Editorial

Dear Readers,

In this edition of the newsletter, we begin with a report on an emerging interdisciplinary research field by UZH alumna Nathalie Giroud. She has returned to UZH after a postdoc at Concordia University and is now heading her own research group on auditory neuroscience and aging. Next, the table of contents of a recent edition of *American Psychologist* on adult development once again shows how well represented LIFE faculty and alumni are in this field.

As you know, LIFE Berlin organized "The LIFE Theory Lab" in the past months. In case you missed any of the interesting lectures, you can catch up on YouTube. The links are provided in the overview of talks. We continue with the sad news about the passing of UM LIFE faculty James Jackson.

We provide a reminder that it is high time to apply for the *LIFE Outstanding Alumni Award 2020* if you are eligible. MPIB alumna Verena Sommer, who recently submitted her dissertation, then gives a thought-provoking introduction to the topic of sustainability in view of climate change and what we can can do as scientists. She has selected the photos of landscapes and wildlife for this issue (see below). This is followed by fellows' abstracts for the first virtual LIFE Spring Academy, which was hosted by UVA. Berlin faculty Myriam Sander responds to our 10 questions before we introduce new faculty and fellows at UM and UZH. As usual, we close with a list of recent publications by fellows and a selection of those by alumni and the latest LIFE news.

As always, special thanks to all contributors! Offers of articles, perhaps on aspects of the COVID-19 pandemic, for one of the next newsletter issues would be very welcome.

Stay well!   Julia Delius

Source: Pixabay

The Greenland ice sheet is shrinking. https://www.livescience.com/greenland-melt-point-of-no-return.html

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Reminder

Fellows, alumni, and faculty, please keep us informed about your LIFE-relevant news (e.g., awards, career moves)! Fellows and alumni, please check that your web profiles are up-to-date—they are often the first thing that pops up when your name is googled! Send your updates to delius@mpib-berlin.mpg.de

LIFE Website: www.imprs-life.mpg.de

The Future of Age-Related Hearing Loss Treatment: A Plea for a New Interdisciplinary Research Field

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Why is treating age-related hearing loss important?

You might think that age-related hearing loss (ARHL) is an insignificant decline of hearing functions that will only become evident when you grow very old. After all, it is called age-related hearing loss—often images come to mind of older adults above 80 years who have trouble understanding a significant other or a grandchild, which might even come in handy sometimes. So, why should we care while we are young? And why should we take ARHL seriously (well, at least most of the time, see below)?

First, it is important to note that ARHL often develops early in our 40s, but slowly, which is why we often do not notice it. So even younger newsletter readers may already have some trouble understanding others in adverse listening situations, for example, at the train station or in restaurants, but the disruption of the acoustic signal is usually not enough to miss any important information. Note though, that this is the start of a cascading effect of hearing decline, which might, to some degree, be prevented by treatment if applied from a younger age. Second, once ARHL becomes chronic and more severe, it has many consequences. It has been named one of the top three leading causes of disability in older adults

Source: https://www.pinterest.ch/yourhearingnow

(Mathers et al., 2008). Typically, it is characterized by increased pure-tone thresholds at high frequencies, often resulting from damage to cochlear outer hair cells and the stria vascularis in the auditory periphery (Mills et al., 2006). Importantly, ARHL is multifactorial and is strongly associated with speech understanding difficulties due to the elevated pure-tone thresholds, but also due to inaccurate coding of acoustic signals caused by degeneration in the synaptic connections between cochlear hair cells and nerve fibers (Liberman & Kujawa, 2017) and age-related decline in the (sub)cortical auditory pathway (Giroud, Hirsiger, et al., 2018; Giroud et al., 2019).

The most common complaint of older adults with ARHL is that it is difficult to participate in conversations and social interactions. For many older adults, this means a reduced quality of life, social isolation, and higher rates of depressive symptoms (Arlinger, 2003). Neuroscientific research has also revealed that ARHL leads to stronger gray and white matter decline in the brain, for example, in brain regions associated with auditory processing (e.g., superior temporal lobe), but also in brain regions associated with cognition (e.g., hippocampus, parahippocampus) (Giroud, Hirsiger, et al., 2018; Giroud et al., 2019; Lin et al., 2014; Xu et al., 2019). Furthermore, and thanks to the great work of our LIFE faculty, for almost 25 years, we have known about the direct link between auditory and cognitive functioning in older adults (e.g., Lindenberger & Baltes, 1994). Extending this work, researchers have also described an association between ARHL and cognitive decline in older adults (de la Fuente et al., 2019; Fischer et al., 2016; Fortunato et al., 2016; Merten et al., 2020) as well as a higher risk of incident all-cause dementia with ARHL (Albers et al., 2015; Deal et al., 2015, 2019; Gates et al., 2011; Lin et al., 2011; Lin & Albert, 2014; Osler et al., 2019). Hypothetically, it has been estimated that eliminating midlife- onset ARHL from the population would reduce the prevalence of Alzheimer's dementia by 9%, which is more than any other

potentially modifiable risk factor included in the study (Livingston et al., 2017). Therefore, the degree to which hearing-loss prevention and/or treatment can modify dementia risk is currently being actively investigated (Deal et al., 2018; Sanchez et al., 2020). Regardless of the outcome of these studies, I hope that I have convinced you that the current evidence certainly points to the importance of good hearing for a high quality of life and potentially for high levels of cognitive functioning into old age.

