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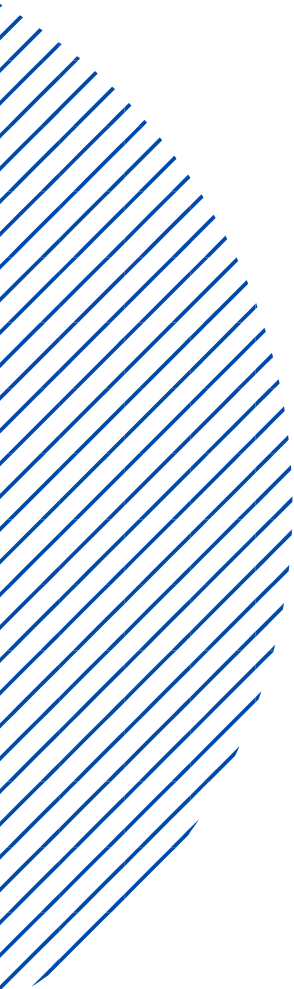


PRESENTATIONS

VUB PhD Day

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ABSTRACTS



Sander De Bock

Building sustainable economies

Can an novel shoulder exoskeleton reduce shoulder muscle fatigue during overhead work?

Despite continuous efforts to reduce the physical load on occupational workers, 40% of the European workers suffer from work-related musculoskeletal disorders every year [1]. To reduce the strain of overhead tasks on the shoulder joint, wearable passive upper-limb exoskeletons have been developed. These devices reduce shoulder muscle activity during overhead work [2], but their effect on muscle fatigue remains unclear. In this study, a novel passive shoulder exoskeleton was evaluated and its ability to reduce shoulder muscle fatigue was investigated. Twenty-two participants completed simulated overhead working tasks with and without exoskeleton. Shoulder muscle activity was continuously measured, and task performance and rating of perceived exertion were assessed together with discomfort and usability. Muscle fatigue was analyzed in the deltoideus anterior muscle. While task performance and rating of perceived exertion were not influenced, the exoskeleton reduced average deltoideus anterior muscle activity with 15.9% during overhead wiring task and muscle fatigue was less prominent when wearing the exoskeleton compared to wiring without exoskeleton. Working overhead with the novel exoskeleton reduced anterior deltoid activity and fatigue. Since the latter negatively impacts working comfort by sensations of exhaustion, muscle soreness, tremor and sensorimotor deficits, this exoskeleton could improve the working conditions of occupational workers during overhead work.

Wout Saelens

Building sustainable economies

The Comforts of Energy? Consumer Culture and Energy Transition in Eighteenth-Century Gent and Leiden (1650-1850).

Consumer Culture and Energy Transition in Eighteenth-Century Gent and Leiden (1650-1850). In recent years historians have come to bear witness to the unprecedented shift over the past centuries in the nature and scale of the energy consumed in (early) modern societies. Until now, the history of energy transition has mostly been an economic history, reserved for specialists of the industrial revolution. Yet, the transition to fossil fuels already happened well before industrialisation – in a household rather than industrial context. Indeed, it was the decisions of thousands of homemakers that made cities like Gent and Leiden into two major consumers of fossil energy. The purpose of my PhD is to uncover the social and cultural roots of energy transition as viewed from the perspective of consumption. Using the material culture of home heating and lighting as a window into the complex relationship between energy transitions and consumer culture, it seeks to address how energy left its imprint on everyday life, and how, vice versa, everyday life itself shaped energy. Ultimately, it has been argued that respectable households ‘invented’ some sort of consumerist model of energy consumption in the ‘long’ eighteenth century which valued fossil fuels for their comfort and led to a more demanding – but also more wasteful – culture of energy.

Lyu Shuping

Building sustainable economies

EU and Chinese competition policy

Competition policy plays a significant role in SDG goals 8 and 9 (economy). A functional competition regime can promote competition, curb anti-competitive practices in the market, increase efficiency and innovation for market players. It not only guarantees consumer welfare, promotes employment and decent work for all but also contributes to economic growth, promotes sustainable industry, and improves infrastructure. The EU and China as two of the three top biggest jurisdictions in the world (following the USA) have their own characteristics of competition policy. EU already has more than sixty years experience of implementation of competition policy, whereas China only began its competition policy since August 2008. What similarities and differences do EU and China have, in terms of against economic monopolies, i.e. mergers/concentrations, abuse of dominant positions, and antitrust agreements? and what can they reference from each other, also regarding government monopolies, i.e. EU state aid control regime, and China's fair competition review system? Case studies methodologies and comparative analysis are both carried out. The results will probably be guidance for authorities, academics, and practitioners from both Sides.

