University of Amsterdam
Institute for Advanced Study

Annual Report 2020

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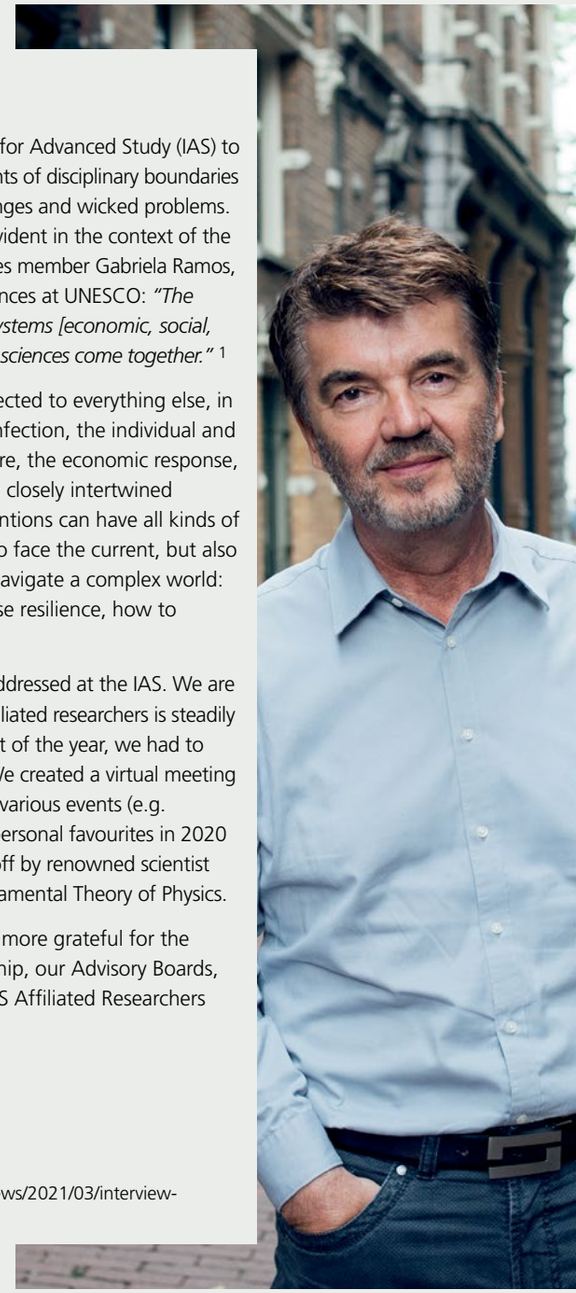
UvA Institute for Advanced Study



From the Scientific Director

The University of Amsterdam has established its Institute for Advanced Study (IAS) to offer outstanding researchers a haven - free from constraints of disciplinary boundaries - where they can work collaboratively on complex challenges and wicked problems. The importance of our mission has become even more evident in the context of the COVID-19 pandemic. In the words of IAS Board of Trustees member Gabriela Ramos, Assistant Director-General for the Social and Human Sciences at UNESCO: *"The complexity of the times we live in shows us that all our systems [economic, social, environmental] are interconnected, which requires that all sciences come together."* [1]

Today we experience in real life how everything is connected to everything else, in ways that are poorly understood: the dynamics of the infection, the individual and collective behaviour of citizens, the physical infrastructure, the economic response, social inequality etcetera. Because all of these facets are closely intertwined through many interacting processes, our (policy) interventions can have all kinds of unexpected and also undesirable side-effects. In order to face the current, but also our future challenges, we need to understand how to navigate a complex world: e.g. how to detect early warning signals, how to increase resilience, how to responsibly intervene in complex adaptive systems?

These are typically the type of questions that are being addressed at the IAS. We are proud to see that the number of research themes and affiliated researchers is steadily growing. As our buildings were closed for the largest part of the year, we had to explore new ways to keep all the great research going. We created a virtual meeting place for our community to talk and work together; and various events (e.g. lectures, workshops) were organised online. One of my personal favourites in 2020 was the new Science beyond the Horizon series, kicked off by renowned scientist Stephen Wolfram presenting his Project to Find the Fundamental Theory of Physics.

Given last year's extraordinary circumstances, I am even more grateful for the continued dedication to our mission of the UvA leadership, our Advisory Boards, External Faculty members, Collaboration partners, all IAS Affiliated Researchers and Students, and Staff members.

Peter Sloot
Scientific Director

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[1] Interview with Gabriela Ramos: https://ias.uva.nl/content/news/2021/03/interview-gabriela-ramos.html

From the Management Team

Since the number of research directions at the IAS has grown considerably over the past period, we have installed a Management Team (MT) in which the major groups of academic disciplines are represented (following the classification commonly used in the Netherlands: alpha, beta, gamma). We are happy to introduce the following MT members, and their focal areas at the IAS:

Dr. Federica Russo
Representing the Humanities (Alpha)

Federica Russo (Philosophy Dept & ILLC, UvA) joined the Management Team of IAS in September 2020. She contributed to strengthen the visibility and presence of the humanities within the Management Team and the Board of Associates. This meant, in practice: to be able to identify more easily possible humanities scholars to take part in IAS activities, to have stronger expertise when evaluating fellowship proposals from humanities scholars, directly contribute to the writing of documents for POLDER and MSc Strategic Decision Making making the humanities perspective more prominent, organise and lead a series of seminars on causality as cutting across different fields and domains, co-organise a workshop on bias in scientific research, targeting junior scholars within the UvA, participating into an IAS-supported webinar on information pollution and online argument checking.

Prof. Willem Bouten
Representing the Formal and Natural Sciences (Beta)

Willem Bouten is professor of Computational Geo-Ecology at the Faculty of Science. In 2020 he took charge of the Coupled Human and Natural Systems theme at IAS. Having been active in the environmental sciences for the largest part of his research career, Willem has gained much experience with interdisciplinary collaboration. He is the initiator, developer and former director of 'Future Planet Studies', an interdisciplinary educational programme that focusses on complex societal challenges, like climate change, energy transition, future food, and water governance and management. It teaches systems thinking, which is also the 'common language' for the research theme Coupled Human and Natural Systems. He plays a pivotal role in advancing cross-faculty research, specifically in the field of energy transition, and future agricultural systems tailored to feed the human population and to conserve biodiversity.

Prof. Han van der Maas
Representing the Social and Behavioural Sciences (Gamma)

Han van der Maas is professor of Psychological Methods at the Faculty of Social and Behavioural Sciences. He has been involved with IAS right from the early start in 2016. In the Management Team his focus is on various organisational issues. One of the latest great results of his efforts is IAS Review, the overlay journal in which we highlight a selection of papers recently published by members of the IAS community. Furthermore, Han advances research into applications of complex system research in the behavioural and social sciences, with a focus on two topics: attitudes towards COVID-19 vaccination and opinion polarisation, for which he organised think tanks and initiated new research.