So, what can we do against ARHL?

Besides prevention of ARHL by avoiding noise, and getting tested for hearing loss early, the most common treatments are hearing aids (or in very severe cases sometimes cochlear implants). The traditional way in which hearing aids can help is through sound amplification, which increases speech intelligibility (Coez et al., 2010). After many years of research, the available amplification algorithms have become more sophisticated and can be tailored to the hearing loss profile of the hearing-impaired individual. For example, noise reduction or compression of higher frequencies in which hearing loss is most severe, can improve speech intelligibility tremendously and also increase auditory processing in the brain (Giroud et al., 2017).

But is this enough?

Yes and no. Without hearing aids, it would not be possible for the brain to receive enough acoustic information to process the signal and extract its meaning. But our research has shown that at older ages, neural processing may also not work as well as at young ages, leading to problems in understanding speech (Giroud et al., 2019; Giroud, Hirsiger, et al., 2018; Giroud, Lemke, et al., 2018). Thus, hearing aids are necessary, but to date they can not replace the brain's functioning that is essential for further processing of the incoming sound (e.g., extracting syllables and words, storing them in our memory, preparing a response through the motor system, creating ideas, etc). So, the "million-dollar question" in hearing research is really how we can help an older brain to do that. Now, of course, we are talking about a huge field of research at the intersections of hearing science, neurobiology of aging and of language processing. And by pure chance of course, those three fields happen to be my scientific passions.

What can neuroscience contribute?

I believe that the solution is not so much as to what neuroscience can contribute, but more how we can combine the knowledge of these fields to advance the knowledge that is important for patients further. In the sense in which David Poeppel talks about the challenges combining neuroscientific language research and linguistic research, there is a mismatch problem between the fields (Poeppel, 2012). In other words, we have a lot of behavioral understanding of the relation between, for example, speech intelligibility, speech understanding, and cognitive compensation during speech processing in older hearing-impaired individuals (hearing science), but it is a huge challenge to attribute these concepts to specific neural computations in the older brain (neurobiology of language in the aging brain). For example, the often encountered Ease of Language Understanding (ELU) model (Rönnberg et al., 2013, 2019) describes the role of working memory for speech understanding. It states that working memory becomes important for successful speech understanding when there is a mismatch between the auditory input, for example, due to background noise or hearing loss, and the stored representations of sounds in semantic long-term memory. Because distorted or unclear auditory input does not necessarily match phonological or lexical representations, working memory keeps the relevant auditory input active, while more information such as context can be processed until a match between the input and the stored representations can be achieved. If we now want to map these hearing science concepts (e.g., working memory, lexical representations, etc.) onto neural concepts of language processing, our task will become difficult. We have a poor understanding of the neural basis of working memory and we know next to nothing about how lexical items are stored in the brain.

Some of you might argue now that this does not matter and there is no need to understand the neural mechanisms. Because if the ELU model helps us to improve speech perception in hearing-impaired older adults, for example, by training their auditory working memory capacity (Anderson et al., 2013, 2014), then that is all we wanted to achieve. But is it? We will first need evidence of its effectiveness, because not much research has been done so far. Second, the few studies that

conducted such research showed very moderate effects (e.g., approx. <0.7 dB increases in the signal-to-noise ratio in a speech-in-noise perception in the study by Anderson and colleagues). And third, it would still remain an open question as to what we would recommend for older adults who are not able to perform intensive cognitive training because, for example, they have dementia or other cognitive impairments (especially in view of the rise in dementia—we are expecting the global prevalence of Alzheimer's dementia to triple by 2050).

Thus, behavioral training might not always be an option, which is why I believe we need neuroscience for the following reasons:

1. We need non-behavioral methods to diagnose a hearing impairment which is related to decline in auditory processing in the brain for individuals who cannot perform complex behavioral tasks with complex instructions (like speech-in-noise perception testing which includes a strong memory component).

2. We need to tackle some of the neural auditory processes in hearing-impaired older adults to tailor neurostimulation protocols or other novel technological devices to improve speech perception.