Younes Zeboudj

Building sustainable economies

User-centric approach for a re-decentralized web

The worldwide web is in continuous growth. The massive amount of data is a mine of information for companies and startups, especially in the Artificial Intelligence era. Nevertheless, it is not easy, and sometimes impossible, to access the data needed for a specific task. In general, most web users (main generators of data) would accept giving their consent for using their data in technological advancement, particularly when used privately or in exchange for an incentive. However, the challenge is not with motivating users to give their data. A closer look reveals that users already provide their data, but for a limited number of central actors. This pseudo-centralization has significant socio-economic detriments, such as limiting the number of startups who want to enter the innovation race. Our research investigates a more flexible disposition of the web. The old actors can still offer the same services but where new actors can easily take place. The main characteristic of such a disposition is that the control of data is user-centric rather than company-centric. Additionally, contrary to the current setting where services are coupled with data, we propose a decoupled solution where data is no longer bound to service.

Alessandra Calvi

Cities of the future: smart, sustainable & inclusive

Enhancing the inclusiveness of smart cities: reinterpreting Data Protection Impact Assessment under the General Data Protection Regulation through intersectional gender lenses.

Smart cities build so much upon processing of (personal) data to the extent that they may be considered data cities. This characteristic raises a plethora of fundamental rights-related concerns, exacerbated by the complexity of smart city environments, where multiple public and private entities interact. Furthermore, urban environments -and smart cities projects and initiatives- still tend to reflect mostly the one-sided perspective of able-bodied, cisgender, heterosexual men and therefore are suitable to perpetuate and reinforce gender inequities. To address the fundamental rights challenges arising from the (personal) data processing operations occurring in the context of smart cities, academics and regulators in the European Union are increasingly showcasing Data Protection Impact Assessment (DPIA) under the General Data Protection Regulation (GDPR) as a solution. However, is DPIA really adequate to achieve the fundamental rights related challenges arising from smart cities? What are its advantages and drawbacks? What best practices can be adopted by data controllers to overcome these limits? The objective of this work is to critically evaluate DPIA as a tool to effectively address the fundamental rights challenges raised by smart cities and ensure inclusiveness by adopting intersectional gender lenses.

Carmen Mazijn

Cities of the future: smart, sustainable & inclusive

How impartial are algorithms? Notions of fairness for Artificial Intelligence

To achieve the Sustainable Development Goals (SDGs), Artificial Intelligent (AI) systems are used to solve a variety of ecological, economical and societal problems. In the past decade, this technology has widely and rapidly been implemented all around the world. Unfortunately, countless examples of biased AI show us that it can also cause SDGs to fail. For example, consider an AI system that determines if a patient needs a certain medical treatment. This can help achieve SDG3 'Good health and well-being'. It predicts the optimal treatment based on a person's age, gender, occupation, postal code and other diseases. Carelessly created algorithms can, however, be biased towards elderly people, people with a disability, people of color or women. This will impact SDG5 'Gender equality' by propagating gender bias and SDG16 'Peace, justice and strong institutions' by eroding trust in institutions. In my research, I look at various fairness notions and the potential moral and technical trade-offs between fairness notions. Furthermore, I study how AI systems can adhere to fairness notions and what it means if the systems fail to do so. As Artificial Intelligent systems are technical implementations of human values, an interdisciplinary approach is essential.

Koen Borghys

Cities of the future: smart, sustainable & inclusive

Monitoring SDG-progress: Developing tools for local communities within the Brussels Capital Region

Following the Agenda 2030, numerous initiatives are being launched worldwide to support local governments in implementing the Sustainable Development Goals (SDGs). In this context, instruments are being developed in various cities to monitor progress towards the SDGs. In collaboration with IDEEA Consult, a Flemish consultancy firm, my PhD project will develop a monitoring tool tailored to local communities within the Brussels Capital Region (BCR) and will be at the service of both public and private actors. The project aims to support local communities within the BCR, using a data-driven approach to better map their SDG efforts and to focus maximally on the intended purposes in function of the local and global SDG agenda. It focuses on the following key innovations: - The measurement of collective efforts and goals, at the level of communities in the BCR; - The search for new data sources and ambitious use of open/big data; - A holistic and systemic approach, at different levels. The four-year project will gradually develop two dashboards that will subsequently be tested in pre-selected local communities within the BCR.