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UBIAS

The UvA Institute for Advanced Study is member of the international network of University-Based Institutes for Advanced Study (UBIAS). UBIAS institutes bring together outstanding researchers from different disciplines, nationalities and academic backgrounds, creating a productive environment for innovative research. The network was established in 2010 to enable structured forms of exchange between partner institutes. Today, it has 51 members spread across the globe.

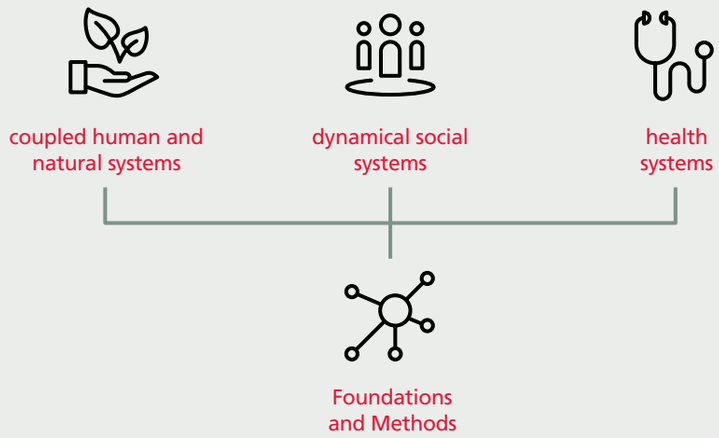
www.ubias.net

Research

Many breakthroughs in modern science happen at the interface of previously unconnected fields of insight. At the UvA Institute for Advanced Study we bring together outstanding researchers from all disciplines to collectively unravel wicked problems. We use system's thinking and complexity science methods as our common language to bridge disciplines, scales and paradigms.

The IAS aims to create a vibrant and inspiring environment for interdisciplinary and cross-faculty collaboration. We host and organise events to facilitate networking and knowledge exchange, spark ideas, and create new research partnerships. We offer multidisciplinary research teams a physical home base where they can work together and utilise the synergy potential with other research activities at the institute.

The IAS also adds a new dimension to the university landscape by creating a place for 'slow science', where outstanding researchers and out-of-the box thinkers can escape the academic rat race for a while and hit upon new ideas in a serendipitous way. Through the IAS fellowship programme, they have time to focus on a specific scientific question in interaction with other bright and creative minds. The number of events, IAS-affiliated researchers, theme groups is steadily growing.



Research themes

We live in an increasingly interconnected and rapidly changing world. A world where everything is interwoven with everything else, and where cause and effect are hard to unravel. As our challenges evolve and become more complex, we must resist the temptation to reduce large, wicked problems into isolated issues, and avoid piecemeal 'solutions' to individual issues that lead to a worsening of others. We cannot afford such mistakes in combating problems like climate change, pandemics, economic crises, social inequality. To get a grip on the scientific, technological and societal challenges that we are facing, we need to understand what kind of interventions will produce what type of outcomes in such complex adaptive systems. This requires a true game-changer, a new disruptive way of doing science that cuts across the alfa, beta and gamma sciences. That is exactly what the IAS aims for.

We have organised our research activities in three broad application-oriented domains. Each domain contains several research projects and theme groups. Additionally, we focus on the development of foundations and methods to bridge disciplines, scales and paradigms.

COVID-19 Pandemic: Time to Reflect

Together with Science versus Corona, an initiative that unites experts from different disciplines to join together in the fight against the corona virus, we organised a series of discussions to foster exchange, debate and collaboration.

The COVID-19 pandemic...

Pandemics are known to affect societies at large. COVID-19 has spread to most countries and its impact is huge: millions of people have died, the burden on healthcare workers and facilities is a matter of major concern, lockdowns are seriously damaging economies, social distancing has a huge impact on the well-being of citizens; inequality and social unrest are on the rise, tensions increase in international political relations. The longer it takes, the more difficult it gets for many people to comply with the measures imposed, which increases the risk of new spreading. Countries across the world are now slowly loosening the restrictions, but until there is widespread vaccination or medication, uncertainty remains. Relying on an effective vaccine to become fully available is not a safe bet either, since we still have an awful lot to learn about the virus itself.

... time to reflect

The COVID-19 pandemic has fueled a huge amount of new research initiatives, leading to massive knowledge creation in many academic fields. At the same time, we know that this crisis is highly complex; everything is connected to everything else, in ways that are poorly understood. This implies that, if we want to take our knowledge development one step further towards creating actionable insights for strategic interventions (policy-oriented research), we need to foster exchange, debate and collaboration between the disciplines.

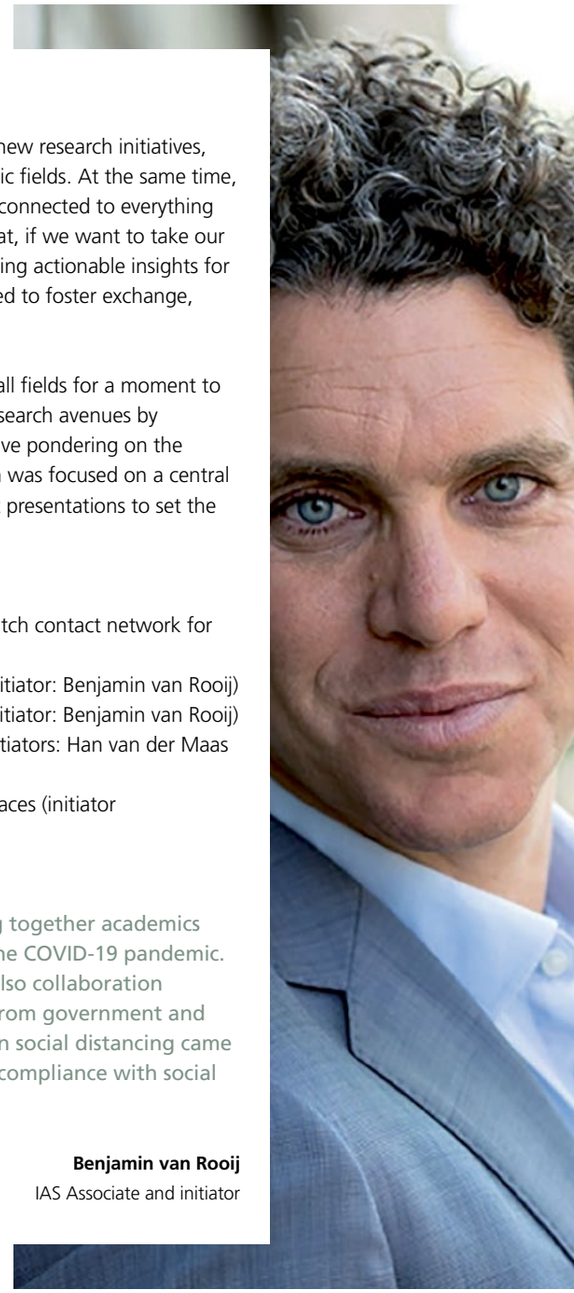
IAS has brought together researchers and experts from all fields for a moment to reflect. The aim of these sessions was to explore new research avenues by combining insights from different disciplines and collective pondering on the scientific questions that were still unsolved. Each session was focused on a central theme or open question and consisted of one/two short presentations to set the scene, followed by a moderated discussion.

