Quentin Béran

Université de Genève

Unité d'histoire de l'art

À une époque où les agglomérations urbaines ne cessent de croître et de gagner en importance, notre environnement se compose principalement de réalisations humaines à différentes échelles, allant de la ville au foyer. Ces constructions, qui répondent à des besoins primaires, font souvent fi d'un élément pourtant capital : le bien-être de leurs usagers.

À travers ses recherches, Quentin Béran cherche à comprendre les éléments qui, à l'échelle du foyer, permettent de créer des environnements propices à l'épanouissement de ses habitants.

Pour ce faire, il approche l'architecture à travers les spatialités qui y sont créées afin d'analyser les outils déployés dans la perspective de produire des volumes agréables et accueillants. Comme un espace n'atteint son plein potentiel qu'au moment de sa rencontre avec le regard et le corps d'un être humain, c'est systématiquement à travers ses retombées sensibles sur ses usagers que l'architecture est étudiée.

De fait, l'approche de l'objet est systématiquement teintée d'une démarche phénoménologique. Il ne s'agit plus simplement de décrire la phénoménalité des objets construits, mais d'analyser l'espace architecturé lui-même en tant que construction. Ainsi, l'espace ne se définit plus seulement par les éléments structurels qui le cloisonnent, mais par le volume que ceux-ci participent à créer, qui possède sa propre intégrité en tant que phénomène construit.

La position adoptée convoque des notions et méthodes empruntées à différentes disciplines telles que les sciences historiques, la sociologie, la philosophie ou encore la psychologie cognitive. Cette approche transdisciplinaire permet d'identifier et d'analyser les éléments qui suscitent le bien-être des usagers au sein d'un volume construit en plaçant l'être humain au cœur des préoccupations.

Rasmus Kyng

Ecole polytechnique fédérale de Zurich

Department of Computer Science

Algorithms are the recipes computers follow to solve problems. As we seek to analyse ever-larger data sets, we need algorithms that can answer complex questions about them extremely quickly. Designing such fast algorithms, especially for data with network structure, is the core of Rasmus Kyng's research. Network structures abound: think of Internet traffic, transportation, logistics, social ties, and physical systems such as electric grids or even heat flows through a physical material.

Prof. Kyng's group has created radically faster algorithms for many computational problems on networks. As theoretical computer scientists, the group begins by formally proving that efficient algorithms exist using mathematical models and formal analyses of the algorithmic process itself. When this succeeds, the group works on turning these theoretical algorithms into practically useful software.

Electrical flows

A theoretical breakthrough in the early 2000s showed that electrical flows could be computed quickly, at least in theory. Yet usable code remained elusive. Prof. Kyng uncovered simple, practical algorithms and proved why they work using random matrix theory that originated in quantum mechanics.

Logistical networks

Assignment tasks—matching workers with jobs, taxis with riders, or data requests with servers—and combinatorial flow tasks—scheduling trains, routing digital traffic, or coordinating currency trades—all fit a broad template studied by algorithm designers. Together with collaborators, Prof. Kyng introduced a striking new framework that merges gradient descent techniques with novel network data structures, yielding far faster solutions to all these problems—in theory. His team is now focused on turning these advances into high-performance tools for real-world use.

Philippe Schwaller

Ecole polytechnique fédérale de Lausanne

Laboratory of Artificial Chemical Intelligence

AI-Augmented Chemical Science through Language Models

Modern society urgently needs new medicines, sustainable materials, and efficient chemical processes. Accelerating chemical discovery has become a grand scientific challenge, as exploring the vast chemical space (estimated at 10^60 feasible drug-like molecules) and predicting reaction pathways remain formidable tasks.

Professor Philippe Schwaller pioneers artificial intelligence to transform chemical science by treating chemistry as a language that machines can learn. His groundbreaking work encompasses data-driven computer-assisted synthesis, sample-efficient generative molecular design, and large language models (LLMs) for chemical research.

His influential Molecular Transformer taught computers to understand chemical reactions like a language, garnering over 1,000 citations and revolutionising how AI approaches chemistry. Building on this breakthrough, ChemCrow became one of the first LLM agents capable of autonomously planning and executing chemical experiments using robotic laboratories. Schwaller's team also developed a molecular design framework that creates new molecules optimised for desired properties while guaranteeing viable synthesis routes from targeted starting materials. This innovation enables practical applications such as transforming industrial waste into valuable therapeutic compounds.

Most recently, his research allows chemists to simply describe their synthetic preferences in plain English, with AI systems finding matching chemical routes – essentially enabling scientists to communicate with laboratory systems in their own language.

A defining characteristic of Schwaller's approach is the emphasis on practical applicability. Rather than developing AI methods in isolation, his research consistently bridges computational innovation with real-world chemistry, incorporating feedback from experimental chemists. His innovations establish a new paradigm where AI systems truly augment human chemists' capabilities, ultimately accelerating the discovery of life-saving drugs and sustainable materials.

Martin Wolf

University of St Gall

Swiss Institute for International Economics and Applied Economic Research

Debt ratios in many advanced countries are at historically high levels. In his research, Martin Wolf points out three ways in which high debt can adversely affect our economies: a risk of fiscal stagnation; a risk that debt levels rise even more once interest rates go up; and the idea that monetary policy can become less effective at controlling inflation due to self-fulfilling beliefs of financial dominance.

Fiscal Stagnation: High government debt tends to be accompanied by low productivity growth. One reason may be that, to stabilise their debt, governments need to take costly measures that hamper the growth process, such as taxing firms' investment. As Martin Wolf shows in joint work with Luca Fornaro, this can induce a negative feedback loop: as growth falls, the debt-to-GDP ratio rises even more, forcing the government into even costlier measures to stabilise the debt. This can imply that, once debt-to-GDP is high enough, the country can become trapped in an equilibrium with high debt and low growth, from which it is very hard to escape.

Debt and interest rates: Martin Wolf and Leopold Zessner show that high-debt and low-debt countries respond very differently to rises in interest rates. When interest rates go up, low-debt countries respond by reducing their debt, because borrowing is more expensive. In contrast, high-debt countries respond by borrowing more. Intuitively, the interest expense on the debt is much higher for high-debt than for low-debt countries. As interest rates rise, this mechanically forces high-debt countries into more debt. This channel makes heterogeneity in debt levels self-reinforcing. For example, once the ECB raises rates, Italian debt levels may rise, but German debt levels may fall, adding to the already-large cross-country heterogeneity in the euro area.

Self-fulfilling financial dominance: High levels of private sector (e.g. bank) debt breed the possibility of a financial crisis, especially when interest rates go up. This makes central banks reluctant to raise interest rates after inflationary shocks, so-called financial dominance. Martin Wolf and Leopold Zessner argue that financial dominance can lead to self-fulfilling beliefs. When the private sector expects low interest rates going forward, leverage stays high, and financial dominance stays strong. The central bank responds by keeping interest rates low, validating the beliefs by the private sector. High debt may thus erode the ability of central banks to control inflation, by giving rise to self-fulfilling beliefs of financial dominance.

Martin Wolf is an Assistant Professor for Monetary Economics at the University of St Gallen. He has studied the impact of globalisation, automation, and financial crises on our economies, among other topics. He has recently been awarded an SNSF Starting Grant over CHF 1.1 million, on the topic "Debt, Growth, and the Macroeconomy: A Unified Perspective".