Senne Schraeyen

Cities of the future: smart, sustainable & inclusive

How the aesthetics of de Nieuwe Visie advocated the need for sustainable cities and settlements

It is a well-known fact that Belgium evolved into one of the most unorganised, parcelled and paved landscapes of Europe throughout the 20th century. Starting from the late sixties, experts warned for both the short and long term environmental consequences of this attack on open space. It is also during this period that Roger Raveel founded de Nieuwe Visie in Machelen-aan-de-Leie. This artist collective observed the modernisation of the rural village with great interest, but loathed its profit-driven speed that destroyed the local landscape. With this presentation I will illustrate how two artists of this collective addressed the issues of profit-driven urbanisation and disseminated alternative, sustainable, world views. Raveel pictures how the complex intertwinement of human and natural actors elevates the rural landscape to an infinite source of aesthetic inspiration. He considers the forced modernisation as a threat which reduces the rural life to a grey monoculture. Antoon De Clerck, in turn, strives to create Visuele Hygiëne with his paintings of everyday life. De Clerck researches how art can contribute to thoughtful implementations of new technologies in the mundane. The painter is convinced that modernisation and environment go hand-in-hand when technology serves humans, and not the other way around.

Albert Nkwasa

Clean water for the future

Global Impacts of Land Use and Climate Change on Diffuse Pollution in Africa

As an example of diffuse pollution, picture an agricultural field during a rainy period. As rainwater flows over the field, it washes away nutrients (like; fertilizer, soil, crop residue) into a nearby river or lake. An accumulation of these nutrients into a water body results in poor water quality and eutrophication - a state when a water body is overly enriched with nutrients. In Africa, land use changes such as agricultural expansion are increasing nutrient loadings to water bodies. Additionally, the continent has been identified as one of the most vulnerable regions to climate change. Climate change modifies nutrient transport and transformation, intensifying pollution. However, Africa remains a blind spot in diffuse pollution research. Furthermore, efforts to predict impacts of land use and climate change on diffuse pollution are developing but limited at regional scale. In this research, we build a diffuse pollution model for Africa to predict the water quality under past, present and future conditions of land use and climate change for different global emissions of greenhouse gases. The findings from this research will inform efforts to mitigate diffuse pollution risks in Africa while contributing to the 2030 SDG agenda, target 6.3; "Improve water quality by reducing pollution..."

Gianmarco Minuti

Clean water for the future

Invasive Aquatic Plants (IAPs): A Growing Threat to Sustainable Development

Invasive aquatic plants (IAPs) are species that have been introduced, usually by human action, to areas outside of their native range, where they established and have become a threat to natural ecosystems. IAPs can have a widespread impact across all Sustainable Development Goals (SDGs): In rural areas, invasion-related yield losses can affect the income security of small farmers (SDG1). Reduced crop yields and the consequent increase in prices undermines food security, disproportionately affecting poor rural communities (SDG2). IAPs are also linked to a variety of health issues. For instance, floating mats of water hyacinth – *Pontederia crassipes* – are a habitat for disease-spreading mosquitoes (SDG3). In many developing countries, weeding is still carried by hand and is often left to women and children, negatively impacting their health and education (SDG4 and SDG5). IAPs reduce water quality and alter the hydrology of water catchments, hindering clear water provision (SDG6) and hydroelectric power production (SDG7). Aquatic weeds create dense mats that block waterways, diminish fish stocks and damage infrastructure, with a severe impact on transportation and commerce (SDG8 and SDG9). IAPs alteration of freshwater ecosystems undermine their role in contrasting climate change (SDG13). Biological invasions are considered a major driver of biodiversity loss (SDG14 and SDG15). Current management methods consists mainly of manual, mechanical and chemical treatments, which are expensive, often have a negative impact on natural ecosystems, and require recurrent implementation in order to achieve substantial control. With my research project, I am exploring the use of biological control, a lower risk management method, for the management of IAPs. Biocontrol holds the potential to achieve long-term control of aquatic plant invasions, with low impact on natural communities and a higher cost-effectiveness compared to other methods. Furthermore, biological control promotes collaboration between stakeholders, companies and research institutes both at the national and international level (SDG17), creating job opportunities, endorsing scientific education and increasing public awareness.

Mohammad Azadi Tabar

Ecological change and how to act on it

From waste and greenhouse gas to fuel and affordable clean energy

Sunlight passes unhindered through the atmosphere and heats the earth's surface. In turn, infrared light is re-emitted by the earth's surface and captured by greenhouse gases (GHG) in the atmosphere, creating a greenhouse around the earth. GHG are entirely responsible for raising the average surface temperature from less than $-20\text{ }^{\circ}\text{C}$ (without GHG) to about $14\text{ }^{\circ}\text{C}$. Common GHG are carbon dioxide, methane, nitrogen oxides and water vapour. Methane has a warming potential 21 times higher than that of carbon dioxide. Manure, crop, landfills, and wastewater are main sources of methane emission. However, techniques and plants, such as anaerobic digestion, have been well established for turning these wastes into biogas. Biogas mainly consists of CH_4 and CO_2 but other impurities such as water vapour, H_2S , and siloxanes may also be present. Biogas must be upgraded to obtain biomethane (purity $>95\%$) and high purity byproduct of CO_2 . The earlier can be used as a fuel and later can be used in the industries of food, oil, and chemical. There are several techniques for biogas upgrading such as pressure and temperature swing adsorption. Although they have been already applied on large scale, more efficient technology is still highly needed as it involves a significant energy cost.