Events that took place in the Time to Reflect series:

- 3 July 2020 - Parsimonious representations of the Dutch contact network for COVID-19 modelling (initiator: Luc Coffeng)
- 25 Aug 2020 - Behaviour in the 1.5 meter society (initiator: Benjamin van Rooij)
- 1 Oct 2020 - Behaviour and quarantine / isolation (initiator: Benjamin van Rooij)
- 13 Nov 2020 - COVID-19 vaccination acceptance (initiators: Han van der Maas and Roland Pierik)
- 26 Nov 2020 - Effective social distancing in public spaces (initiator Denny Borsboom)

"The goal of the Time to Reflect series was to bring together academics and practitioners to discuss how best to address the COVID-19 pandemic. The sessions resulted in direct contacts and later also collaboration between IAS/UvA researchers and policy officers from government and the RIVM. One example is how the RIVM report on social distancing came to incorporate findings from UvA research about compliance with social distancing mandates."

Benjamin van Rooij
IAS Associate and initiator



Events IAS 2020

In 2020, we hosted and organised approximately 40 events, using various formats: think-tanks, lectures, network events, slow science days, etc. Most events at the IAS are typically small-scale and flexible, offering researchers a haven to ponder, debate and reflect in an almost 'homely' ambiance. Due to the COVID-19 restrictions, we organised the majority of events online.

New Years's reception 2020
10 January | Community building
Scientific Lead: NA

We celebrated the new year and highlighted some achievements and new developments.

Kick-off meeting with IAS excellence students
15 January | Talent development
Scientific Lead: NA

Nine master's students were selected to write their final thesis at the IAS. In this kick-off meeting, the students presented their topics.

Future of Energy
16 January | Seminar
Scientific Lead: Bob van der Zwaan

The programme of each seminar consists of two presentations on the energy transition, coming from different academic fields, followed by general discussions that are relevant for the UvA Future of Energy network.

Workshop of the ODYCCEUS project (H2020)
27-28 January | Workshop *(hosted event)*
Scientific lead: Justus Uitermark

We hosted a two-day workshop of the ODYCCEUS project; an international research collaboration funded by Horizon 2020. At this meeting, scholars participating in the ODYCCEUS project with a wide range of disciplinary backgrounds discussed how their methods and concepts can be used in case studies of cultural conflict.

Amsterdam Young Academy on interdisciplinarity
29 January | Talent development
Scientific Lead: Peter Sloot

Lunch meeting of the Amsterdam Young Academy. IAS Scientific Director Peter Sloot gave a presentation on interdisciplinary research, followed by a discussion.

Applications of complexity theory in official statistics
11 February | Expert meeting
Scientific Lead: Frank Pijpers

In 2018, Statistics Netherlands published a discussion paper "Applications of complexity theory in official statistics". This brainstorm between experts from Statistics Netherlands (CBS) and researchers from UvA was aimed at strengthening collaboration on the topic.

Visit of IAS Scientific Advisory Board member: Ben Feringa
21 February | Distinguished guest
Scientific Lead: NA

Professor Ben Feringa, Full Professor and Jacobus van 't Hoff Distinguished Professor of Molecular Science at the University of Groningen, Winner of Nobel Prize in Chemistry (2016) and member of the Scientific Advisory Board of the Institute for Advanced Study, visited us on 21 February 2020.

Future of Energy
24 February | Seminar
Scientific Lead: Bob van der Zwaan

The programme of each seminar consists of two presentations on the energy transition, coming from different academic fields, followed by general discussions that are relevant for the UvA Future of Energy network.

From information to consciousness: New views on the analysis of complex dynamical systems

25 February | Workshop

Scientific Lead: Umberto Olcese

This workshop aimed to bring together scholars from different disciplines (e.g. neuroscience, philosophy, physics, computer science) to discuss with which methods to investigate the structure of brain activity and dynamics, with a focus on the study of the neuronal mechanisms of consciousness.

Origins Center fellows meet-up

26 February | Workshop

Scientific Lead: Renske Vroomans

In this meeting, the eight postdoctoral fellows of the Origins Center gave updates on the results of their research on various facets of the origins of life. Furthermore, the group discussed possibilities for outreach and prepare the Origins Center conference planned for the start of 2021.

Can ethnic tolerance curb self-reinforcing school segregation?

2 March | Lecture

Scientific Lead: Andreas Flache

Lecture by visiting research fellow Andreas Flache on his paper (joint work with Lucas Sage, Sorbonne), exploring with an agent-based theoretical model how ethnic tolerance among parents can affect the level of school segregation that emerges based on preference dynamics similar to those proposed for residential segregation.

Network Meeting for UvA Research Directors

5 March | Network meeting

Scientific Lead: NA

The programme included a discussion on how we can bring the UvA's interdisciplinary, cross-faculty research efforts to another level.

How can we shape research into immune fitness? (online)

1 April | Think tank

Scientific Lead: Anje te Velde

This interdisciplinary brainstorm was a follow-up of the workshop "Enhancing immune fitness: where to start"? (May 2017). The goal of this event was to find a suitable human model system that can be used to study immune fitness.

Polarisation (online)

2 April | Think tank

Scientific Lead: Han van der Maas

In this think tank, we discussed current developments in polarisation research and looked for new avenues of collaboration across disciplines.

Sleep Transitions (online)

21 April | Discussion

Scientific Lead: Han van der Maas

Online meeting of the theme group on sleep transitions, where we bring together researchers from different disciplines to discuss how to model and analyse sleep transitions.

Climate Policy Revolution (online)

12 May | Book presentation and discussion

Scientific Lead: Roland Kupers

On the occasion of the publication of Roland Kupers' new book "A Climate Policy Revolution," we convened a select group of researchers and policymakers to discuss how Complexity is relevant to Public Policy, focusing in particular on climate.

Polarisation (online)

15 May | Think tank

Scientific Lead: Han van der Maas

In this think tank, we discussed current developments in polarisation research and looked for new avenues of collaboration across disciplines.

Simulating extreme events and transitions (online)

15 May | Lecture

Scientific Lead: Daan Crommelin

In this talk, IAS research fellow Daan Crommelin distinguished several types of extreme events like hurricanes and building collapse (e.g. relating to static and dynamic model problems) and discussed some of the concepts and techniques that have been developed to study them with simulation.

Assumptions and attitudes towards interdisciplinary research (online)

25 May | Talent development

Scientific Lead: Machiel Keestra

In this Toolbox Dialogue workshop for IDA (Interdisciplinary Doctorate Agreement) PhD candidates, the participants made explicit individually and discussed together various kinds of assumptions and habits that influence research aims, methods and expectations.

