted well into the 13th century. When money replaced the barter economy, rulers could start to think about building a state, a bureacracy and an army," says Professor Welzel. Raising taxes was essential to this, and city dwellers were a prime target; Professor Welzel believes that strong social organisations protected people against over-ambitious rulers. "There were local assemblies, city assemblies and associations that were built on a voluntary basis, and they were practiced in self-organisation. They having less children, which meant that knew how to organise resistance against they could pay more attention to their over-ambitious rulers." he explains.

to build a state in return for representation - the principle was no taxation without representation."

The same principle lies at the root of moves in the Protestant West towards universal education. A state is built on the consent of the people, so in order to maintain and strengthen their power base, rulers had to unlock the potential of the whole population, and not just narrow sections of it. "In order to gain power, rulers had to appeal to society. Rulers began to recognise that they had to unlock the intellectual potential of the population, and therefore education was essential. When nation states started to introduce universal schooling, people got an education, became literate, and started to think for themselves." outlines Professor Welzel. Around this time women were also marrying later as a result of lower fertility pressure and offspring as a result. "If you don't have "In Europe, the authorities were only able a lot of offspring then you have more room and opportunity to invest in those children and their education and skills," points out Professor Welzel.

#### Historical road-map

Researchers now aim to bring together these ideas and develop a kind of historical roadmap. There are a lot of loose ends in the literature, which Professor Welzel believes are connected by the cool water idea. "Our achievement is to create a synthesis, an integration of all those loose ends, which gives us a more comprehensive and coherent understanding of what happened," he says. A key part of the project's work involves collecting supporting data from across the globe. "We are collecting data on households and families in pre-industrial societies for example. We've found evidence on households and families in North America with respect to the leaning towards nuclear families in cool water areas," continues Professor Welzel. "However, we don't want to be misunderstood as people who rigidly believe in geo-climatic determination. In one part of the project – that we're still working on - we've shown that the explanatory power of this cool-water condition has loosened over the past 20-25 years, in parallel with rising globalization."

The cool-water areas of the Protestant West still score well today in important developmental outcomes, such as per capita GDP, life expectancy, gender equality and levels of corruption. However, the explanatory power that the cool water condition has over these and other developmental outcomes has declined over

globalising conditions than it was in earlier periods of history," he points out. "Societies can learn from each other, and so we get a degree of policy diffusion."

This research could help inform the wider process of policy diffusion, something Professor Welzel is keen to explore in the future. In particular, the project's

Western Europe is unique in terms of this capillary system of smaller rivers. Rather than having one central stream that dominates the continent, we have a **connected** system of smaller rivers connected to each other that creates a web of connections.

the past 20-25 years. "It's a fairly steady process that we can map and trace," says Professor Welzel. This shows that societies can escape the determinative power of geography in today's globalised world, where information flows more easily than ever before, believes Professor Welzel. "Cross-cultural learning is much easier under

work holds important implications for

water policy, and how water can be made universally accessible. "It also has implications for how we incentivise lower fertility among women and later marriage. Gender equality is another very important consideration, how do we encourage that?" says Professor Welzel.

Professor Christian Welzel, Principal Investigator









DEG

THE COOL WATER EFFECT

The Cool Water Effect: Why Human

**Emancipation in Cold-Wet Regions** 

This project examines the deep causes of

this civilizational turn, analyzing the role

of geography, genes, disease, agriculture,

language, religion, statehood, colonialism,

law traditions and other institutional factors.

such as emerging democracy. The evidence

shows that, among multiple possible paths

towards human emancipation today, there

is only one narrow route of significance. The

very narrowness of this route explains why

it took civilization so long to reach towards

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Civilization Turned Towards

**Project Objectives** 

human emancipation.

**Project Funding** 

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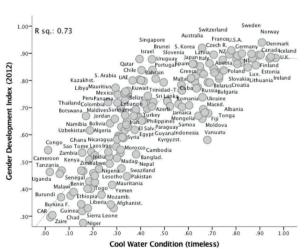
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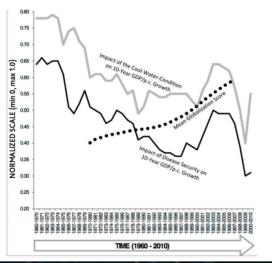
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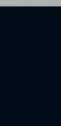
1 Million Euros

The Cool Water Condition and Gender Equality today



The Declining Impact of Environmental Advantages on Economic Growth





The Cool Water Project Team (from left to right): Lennart Brunkert, MA, Doctoral Researcher, Phuong Pham, BA, Research Assistant, Dr. Stefan Kruse, Postdoctoral Researcher, Le Cam Nhung, BA, Research Assistant

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#### Research News

EU Research takes a look at the latest news in scientific research, highlighting new discoveries, major breakthroughs and new areas of investigation

#### 10 TrueBold

Current MRI methods are not particularly sensitive to the smaller blood vessels in which neural activation typically occurs. We spoke to Professor Klaus Scheffler about his work in developing improved methods to detect neural activity in the brain

#### 12 P2X7 and P2X4

The P2X7 receptor is known to play an important role in the development of some forms of cancer, now researchers are seeking to explore its potential as a target for treatment, as Dr. Anna Junker, an Emmy-Noether research group leader at the University of Munster, explains

#### 13 REWARD

The REWARD project is investigating a performance-based reward mechanism to encourage pharmaceutical innovation and help bring drugs to more of the people that need them, as Professor Thomas Pogge explains