Yi Yao

Clean water for the future

Evaluation of the new irrigation implementation in Community Terrestrial Systems Model (CTSM)

Many observational and modelling studies have highlighted the important role that irrigation plays in the terrestrial hydrological and energy cycle. Land surface models are a key tool to study these interactions, underlining the importance of an accurate representation of irrigation in these models. However, most land surface models either ignore irrigation or represent it in a crude way. Here we improve and evaluate the implementation of irrigation in the Community Terrestrial Systems Model (CTSM), the land component of the Community Earth System Model (CESM). In this improvement, we consider three irrigation techniques (flood, sprinkler and drip), which differ in the amount and way of water applied. By combining global maps of the area equipped for irrigation with the distribution of different irrigation techniques, we represent the transient spatial distribution of irrigation techniques. Subsequently, we evaluate the performance of CTSM with the improved irrigation module. Three experiments are conducted: one with irrigation switched off, the second with the original irrigation module and the third with the improved irrigation module implemented. All three outputs are evaluated against observed or remotely sensed land surface energy fluxes and near-surface climate datasets. We anticipate that the results will reveal how our new irrigation schemes improve or reduce the performance of the land surface model.

João De Freitas

Ecological change and how to act on it

Transnational Ecological Conflicts, Courts and the SDG's

This presentation will provide an overview of the Curiae Virides research project. The project conceptualises the worldwide progressive transformation of human rights litigation into ecocentric litigation that, by triggering activist courts, aims at filling ecological governance gaps with the expectation to provide effective remedy to victims of transnational ecological harm. This project is motivated by increasing lawsuits lodged in the public interest of protecting ecosystems, to fill the legal and governance gaps that obstruct the sustainable conservation of these ecosystems. The character and scope of these lawsuits is varied, depending on their level (local, international, transnational), involved actors, their objectives, and the ecological conflicts at stake (climate change, biopiracy, pollution, deforestation, carbon leakage, forced displacement, intergenerational justice, etc.). The presentation will provide an opportunity to frame the research project within the context of the UN SDG's, discussing the role of courts in achieving those goals, outlining different types of transnational ecological conflicts, and their relation to the UN SDG's.

Meenakshi Poti

Ecological change and how to act on it

Responses to environmental change in small tropical islands in the Western Indian Ocean

Tropical small islands are in the frontline of rapid environmental change, impacting people and natural resources. Representing a manageable scale, islands provide a unique opportunity as model systems for research and governance on sustainable development. Valuable lessons from islands are potentially applicable to larger-scale non-island settings. Through a qualitative systematic review of academic literature from 2010 - 2020, we study the type of responses or adaptation strategies to environmental change in small islands in the Western Indian Ocean (WIO). The actors involved in the responses and the effectiveness of the responses were also assessed. We analysed 334 studies focusing on nine economically important archipelagos in the WIO – Zanzibar, Mafia, Seychelles, Comoros, Mayotte, La Reunion, Mauritius, Maldives and Lakshadweep. This work establishes a baseline by mapping diverse adaptation strategies to tackle complex environmental change in the WIO, an understudied region. The strategies range from infrastructural (physical and technological), ecological restoration, social (educational and informational) and institutional (financial instruments, laws, policies and community based) changes. Responses often overlap across categories and may be combined to address multiple stressors. Governments at the national and local level play a key role in planning these responses. We highlight the levers and barriers to adaptation.

Inne Vanderkelen

Ecological change and how to act on it

The impact of global reservoir expansion on the present day climate

By now, humans have constructed more than 45,000 large reservoirs across the globe. These reservoirs have large impacts on freshwater processes and resources by impounding continental runoff and altering river flows. So far, the impact of reservoirs on the climate remains largely unknown, as they are typically not represented in current Earth System Models. This is remarkable, as two-way interactions between reservoirs and climate are likely to alter hydrological extremes and impact future water availability. Here we present the implementation of the role of reservoirs in the Community Terrestrial Systems Model (CTSM), a land surface model, by accounting for the increase in open water surfaces due to reservoir construction throughout the 20th century. To this end, we allow lake area to expand in the model, while ensuring that the surface energy and mass balances remain closed. We assess the added value of accounting for reservoir expansion in the land surface model performance and investigate their impacts on the mean climate and extremes. Globally, the effect of reservoirs on temperatures and the surface energy balance is small, but responses can be substantial locally, in particular for grid cells where reservoirs make up a large fraction. Our results show that reservoirs reduce temperature extremes and moderate the seasonal temperature cycle.