Capturing emergence in bacterial biofilms (online)

29 May | Lecture

Scientific Lead: Vivek Sheraton

In this edition of the Simulation-based Science series, Vivek Sheraton gave a presentation about his work on bacterial biofilms.

Social Unrest in epidemics (online)

26 June | Expert discussion

Scientific Lead: Ana Isabel Barros

The meeting aimed to develop ideas that can aid progression towards scenario development, modelling scenarios, or pathways to social unrest. Part of the discussion focused on the possibilities of computational modelling to detect the emergence of social unrest during epidemics.

Parsimonious representations of the Dutch contact network for COVID-19 modelling (online)

3 July | Expert discussion

Scientific Lead: Luc Coffeng

This expert meeting was organised to discuss how the most important aspects of the Dutch contact network can be implemented in a transmission model in a parsimonious way. The discussion was part of the series: 'The COVID-19 pandemic: time to reflect', organised together with Science versus Corona.

Complexity Science – Analysing stability and shifts in natural and social systems (online)

8 July | Lecture

Scientific Lead: Marten Scheffer

Lecture by IAS external faculty member Marten Scheffer, as part of the online lecture series of the Centre for Urban Mental Health.

Interactions Summer School: Collective Intuition

14-20 August | Summer school

Scientific Lead: Orion Maxted

The Interactions Summer School brought together artists and scientists for a 4-day intensive investigation at the intersection of complexity science, theatre and poetry to explore and experiment in collective intuition.

From information to consciousness: new views on the analysis of complex dynamical systems
25 August | Workshop
Scientific Lead: Umberto Olcese

This meeting was a follow-up of the workshop on February 25th in which we brought together scholars from different disciplines to discuss with which methods to investigate the structure of brain activity and dynamics, with a focus on the study of the neuronal mechanisms of consciousness.

Behaviour in the 1,5-meter society (online)
25 August | Expert discussion
Scientific Lead: Benjamin van Rooij

Expert meeting to discuss research about behavioural responses to the social distancing measures, and on how new research findings could serve to shape policy. The discussion was part of the series: 'The COVID-19 pandemic: time to reflect', organised together with Science versus Corona.

Complexity and Leadership Course by Comenius
26-28 August | Executive training
Scientific Lead: NA

Three-day course organised by Comenius in collaboration with IAS.

Complex adaptive systems undergoing large unprecedented perturbations (online)
27-28 August | Expert discussion
Scientific Lead: Jan Willem Mantel

The Netherlands Platform for Complex Systems (NPCS) organised a two-day event on how complex adaptive systems respond to large, unprecedented perturbations. Various IAS-affiliated researchers joined the discussions.

How to abstract polarising and misinforming dynamics in online discussions
2-3 September | Workshop
Scientific Lead: Anna Keuchenius

This workshop was focused on abstracting the argument structures in online discussions in order to quantify and illustrate polarising and misinforming dynamics.

Complexity's Futurescapes (online)
22 September | Presentation and discussion
Scientific Lead: Brian Castellani, Lasse Gerrits

Brian Castellani and Lasse Gerrits kicked off their IAS fellowship with an online discussion session in which they presented their project the 'Atlas of Social Complexity'. In this project, they took stock of where the analysis of social complexity stands and outlined future challenges for the field.

Quarantine and isolation (online)
1 October | Expert discussion
Scientific Lead: Benjamin van Rooij

Online expert meeting to discuss research about behavioural responses to COVID-19 measures. This session specifically looked into quarantine and isolation. The discussion was part of the series: 'The COVID-19 pandemic: time to reflect', organised together with Science versus Corona.

Networks seminar (online)
20 October | Seminar
Scientific Lead: Michel Mandjes

Seminar in which the potential of networks was explored to explain phenomena in complex social, economic and technological systems.

Causality (online)
23 October | Think tank
Scientific Lead: Federica Russo

Interdisciplinary discussion on causality aimed at gaining acquaintance with causal problems, methods and assumptions in various academic fields.

Have you ever thought about bias (online)
28 October | Workshop
Scientific Lead: Federica Russo, Nadège Merabet

The aim of this workshop was to detect and analyse bias in research practice, using a hands-on approach.

Science beyond the horizon: Stephen Wolfram on a Fundamental Theory of Physics (online)
10 November | Lecture
Scientific Lead: Stephen Wolfram

Renowned scientist Stephen Wolfram presented his recent work on his Project to Find the Fundamental Theory of Physics as the first keynote speaker in our new Science beyond the Horizon series.

COVID-19 vaccination acceptance (online)
13 November | Workshop
Scientific Lead: Roland Pierik, Han van der Maas

This workshop on COVID-19 vaccine acceptance was aimed at initiating new research that will help policymakers to shape vaccination policy. The workshop was part of the series: 'The COVID-19 pandemic: time to reflect', organised together with Science versus Corona.

DIEP@UvA kickoff meeting (online)
26 November | Community building
Scientific Lead: Jácome Armas, Mark Golden

Kickoff event in which the new DIEP fellows presented their current research and future plans. The topics spanned multiscale modelling, probabilistic models, self-learning algorithms and many-body stochastic systems.

Effective social distancing in public spaces (online)
26 November | Workshop
Scientific Lead: Denny Borsboom

Together with Science versus Corona, we organised a workshop to assess the feasibility of 'connecting the dots in a collaborative research effort to develop integrated data-driven simulations for effective social distancing in public spaces.

Prize Ceremony IAS Excellence Students (online)
15 December | Talent development
Scientific Lead: NA