#### 16 Development of integrated continuous flow systems

With pharmaceutical companies under pressure to both improve productivity and reduce manufacturing costs, scientists are investigating alternatives to the established batch processing methods, a topic at the heart of Dr. Janina Bahnemann's research

#### 18 Planctomycetes as a source of novel secondary metabolites We spoke to Dr. Nicolai

Kallscheuer about his work in characterising the metabolome of different recently isolated planctomycetal species, which could hold important implications in terms of drug development

#### 19 Development of heteropolyvanadate spin clusters

Dr. Kirill Monakhov and his colleagues synthesise stimuli-responsive molecules, characterise them, and apply them on substrate surfaces, work which could open up new possibilities in highly sought after 'More than Moore' information technology

#### 22 Importance Sampling of **Chemical Compound Space**

A lot of attention in research is focused on moving towards a more structured approach to materials design. Dr. Tristan Bereau and his colleagues are using computer simulations to systematically explore chemical space and help accelerate compound discovery in soft matter

#### 24 DiluteParaWater

Para-water accounts for 25 percent of water at room temperature, while the remaining 75 percent is ortho-water, in which the proton spins in water molecules are symmetrical. We spoke to **Professor** Geoffrey Bodenhausen about his research into the properties of water

#### **26** Reforestation Report

The world's forests have declined significantly in size over the last century, but now some countries are replanting trees to remove carbon dioxide from the atmosphere. How effective could planting more trees be in helping to mitigate the impact of climate change? **Richard Forsyth reports** 

#### 30 Conducting Assisted **Evolution**

Coral reefs are among the longestliving ecosystems on Earth, yet they are struggling to keep pace with unprecedented rates of environmental change. Human intervention is essential to ensuring the long-term future of coral reefs, argues Dr. Hanna Koch

#### 32 ICONOX

Oxygen concentrations in the world's oceans are decreasing, which is affecting nutrient recycling from sediments and thus the nutrient balance in the water column. We spoke to Dr. Florian Scholz about his research into iron cycling in marine sediments

#### 34 INMARE

The INMARE project brings together researchers from several different disciplines to discover new enzymes and bioactives from marine environments, which could help chemical and pharmaceutical companies work more effectively, as Professor Peter Golyshin explains

#### 37 TropSOC

A lot of the research into biogeochemical cycles over recent decades has been conducted in temperate zones, yet less is known about the underlying mechanisms in tropical Africa, where soils function very differently, a topic that Dr. Sebastian Doetterl and his colleagues are addressing

#### 38 A new threat to the stratospheric ozone layer

Increased levels of Very Short-Lived Halocarbons (VSLH) might represent a new threat to the ozone layer. We spoke to Dr. Susann Tegtmeier about her work in assessing the likely extent of future VSLH emissions and their impact on the atmosphere

## 40 Paleolandscape – reconstructions of

Landscapes in tectonically active regions have changed dramatically over the course of human history. We spoke to Dr. Simon Kuebler about his work in reconstructing earlier landscapes, which will help researchers understand the factors that affected early settlement patterns

#### 41 Differential processing of host plant toxins

Plants are not only a source of food for insects, but also toxins that can provide protection against predators. Dr. Georg Petschenka and his colleagues are investigating the interactions between plants and insects, with the aim of building a deeper understanding of their co-evolution

#### **42 TROCONVEX**

The earth's outer core is comprised of liquid, which flows in a highly turbulent manner. The flow inside the earth's outer core is thought to be organised in such a way that this liquid metal moves around in a spiral-like fashion, a topic of great interest to Professor Rudie Kunnen

#### 45 The power behind German research (DFG)

The German Research Foundation (DFG) supports the country's scientists, helping to strengthen the country's research base and lay the foundations for future technical developments. Richard Forsyth examines its history and looks forward to its future

#### 48 The Cool Water Effect

Cool water conditions were an important factor behind the Protestant West's pioneering role in industrial history, believes Professor Christian Welzel, the Principal Investigator of the Cool Water Effect project

#### 52 SIREN

The Internet plays a central role in the modern economy, yet its communication infrastructure remains vulnerable to attack. Researchers are now exploring a new approach to securing the routing of Internet traffic, as Professor Michael Schapira explains

### tectonically active regions 54 From Dark to Light

The next generation of telescopes will allow scientists to look back even further into cosmic history, opening up new possibilities in research. We spoke to Dr. Benjamin Moster about his work in developing a new approach to modelling the formation and evolution of galaxies

#### 57 A history of philosophy in global perspective

We spoke to Professor Rolf Elberfeld about his work in developing a global framework on the history of philosophy, which will help pave the way for doing philosophy in a global perspective in future

#### **60** A Scientific Theology?!

On the surface the methods used in scientific research may seem to be very different to those applied in theology, where researchers look at the nature of God and investigate how religion shapes the world, yet Dr. Benedikt Göcke's group brings these two topics together

#### 63 Black Swans in public administration

Major failures of public administration are rare in democratic states, yet they can have serious consequences when they do occur. We spoke to Professor Wolfgang Seibel about his work in identifying the causal mechanisms behind organisational failures

#### 66 Propositionalism in linguistic semantics

Language is understood not just

through the words of a speaker, but the grammatical structures they use. **Professor Thomas Ede Zimmermann** is probing deeper into the semantic structure of language, using methods derived from mathematical logic

#### 68 EUPLEX

The policy issues that the European Union deals with have become progressively more complex over recent decades, raising the question of how proposals can be processed and implemented efficiently, a topic at the heart of Dr. Steffen Hurka's research



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