Brenda Bikoko

Human relations & emotions in a sustainable society

Ask Female Artists Appropriating the Colonial Archive

Intersectional Approach to Female Artists' Appropriations of Colonial Archives (1990-2020) has relevance for broader social issues. It tells the stories of the photographed: forced migration, forced female sterilisation, forced sexual relations, forced labour and other harmful practices against women, girls, men and young boys in a revised context. When addressing archival photographs like Ariella Aïsha Azoulay does in *The Civil Contract of Photography*, it becomes a tool for dialogue, where perception and reception of the other is made possible beyond state boundaries and interests. The engineers of future inclusive models need to understand the complexity of the key societal challenges faced by the world today. The study of appropriated colonial photography by women teaches us about the equal female artist and the endurable inequalities of in our colonial or imperial past which must be avoided for the future. Compassion, justice, generosity and community spirit is what the artists put forward and propagate through artistic means.

Ida Andersen

Human relations & emotions in a sustainable society

Integrating Mental Health and Psychosocial Support Into Health Facilities in Conflict Settings: A Retrospective Review From Six African Countries

Psychosocial programmes integrated into health facilities in conflict settings across Africa. This study looks at changes in symptoms of psychological distress and impaired functioning among patients supported through such programmes. **Material and Methods:** Between January and December 2019, 5,527 victims of violence received mental health and psychosocial support in 29 health facilities in Burundi, Central African Republic, Democratic Republic of the Congo, Mali, Nigeria and South Sudan. Symptoms of psychological distress (IES-R or DASS21) and daily functioning (ICRC scale) were assessed before and after the intervention. Logistical regression models were used to measure associations between these symptoms and the other variables. **Results:** Factors associated with high distress prior to receiving support included age (peaking at 45–54 years), intervening within three months, rape, caretaker neglect, internal displacement, secondary education level and referral pathway. Anxiety levels in particular were higher among victims of violence committed by unknown civilians, the military or armed groups. Low functioning was associated with divorce, grief and violence committed by the military or armed groups. Following the intervention, the vast majority of patients reported reduced psychological distress (97.25% for IES-R and 99.11% for DASS21) and improved daily functioning (93.58%). A linear trend was found between number of individual sessions and reduction in symptoms of distress. Financial losses were associated with less reduction in symptoms of depression and stress. **Discussion:** To further address the mental health and psychosocial needs of victims of violence, intervening quickly and increasing the number of individual sessions per patient is crucial. This requires proximity—being in the right place at the right time—which is challenging when working in stable health structures. Symptoms of depression should not be overlooked, and financial losses must be addressed in order to holistically meet the needs of victims of violence.

Karen Puttemans

Human relations & emotions in a sustainable society

Poverty, grief and sustainability

As a PhD researcher, I explored connections between poverty, loss and grief. The study, finished in december 2020, was conducted in close collaboration with people living in poverty and three of their organizations: the Brussels social restaurant Chez Nous, the Brussels collective Morts de la rue and ATD Fourth World Movement. The presentation for this PhD Day has a double focus. I begin by discussing the ways in which our research contributes to a combination of the first and the third Sustainable Development Goal, namely to end poverty in all its forms everywhere (SDG1) and to ensure healthy lives and promote well-being for all at all ages (SDG3). Next, I address the interdependency between the SDG's as a whole. First, we discover how the PhD partner organizations integrate several other SDG's into their core target of eradicating poverty, for example by promoting a combined care for people and planet. Secondly, we explore the work of critical thinkers who argue that grief needs to be understood as a collective experience that can be a powerful catalyst towards justice and positive social change. The presentation aims to be interactive. Participants are kindly invited to ask questions and share their thoughts.

Lise Switsers

Human relations & emotions in a sustainable society

The role of (negative and positive) life events on loneliness in later life

Lise Switsers extends the current loneliness research with a life course perspective and demonstrates how life events, as early as childhood, still influences current loneliness among older adults. While gerontological research often focusses on negative life events in later life (e.g. widowhood, declining health), this PhD-research also points to the role of positive life events which might have the potential to reduce or balance feelings of loneliness. Using a mixed-methods design (with both survey data as qualitative life stories) Switsers' research makes a plea for lifelong prevention of and attention to loneliness. Additionally, prevention of loneliness needs to be seen within a broader perspective. The findings revealed that not only negative events are of relevance to loneliness in later life, also age-related changes and people's personal resources are relevant towards coping with loneliness effectively. The 2030 Agenda for Sustainable Development calls for leaving no one behind and for ensuring that the Sustainable Development Goals (SDGs) are met for all ages, with a particular focus on the most vulnerable, including older persons. This PhD research acknowledges the importance of a life-course approach to ageing, and links lifelong prevention of and attention to loneliness with the SDGs in order to leave no one behind.