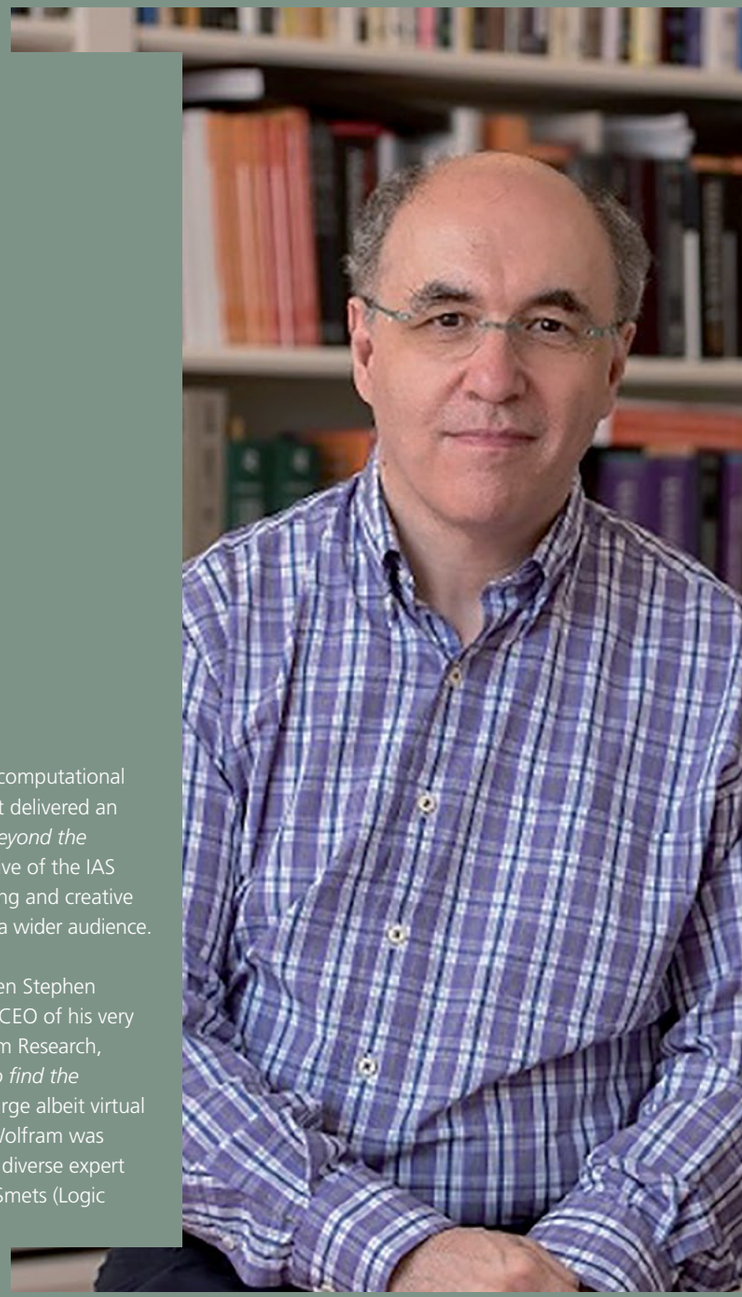
In this final event of the IAS excellence student programme 2020, the winner was announced and presented her work.

Negative poetry: Human Algorithm (online)
20 December | Performance
Scientific Lead: Orion Maxted

In this online performance, a computer made of people tackled the complex task of transforming a poem into its opposite, thereby generating a potentially infinite combinatorial polyphony of possibilities.

Stephen Wolfram, master of the computational universe, in Science beyond the Horizon

On 10 November 2020, World Science Day for Peace and Development, we launched our new lecture and debate series: Science beyond the Horizon. In this series, we give the floor to leading thinkers who are at the forefront of science to present novel ideas. We were honoured to have renowned scientist Stephen Wolfram as the first keynote speaker.



Beyond the Horizon

Stephen Wolfram, the distinguished computational scientist, mathematician and physicist delivered an inspiring first lecture in the *Science beyond the Horizon* series. This series is an initiative of the IAS and aims to introduce ground-breaking and creative ideas and their intellectual authors to a wider audience.

So, it was an extraordinary event when Stephen Wolfram the influential scientist and CEO of his very successful software company Wolfram Research, introduced his new book *A project to find the fundamental theory of physics* to a large albeit virtual audience. The hour-long lecture by Wolfram was followed by a lively discussion with a diverse expert panel consisting of professors Sonja Smets (Logic

and Philosophy, in particular epistemology), Klaas Landsman (Mathematical Physics, in particular foundational aspects), Max Welling (Information Science, in particular machine learning), and Jan de Boer (Theoretical Physics, in particular string theory).

Wolfram's computational universe

His 1992 book, A new kind of science, a Bible-sized bestseller, entails the introduction of and extensive study of cellular automata, their classification and great potential. What he basically discovered was that simple rule based programs/algorithms can upon many, many iterations generate diagrammatic patterns that are highly complex and non-trivial. Moreover, in contrast to the rules themselves the structures that emerge are highly irreducible in the sense that they exhibit a level of randomness that is very hard to directly assess by standard mathematical analysis. And in his new 2020 book or better, project, he claims that such structures do actually exhibit the universal features of all of fundamental physics, say, the principles of relativity, quantum theory, gauge symmetry and evolution. These would manifest themselves in certain well defined computational features of his complex graphs. One is the causal structure and invariance of the graph allowing to implement the basic principles of relativity. Applying the rules in all possible ways generates multiway graphs with a branchial structure that emulates quantum features like entanglement and path integrals. Finally one may introduce the notion of rulean graphs where starting from a given initial sequence many different rules are applied in parallel, to generate an all-overarching multiverse- or theory-of-everything-like framework.

Deep questions

What Wolfram kept emphasizing is the vast space of opportunities that his rule-based computational universes offer to rethink the core of natural science, but that in order to successfully exploit them as a researcher you will have to change your mindset towards this algorithmic thinking. The panel discussion touched on vast domains deserving further scrutiny centred on for example falsifiability, on different notions of irreducible complexity, on potential new universal constants of nature, on meta-mathematics and how to explain the remarkable successes of reductionism in conventional science. I must say Stephen Wolfram succeeded in creating an inspiring -- not to say mind-boggling – experience, worth checking out on YouTube and his very well maintained website devoted to the project.

Sander Bais
Chair and moderator of the event
Em. Professor of Theoretical Physics
IAS

Fellowship programme

UvA researchers and external researchers can apply for a fellowship at the IAS. Fellowships are awarded to renowned researchers as well as to talented early-career scholars. We can accommodate approximately 10-15 fellows per year. Fellows are selected by the IAS Board of Associates.
A fellowship at the IAS in Amsterdam is all about lively multidisciplinary interaction in an inspiring environment with other bright and creative minds. In 2020, the COVID-19 pandemic seriously hindered our possibilities to foster on-site encounters, since the institute was closed for the largest part of the year. Therefore, the majority of already selected fellows decided to postpone their stay until better times. Still, we had 7 fellows in total; some finishing their fellowships and other starting their fellowships online. Since 2019, the selection also includes one Artist in Residence.

Fellows

Andreas Flache

Prof. dr., Professor of Sociology, Department of Sociology, University of Groningen, The Netherlands

Research question

Can school segregation in a concrete Urban environment be explained as unintended outcome from the aggregation of multiple interdependent school choice made by households and schools?

I am involved as participating researcher, co-supervisor and co-promotor in the project "Agent Based Modelling of School Choice and Primary School Segregation", jointly initiated by Michael Lees, Willem Boterman, myself and Peter Sloot. Being a computational social scientist with a background in computer science and strong interest in applications of agent-based modelling in sociology, I see my main input into the project in supporting the development of the individual-level modelling of school choice and school choice dynamics, with a particular focus on distinguishing theoretically and testing empirically different choice mechanisms as well as their complex aggregation into school composition patterns. Working with the research team at IAS on this topic enriches also my research in general, as this is one of the projects in which I can link theoretical agent-based models with spatial empirical data, a long-standing interest of mine.
I also have given various lectures at IAS about my main research on modelling polarization and agent-based modelling on sociology, and I have organised jointly with Han van der Maas a series of workshops on polarization. For more details of recent activities, partly with IAS researchers, see https://flache.gmw.rug.nl/.

Lasse Gerrits (co-fellow Brian Castellani)

Professor of Urban Planning at the Institute for Housing and Urban Development Studies (IHS) of Erasmus University, Rotterdam

Research question

What is the state of art in the study of social complexity? In what ways can the study of social complexity become truly transdisciplinary? How can we merge existing social science theories, concepts and empirical data with the study of social complexity?

My co-fellow, Brian Castellani and I received our IAS fellowship to write The Atlas of Social Complexity, which maps the leading-edge research in social complexity. To create our map, we were to interview complexity scholars at Amsterdam and across the Netherlands. Then the pandemic hit. The IAS responded brilliantly. Not only did they help us set up a series of over 40 online interviews, but they also helped us hold two virtual public seminars, which were very well attended. The wider IAS community was also just brilliant – very open-minded, broad-thinking and inviting, providing a great intellectual setting for thinking through new ideas.

Brian Castellani (co-fellow Lasse Gerrits)

Full professor of sociology at Durham University, UK; Adjunct professor of psychiatry at Northeastern Ohio Medical University, USA; Research Fellow, Wolfson Research Institute for Health and Wellbeing, UK

Research question

What is the state of art in the study of social complexity? In what ways can the study of social complexity become truly transdisciplinary? How can we merge existing social science theories, concepts and empirical data with the study of social complexity?

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Danielle van den Heuvel

Associate Professor, Amsterdam School of Historical Studies, University of Amsterdam

Research question

(Why) do women disappear from the streets as cities modernize?

Due to the COVID Pandemic the planned collaborative events that were scheduled unfortunately were postponed. As soon as the circumstances allow, however, I will be organising an event on how best to capture, analyse and model data on mobile subjects that are difficult to grasp (e.g. animals, homeless people, informal street vendors, people from the past), and launch a new multidisciplinary platform to discuss the dynamics of street life in the past, present and future with colleagues from Amsterdam and beyond.

Daan Crommelin

Professor of mathematics, University of Amsterdam; Senior researcher and group leader, CWI (Dutch national research institute for mathematics and computer science), Amsterdam

Research question

How can we track the progress towards extreme events and regime switches in complex dynamical systems?

I am interested in uncertainties and rare events (extremes and regime switches) that occur in mathematical models of complex dynamical systems such as the climate system. At IAS I initially focused on extremes and regimes, but when the Covid epidemic started to spread in the Netherlands I shifted my attention to uncertainties in epidemic predictions. I got involved in the analysis of uncertainties of Covid-19 epidemic models using mathematical and computational tools for uncertainty quantification. Obviously, I had not anticipated to be working on epidemic models when I started my IAS fellowship, but it has been very interesting nonetheless.

René Melis

Principal Investigator at the Department of Geriatric Medicine of the Radboud University Medical Center, Nijmegen, the Netherlands

Research question

How are processes across multiple spatial and temporal scales involved in the emergence of resilience of aging humans against health stressors?

Successful and healthy aging is not just about the avoidance or elimination of health risks and treatment of disease. Equally important, but much less appreciated, is the capacity to resist, recover from and cope with risks to health and life as they come along. Clinicians currently lack valid tools to manage their patients' resilience and results in avoidable disease burden, delayed recovery, and healthy life years lost in the increasing group of older persons and persons with multimorbidity. This calls for a better understanding of the underlying mechanisms. I hope to involve a mixture of methods and disciplines to increase our understanding of how resilience comes about in aging humans.

Albert Feilzer

Professor of Comprehensive Dentistry at ACTA Former Dean of ACTA (Jun 2009 - Jun 2019)

Research question

Caries prevention the last mile
Adverse reactions of medical devices

As Past-dean, I received a sabbatical for six months, which I partly fulfilled at the IAS. Afterwards I will remain connected to the IAS as a fellow. On one hand, I am involved in setting up research on how we can make the world's most common non communicable disease 'caries' to disappear While on the other hand I execute research on adverse reactions of medical devices.
During the last fifty years, the oral health of the Dutch population has improved enormously. However, caries has not completely disappeared, and the 'last mile' requires the development of new strategies for prevention of the complex disease caries. I hope to realize a project subsidy for this within IAS for developing a biomedical model of this disease.

Artist in Residence

As part of our ArtScience theme, we host an artist at the institute aiming to integrate thinking and practice at the possible intersections of complexity and arts.

Orion Maxted

Theatre and performance maker. DAS Graduate School of Performance (formally DasArts), Amsterdam; supported maker at Frascati Theater, Amsterdam; and artist-researcher in the ArtScience group of the Center Leo Apostel, VUB, Brussels

Research question

What systems, made of interacting people (and in some cases objects and machines), can we imagine which collectively show emergence, whereby the whole has properties that the individuals do not?

Orion aimed to deepen the ArtScience theme at the IAS inviting artists, scientists and academics from Amsterdam and beyond in order to learn, discuss and experiment together. He initiated an experimental laboratory for thinking together, through which he aimed to build a lexicon of transferable concepts between theatre and complexity, to imagine, and engineer experiments in complexity theatre, that lead participatory and non-participatory performances.

Lasse Gerrits and Brian Castellani about their IAS fellowship

The COVID-19 pandemic has impacted the research activities and outputs of most researchers quite severely. But not always in a bad way: for some projects, the online alternatives have been quite successful. IAS fellows Lasse Gerrits and Brian Castellani talk about their fellowship during the pandemic, and how they were able to use this to their advantage by conducting 50(!) online interviews with researchers, policymakers, artists and musicians from all over the world.

The project Lasse Gerrits and Brian Castellani worked on revolved around writing the book The Atlas of Social Complexity, which extends Castellani's previously created Map of Social Complexity. The goal of the Atlas is to map the history of the study of social complexity but more importantly to look forward into the future. Lasse Gerrits: "We asked ourselves the question, what's next? I've been studying social complexity for two decades now, and it has yielded many results. We want to take stock of what has been done already, but we are mostly interested in: what will be next? What are the pressing themes? What are the new, exciting methods? What topics have been left uncovered? What are the blind spots? What are the challenges for the field? That's what our research project is about." The Institute for Advanced Study has shown to be an ideal place to collect input from many different perspectives. Gerrits continues: "We've conducted about 50 interviews with researchers and other people in the IAS community and beyond, to tease out those questions. Since we are not experts in all

the fields, we tapped into their knowledge to be able to compile the Atlas."

Brian Castellani: "I think both of us were skeptical of being able to pull any of this off in a virtual environment. However, the virtual alternative really proved more useful than we thought it would. I think the norms of online exchange for scholars changed, with people being much more open-minded about how to get work done, which allowed us to interact with a lot more people than we would have otherwise. I don't think we could have interviewed nearly as many people as we did, if we had to physically travel. Also, being in virtual IAS workshops made it easier to connect to people and invite them for an interview. We were not just focused on traditional academics. We interviewed artists, policymakers, musicians we really tried to look more broadly at what's being done. The community of the Institute is leading edge in this, and for me this forms and integral part of this fabric of complexity that is around the Institute".