Peter Dekker

Measuring progress on SDG's using innovative methods

How to support reinvigoration of minority languages? Computational simulations of language dynamics and policy.

In the UN Sustainable Development Goals (SDGs), safeguarding cultural diversity is a central trait: the world's cultural heritage should be strengthened (SDG 11) and education should be accessible to indigenous peoples and appreciate cultural diversity (SDG 4). Minority languages are an important carrier of cultural diversity, but the languages are often threatened by a diminishing number of speakers. To determine effective policies to reinforce minority languages, we propose agent-based computer simulations of interactions between speakers. Applied to case studies of the languages of the world, we use these simulations to model the dynamics of minority languages, and evaluate the effect of different policy measures on language viability. We investigate whether Alorese, an Indonesian spoken language, can be reinforced by granting it a special status, giving it more prestige compared to surrounding languages, incentivising speakers to learn it. These case studies show that agent-based modelling is a transparent and visualizable method well-suited to evaluate language policy measures.

Naihua Xue

Measuring progress on SDG's using innovative methods

Rethink the Global Warming by High-resolution Terrestrial Record of the Early Cretaceous Oceanic Anoxic Event in Northwest China

Since the 19th century, the rapid rise in atmospheric CO₂ concentration driven by human activities has far outstripped the range of its periodic changes driven by orbital forcing. So far, climate action is listed in the Sustainable Development Goals. To reveal long-term effects and continuous variation and the terrestrial responses of global extreme warming events, I conducted high-resolution geochemical and cyclostratigraphic research of the terrestrial record of Early Cretaceous oceanic anoxic event (OAE 1a) in northwest China. This research indicates that continuous active volcanism in ~700 thousand years aroused the sharp rise of atmospheric CO₂ and global temperature, this further leads to decrease of global temperature gradient and collapse of ocean circulation and high terrestrial weathering, which ultimately triggered extensive oceanic and lacustrine anoxic and acidification. After lull of volcanism, long-term carbon burial as a powerful earth's self-regulation promoted global cooling and reconstruction of oceanic circulation. The recovery stage at least needs 300-350 thousand years in this record. This research appeals to regard the long-scale variations of oceanic circulation as an important proxy of global warming.

Sander De Keersmaeker

Measuring progress on SDG's using innovative methods

Calibration of any sort of measuring instrument is important to obtain accurate measurements

As systems are becoming more complex (number of ports increase), the current calibration methods for Vector Network Analyzers don't meet the required accuracy and speed requirements anymore. As the next generation of communication devices requires a more complex interface, meaning: an increasing amount of ports (above 10 ports for the massive MIMO air interface), a larger bandwidth and higher frequency resolution, and a larger power dynamic range for the measurements. The complexity of and longer measurement times for a full calibration of the instruments rise. On top of that, the current calibration methods require the calibration to be done over again whenever a setting of the instrument is changed. To keep the time and hence cost of the measurements acceptable, a significant reduction of the measurement time is therefore mandatory. We propose to reduce the measurement time using a combination of model-driven interpolation and space-filling techniques. The model-driven interpolation reduces the required density of test frequencies and provides robustness to frequency grid variations. With the space-filling techniques we will help designing a measurement sequence that will select the most informative tests to obtain a full calibration for all settings based on a minimal number of tests.

Steve Homer

Measuring progress on SDG's using innovative methods

Identifying and counting nearby species according to their bioacoustic spectral signature

In order to protect biodiversity, we must understand which species are endangered in order to focus our conservation efforts. As the situation of a species becomes more precarious, not only does the need for protection increase, but so does the difficulty in accurately estimating their numbers. Since the underlying data sources necessary for accurate statistical inference become more scarce, especially in remote and inaccessible areas, methods are needed to identify these species in data-sparse environments. Our research aims to alleviate this lack of evidence by providing a method to estimate the presence and number of different animals in a local acoustic area. This is achieved through bioacoustic event detection according to the unique spectral signature of a given species. Simply put, we aim to identify and count nearby animals simply by listening. Our method has the benefit of being robust against noise and capable of identifying multiple sound sources from a single signal, and so provides an effective underlying data source to be used with other inference techniques. Though the method has not been tested in the field, we present a few examples of its efficacy with the calls of various birds and mammals.