Both Brian Castellani and Lasse Gerrits have extended their fellowship and look forward to continuing their project at the Institute in Amsterdam once this is possible again. Because, although they have made good progress during lockdown, nothing beats real-life discussion and interaction in a slow-science type of environment with bright and creative minds.

The book "The Atlas of Social Complexity" will be available through Edward Elgar Publishing next year.

Orion Maxted on theatre and collective thinking as a bridge between art and science

Orion Maxted is an Artist Fellow in Residence at IAS. Here, he met other fellows and formed a multidisciplinary group of artists, scientists and philosophers: The Interactions Group.

Orion Maxted: "The Interactions Group is a collective 'thought band' and artscience group that explores the interconnections of art, theatre, poetry and complexity sciences through the lens of algorithmic theatre and collective human computation. We hold weekly meetings, as well as workshops and performances, bringing together a diverse range of artists, philosophers and scientists.
Our inspirations include algorithmic theatre, collective intelligence, poetry, and complex adaptive systems sciences. Our primary approach is to work together to understand and develop methodologies for collective thinking which help us create a bridge between art,

performance and complexity science. Moreover, the Interactions project is the formulation of the group itself. Thinking about the group as a complex self-organising system, how can we better understand the ingenuity of complex adaptive systems through this living model of collective thought?
The group's weekly collaborative experiments have led to public performance, including *Negative Poetry, The Wonder Machine, and Wandering Together and Alone* - a piece about swarming and social distancing.

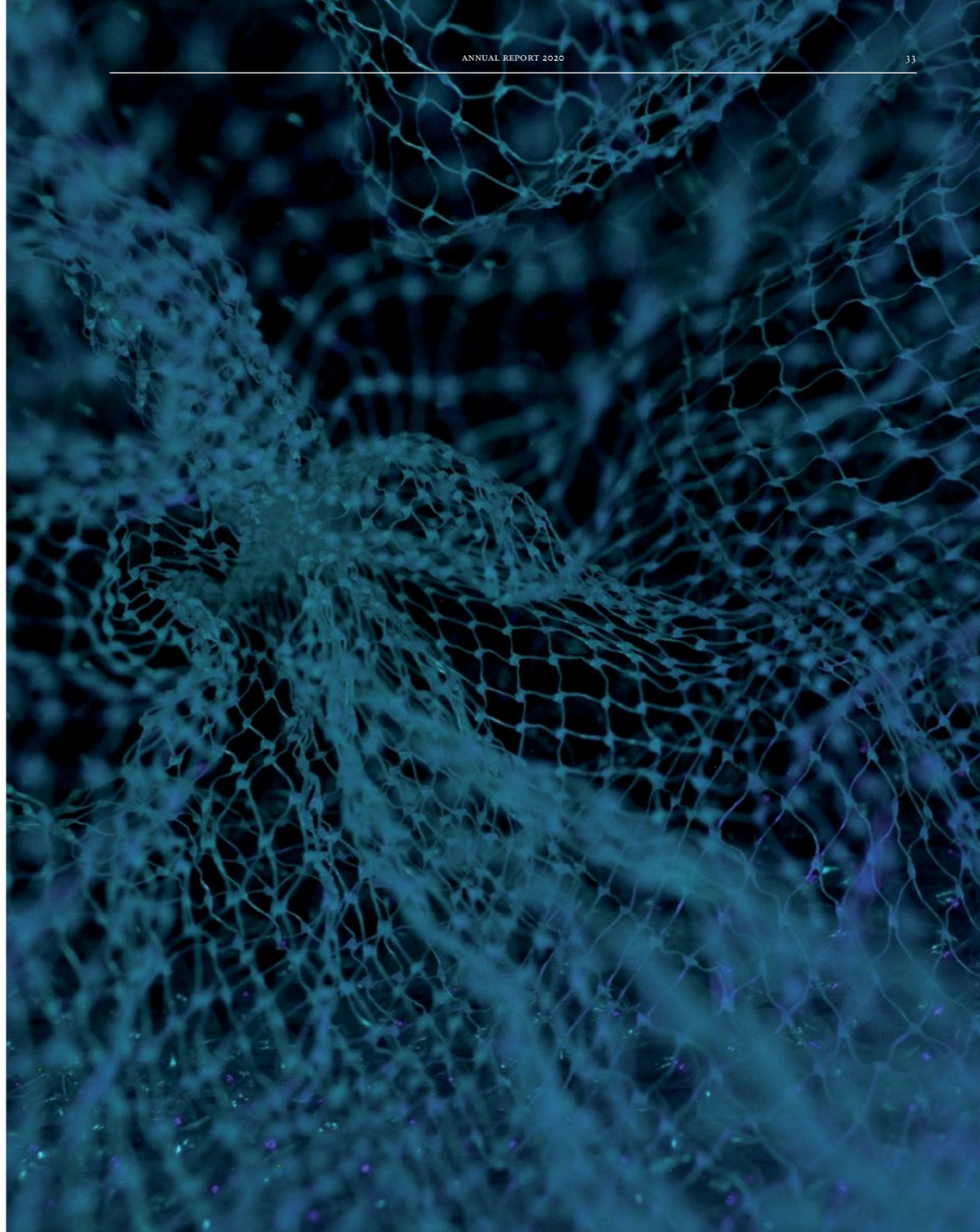
For most of the researchers involved this was the first time they had interacted in such a way.
"I think a lot of the work we do is about building a shared vocabulary between artists and scientists. The fundamental difficulty in artscience is that the ideas you are able to cocreate are limited by the degree to

which you are able to cultivate a shared language around a shared set of practices."

A major part of The Interactions Group is devising systems, games and performances that generate collective thinking.

"One of the performance systems we have devised is called *The Wonder Machine*; a game that generates wonderment - which we see as a key overlapping theme between art and science.
In this reduced form of conversation, each agent speaks in turn, beginning with the phrase 'I wonder…' expressing their current state of curiosity.
The complexity of the collective emergence that arises, makes the simplicity of the underlying rule-set all the more fascinating. One of the interesting features that inevitably emerges, is how the agents' wonderings often merge and co-produce the wonderings of the other agents. Through the interactions and feedback loops of primings and wonders, a simple yet surprising form of collective thinking arises - a collective mind. *The Wonder Machine* is a type of collective computation - which we might also call, collective intuition - i.e. a form of collective (largely) pre-symbolic computation.
The Wonder Machine is different from 'ordinary' conversation because the cue/assignment/task to wonder relieves the participants from trying to be correct and from trying to form a complete thought. I always say it's better to leave a thought unfinished, this invites someone else in the group to continue and develop the thought. I see this as a key in collective thinking and collective computation. In both art and science, it is very important that we disrupt the standard modes and trajectories of thinking."