Cristian Diaz Munoz

Sustainable nutrition for all

Innovative solutions to steer cocoa fermentation processes and improve the quality of cured cocoa beans

Cocoa fermentation lays at the basis of chocolate production. Its traditional, spontaneous nature, together with the usage of non-optimal post-harvesting techniques by local farmers, can lead to an undesired microbial community composition and, hence, low-quality cured cocoa beans. The application of starter cultures positively affects cocoa fermentation process by reducing the fermentation time, decreasing the heterogeneity of the end-products, and improving the quality of the cured cocoa beans and the chocolates produced therefrom. In this research, different functional starter cultures, composed of a lactic acid bacterial strain, an acetic acid bacterial strain, and diverse combinations of yeast strains, have been tested. A fine-scale monitoring of the starter cultures applied in combination with a metabolomic approach have shown a direct effect of the starter culture inoculation on the development of specific flavour compounds in the cocoa pulp and the final cured cocoa beans. Homogeneous end-products in terms of fermentation degree and biochemical composition were achieved by the application of the starter cultures. Thus, starter cultures are a solution to improve and standardize the quality of cured cocoa beans, increasing the income and the impact of the local farmers on the cocoa value chain, as such promoting sustainable development of cocoa/chocolate production.

Dennis De Vriese

Sustainable nutrition for all

Access to meat for every citizen? Market deregulation and butcher settlement patterns in Brussels, 1816-1866

Seeking to improve the standard of living of poverty-stricken inhabitants, mid-nineteenth-century Brussels urban authorities sought to combat citizens' unequal access to fresh meat, a luxury for many and increasingly perceived as the source of energy crucial to sustaining citizens, their labour, the urban economy and the city itself. To establish this more sustainable consumption, economy and city, they firmly turned toward a freer and more deregulated market. Abandoning centuries restricted sales in municipal meat halls in the city centre, meat sales were now allowed from butchers' homes. This was expected to convince new butchers to settle in the city in a dispersed manner, spreading meat retail and accessibility across the city. This paper seeks to assess the degree to which deregulation and the free market was successful in spatially reshaping butchers' locational retail patterns and boosting access to meat. Using a Geographical Information System analysis, it explores Brussels butcher settlement patterns in the first half of the nineteenth century. While dispersal did occur, deregulation served as a catalyst rather than a cause, revealing it was by itself insufficient to establish the sustainable city authorities aspired to.

Louise Vermote

Sustainable nutrition for all

Metagenomic and metabolomic analysis of Korean rice vinegar fermentation shows large variability between different producers

Korean traditional fermented rice vinegar is part of the nation's food culture. Although sustainable by nature, vinegar production processes can be further optimized. The rice vinegar production process consists of an alcoholic fermentation phase, which starts with the saccharification and fermentation of rice using nuruk, a traditional Korean fermentation starter. The resulting rice wine, named makgeolli, is subsequently converted into vinegar during the acetic fermentation phase. At two traditional rice vinegar production facilities, two fermentation processes were sampled as a function of time during the entire production process, and the samples were investigated using shotgun metagenomics and meta-metabolomics. The results showed large differences in both the microbial ecosystem compositions and the end-products between the two production facilities. For one production facility, there was even a low reproducibility between the two processes performed, suggesting that there is room to improve the production of rice vinegar. Overall, *Saccharomyces cerevisiae* was the predominant microorganism present during the alcoholic fermentation phase at both facilities, accompanied by some other yeasts and lactic acid bacteria, depending on the production process. During the acetic fermentation phase, acetic acid bacteria were present, although identification down to species level was only possible for one of the production facilities, pointing to a wider diversity with possibly a new *Acetobacter* species.

Marianela Ivana Spicoli

Sustainable nutrition for all

Food and nutrition of Women and Children in the Roman World (II BC- III CE)

The aim of my research project is to think about the nutritional state of women and children in the Roman world (II B.C.- III C.E.) from a gender perspective and considering a broad definition of nutrition that includes the biological, the socio-economic and the environmental dimensions (The Giessen Declaration of 2005 may serve as a basis for such a definition). My project focuses on the practices and knowledge of ancient women and infants in connection with nutrition. Given that the ancient written sources have been authored mostly by men, it is essential to incorporate a gender perspective that allows a critical reading of them. I will analyze the cultural perceptions and medical knowledge about women and children's food and nutrition, along with their participation in all stages of food production (cultivation, gathering, processing, exchange, and consumption) to test whether and how their social status mediates their connections with food. I will also include archaeological evidence about the nutritional and health condition of women and children. As a result, I expect to contribute to the reflection about nutrition and society in the past.

Niloo Mohaddese Nabizadeh

Sustainable resources and materials

MaX: a sustainable material for the car body. A key to less fuel consumption and gas emission

Regarding the environmental regulations in terms of greenhouse gas and fine particle emission, the automotive industry is looking for new solutions to reduce weight and fuel consumption and to improve safety performance. One strategy is developing Advanced High Strength Steels (AHSS) which shows a beneficial high strength to low thickness ratio which leads not only to a reduction in the total weight of the car body but also an improvement in the strength of the car body. MaX is a newly developed AHSS that is dedicated to automotive structural parts and chassis parts.