Situating The Interactions Group within the Institute for Advanced Study has been a great match.
"The context of IAS has helped foster transdisciplinary scientific and artistic practices drawing ideas from complex adaptive networks and non-traditional theatre making, and applying this hybrid knowledge to the practice of collective thinking itself. Our methodology for doing art, science, and artscience is not only theoretical or representational, but rather operates through the practical, by embodying systems and processes and proceeding from complex systems we collectively form. For me, that's the essence of theatre and performance as well as science; finding ways to think and do things collectively.



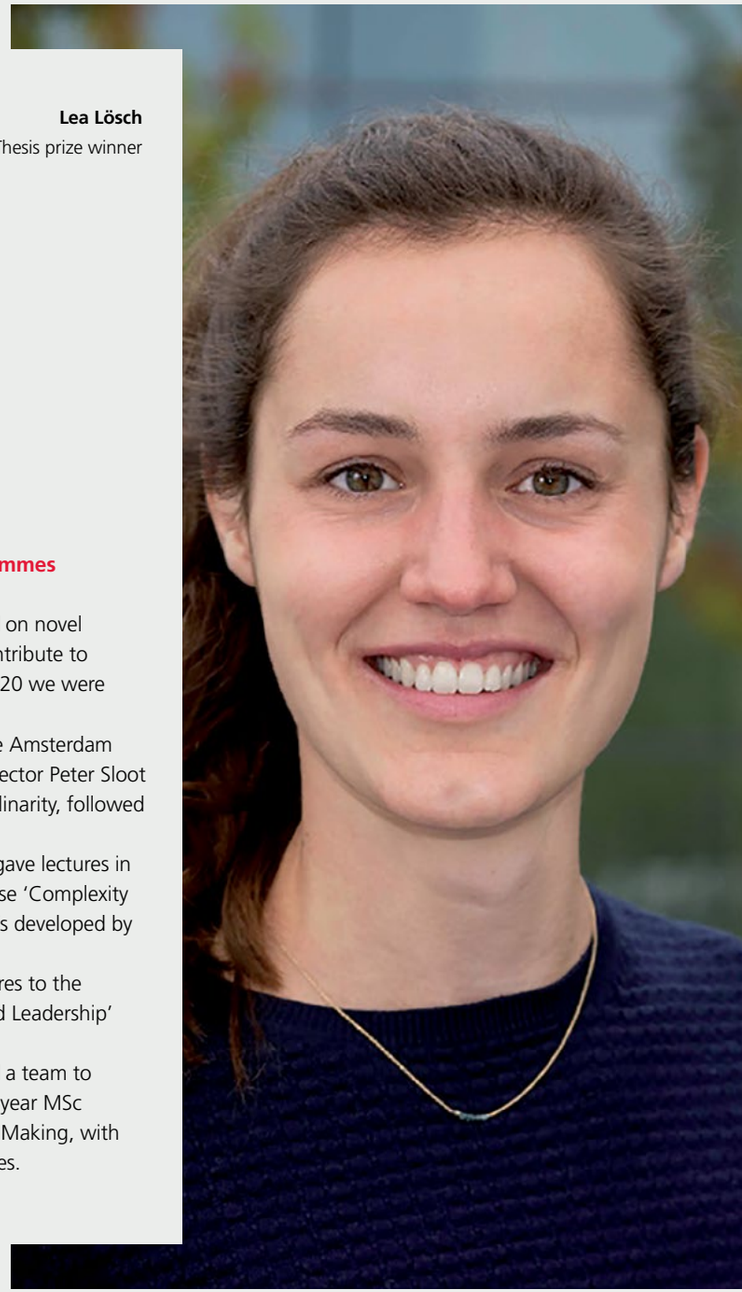
Talent development

We are committed to investing in the training and development of the next generation of interdisciplinary researchers. Talented Master's students who are interested in interdisciplinary research can join the IAS community as student assistant or to work on a thesis project.

IAS Excellence call

In 2020 we ran the second edition of the IAS excellence call for outstanding Master's students. Following a call for proposals nine students were selected to work at the institute on their final thesis, offering them a stimulating work environment alongside outstanding researchers. Due to the COVID-19 pandemics, the experience was different than expected. In the end, six students submitted their work to compete for the thesis prize.
The students came from various programmes, ranging from Brain & Cognitive Sciences, Artificial Intelligence, Computational Science, to Art Studies. The selection committee awarded one student with a prize for the best and most original theses.

After serious deliberation Lea Lösch was selected as thesis prize winner. She received a 500 Euro cash prize for her thesis "Mind Over Matter: the Social Representations of Placebos and Their Effects". She wrote the thesis as part of the Research Master Social Science.



Lea Lösch
Thesis prize winner

Contribution to education programmes

Although the IAS is primarily focused on novel interdisciplinary research, we also contribute to several education programmes. In 2020 we were involved in the following:

- We hosted a lunch meeting of the Amsterdam Young Academy. IAS Scientific Director Peter Sloot gave a presentation on interdisciplinarity, followed by a lively discussion.
- Various IAS-affiliated researchers gave lectures in the interdisciplinary bachelor course 'Complexity can it be simplified?'. The course is developed by IAS' Scientific Director;
- We contributed with several lectures to the executive training 'Complexity and Leadership' organised by Comenius.
- We took the initiative and formed a team to develop a concept for a new two-year MSc programme on Strategic Decision Making, with the involvement of all UvA Faculties.

Collaborations for societal impact

CBS building, *picture by Sjoerd van der Hucht*

At the IAS, researchers from a wide range of disciplines work together on various complex societal challenges. To take our knowledge development one step further towards creating insights that are actionable for the world beyond academia, we closely involve stakeholders from the public and private sector.

A growing part of our research activities is policy-oriented; trying to understand what kind of interventions will produce what type of outcomes in complex systems. In co-creation with policy makers and other experts, we develop integrative methods and tools that help to explore new avenues of intervention.

For this type of research, Statistics Netherlands (CBS), is an important collaboration partner, and we are proud to have its Director-General, Angelique Berg, on our Board of Trustees. In 2020 we have brought our collaboration with CBS to a whole new level with the establishment of a five-year thematic partnership in a field of mutual interest: Complexity for Official Statistics. The agreement comes with a joint research agenda focussing on three methodologies: network science, dynamic systems analyses, agent-based modelling.

The research agenda will be implemented through concrete research projects in various application domains. Examples of projects that are currently being implemented within the framework of the programme agreement are:

- Productivity research using agent-based modelling;
- Population-scale social network analysis (POPNET);
- Social norms, socio-economic inequalities and obesity;
- Inequality growth.

IAS Boards 2020

Associates are researchers at the University of Amsterdam (UvA) who have expertise in various academic disciplines and believe in interdisciplinary, collaborative research. They are involved in developing our research portfolio, increasing our visibility and liaising between the IAS and the UvA's faculties.

Board Of Associates

University of Amsterdam	Dymph van den Boom	Educational Theory	Until Sep 2020
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Amsterdam Academic Medical Centre	Menno de Jong	Clinical Virology	Until Sep 2020
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We are supported by two external boards: the Scientific Advisory Board and the Board of Trustees. They serve as sounding boards for the IAS management.

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