This material is shown to be an efficient material on its own. However, the car body undergoes a painting process to have certain properties in terms of appearance and corrosion protection. Therefore, it is important to see the compatibility of this material with the current industrial painting system. During this research, we study the behavior of this newly developed material in the conventional painting system to see if it can be a sustainable alternative for the classical material.

Koushik Bangalore Gangadharacharya

Sustainable resources and materials

Predicting the life-cycle of metals using corrosion simulations

Atmospheric corrosion of metals is the most common type of corrosion which has a significant impact on the environment and operational safety in various situations of everyday life. Some of the common examples can be observed in land, water and air transportation systems, electronic circuit boards, urban and offshore infrastructures. Metal degradation due to atmospheric exposure has a significant impact on the economy. According to the recent analysis, the overall cost of corrosion is estimated to be 3.4 % of global GDP, of which, atmospheric corrosion accounts for approximately half the annual cost of all types of metal corrosion. As a part of my PhD research, I am developing a simulation model as a step towards having a digital twin of atmospheric corrosion process of metals. The simulation model can help in obtaining a fundamental understanding of the mechanisms involved, shorten the time required to develop new corrosion protection systems and also in implementing an effective corrosion management system. Hence providing an effective solution for increasing the lifetime of the metallic infrastructures by having robust corrosion protection system, which makes it sustainable, safer for operation and inexpensive for periodic maintenance than it is today.

Rania Derouiche

Sustainable resources and materials

Synthesis of Inorganic Polymers based on acid activated fayalite slag: Influence of composition

Copper production results in major amounts of slag, at a rate of 2.2 tons slag per ton of produced copper, with fayalite (Fe_2SiO_4) being the dominant phase. Thus, it is indeed a residue that needs to be exploited. Because of extremely short pot life when mixing fayalite slag with phosphoric acid solution, this work aims to study the effect of the progressive substitution of metakaolinite up to 30% using an iron-based slag in an environment of phosphoric acid, and its effect on the microstructure and mechanical properties of phosphate-based cementitious matrices. The ultrasonic tests were used to measure the E modulus and the scanning electron microscopy (SEM) for the microstructures of the obtained cements. The main results of this work were that the low percentages (from 5% to 15%) of added slag made it possible to obtain a good mixture, a good workability and a low reaction's rate, which allows the use of these cementitious matrices in combination with fibers. In addition, the obtained cementitious binders with 5% of slag have a denser microstructure and better mechanical properties than the others cementitious binders.

Victor Gonzalez Alonso

Sustainable resources and materials

Sourdough production with Triticale through backslopped fermentation

Triticale (X Triticosecale Whittmack) is the first man-made cereal crop species, resulting from the hybridization of wheat (*Triticum aestivum* L.) and rye (*Secale cereale* L.). It was designed to combine the positive attributes of both cereals, as Triticale possesses the functional characteristics of wheat for productivity, whereas exhibiting the disease resistance and adaptability to harsh climates and poor soils of rye. In the context of climate change, Triticale could become a crop able to grow and provide better yields on lands where cereals such as wheat cannot anymore. Today, sourdoughs, which are the result of a co-fermentation by lactic acid bacteria and yeasts, are mostly produced from rye and wheat. Sourdough bread production contributes to the circular economy by adding value to the breads produced through an increase of quality (sensory and nutritional) and a reduction of the waste of baking materials. This research evaluated the feasibility of producing sourdough from Triticale flour using a traditional backslopping method, consisting of ten subsequent refreshments of a fermented flour-water mixture. The resulting sourdoughs were evaluated in terms of their acidification profile, microbial species diversity, and metabolite production. On top of that, the effect of scale of the sourdough production was assessed

Eloa Lopes Maia

Sustainable resources and materials

Effect of superficial microstructural features on corrosion initiation process in liquid metal environment

The demand for electrical energy in the next years is considered one of the main challenges for the economic, environmental and social development. A new generation of nuclear reactors is being developed with high fuel efficiency, low CO₂ emission and increased safety. The MYRRHA project has as main goal the development of a fast spectrum nuclear reactors and accelerated-driven systems (ADS), based on the use of liquid lead bismuth eutectic (LBE) as coolant medium and spallation target. Furthermore, it is devised that spent fuel from current reactors can still be used in these new reactor concepts, contributing to the nuclear waste reduction. Based on materials compatibility criteria, austenitic stainless steel was selected as a promising structural material candidate; however, it is susceptible to liquid metal corrosion (LMC) in LBE. Previous studies showed that for AISI 316L at low temperatures, LMC initiates locally after a few thousand hours of exposure in the LBE environment. In this sense, understanding the localized corrosion initiation process is very important to create the foundation for a corrosion mitigation approach. In this study the main objective is to correlate the location of microstructural features, present at the surface of AISI 316L steel, with the corrosion initiation process in LBE medium.



PhD Day
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