Some work in this latter direction has been done by LIFE alumna Katharina Rufener, showing that brain stimulation devices such as transcranial alternating current stimulation (tACS) leads to short-term improvement of speech perception performance in younger and older adults (Riecke et al., 2018; Rufener et al., 2016, 2018; Wilsch et al., 2018). However, no research has been conducted in older adults with ARHL or cognitive impairment. Further, examining which computations of speech processing in older adults might be deficient under which listening situations will also improve interventions. An example is the most recent development in hearing aid applications that are being directly fed with information on the extent of hearing aid user's neural entrainment to an attended speech stream (Dau & de Cheveigné, 2017). Neural entrainment means the alignment of the phase of the intrinsic neural oscillations with the incoming auditory signal, which is stronger for attended versus unattended streams of speech (Zion Golumbic et al., 2013). This enables the hearing aid to selectively amplify the specific acoustic stream signal that the listener is attending to, thus increasing the quality of auditory processing dramatically. However, initial research has only tested such approaches in normal hearing and healthy young adults (e.g., Biesmans et al., 2017; Das et al., 2017) and as yet, next to nothing is known about how neural entrainment (and other neural filters) change as a function of hearing loss, aging, and cognitive impairment, despite the fact that healthy older adults and older adults at risk of cognitive impairment are those most likely to benefit from the newly developed technology. In our research group, we will focus on these issues.

How we are trying to tackle some of those problems in my research group

In our group at UZH (which started in June 2020) we investigate mechanisms of language processing in the brain using a variety of neuroimaging techniques (e.g., EEG, MRI) as well as psychophysical and neuropsychological testing. In general, our research focuses on the neural underpinnings of the highly prevalent ARHL and speech perception difficulties in older adults. We are working towards understanding its impact on the brain and its relationship with cognitive decline in healthy individuals and in older adults with neuropathology such as Alzheimer's disease. Our long-term goal is to develop diagnostic tools and rehabilitation strategies for audio(-visual) speech processing difficulties in healthy older adults and individuals with mild cognitive impairment and dementia.

As mentioned above, a key computational mechanism of the brain in auditory processing is neural entrainment. We will particularly focus on describing entrainment at different hierarchical stages of speech perception from early bottom-up auditory brainstem entrainment to speech, to bottom-up entrainment at the cortical level and top-down related linguistic extraction of meaningful units (e.g., syllables, words, sentences) and assess to what degree their operating changes as a function of ARHL and cognitive capacity. The goal, and the key to improved intervention for older adults with ARHL, is to use the results to develop simple ways to assess these functions without relying on the tested individuals' behavioral performance. We will combine powerful approaches, namely EEG- and MEG-based recording measures of entrainment originating from the auditory brainstem (Bachmann et al., 2019;

Giroud et al., 2020) as well as from different regions in the cortex probed by the so-called concurrent hierarchical tracking paradigm (Ding et al., 2016; Makov et al., 2017). This paradigm has been used to study the neural signature of entraining to continuous speech at different levels, each corresponding to a distinct pattern in the M/EEG signal.

Why do we need a new research field to work on this issue?

My plea is really more a statement that research questions that have a broader focus and connection to clinical problems or interventions will need to be carried out in an interdisciplinary fashion. For example, we, the developmental neuropsychologists, work with audiologists and engineers to understand ear-related ARHL and hearing aids, with fundamental and computational neuroscientists to understand the micro-computational mechanisms underlying neural entrainment, with clinical neuropsychologists and medical doctors to work with cognitively impaired patients, and with linguists and phoneticians to understand the acoustic and linguistic signals we are presenting to our participants. So many researchers are coming together to solve the problems described above—maybe just enough to fill a new field. Maybe we can call it *clinical neurolinguistics*.

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American Psychologist, Vol. 75(4), 2020

Special Issue:
Rethinking Adult Development: New Ideas for New Times

Guest Editors: Jeffrey Jensen Arnett, Oliver Robinson, & Margie E. Lachman

The LIFE Theory Lab:
Contemporary Theorizing, Methodological Advancements, and Future Challenges for Lifespan Developmental Science

Organizers: Markus Werkle-Bergner, Ulman Lindenberger, & Imke Kruse, MPIB

The LIFE Theory Lab 2020 was an open series of 10 lectures held in June and July 2020 promoting an open-science virtual exchange on conceptual and methodological advances in the study of behavioral development. The Theory Lab gave leading researchers a platform to share their views on the ways in which the "dance" between theory and method (Nesselroade, 1988, cited in Nesselroade, 2006) has informed their own work, and has fostered scientific progress. Recent advances in evolutionary theory, genetics, imaging methods, behavioral observation, statistical tools, formal modeling, and machine learning provide unprecedented opportunities for describing, understanding, and ameliorating individual developmental change across the lifespan. Lifespan psychology has sought to provide a conceptual framework for capturing the overall architecture of human ontogeny (Baltes, 1997). Time has come to revisit this framework in the light of these recent advances, and gauge its function for structuring our knowledge about invariant and malleable aspects of human ontogeny.

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Program

June 04, 2020
Tomás Ryan, Trinity College Dublin
Memory and Instinct as a Continuum of Information Storage

June 11, 2020
Charles Nelson, Harvard University
Critical Periods in Human Development
https://www.youtube.com/watch?v=xMP626NgEVs

June 18, 2020
Candice Odgers, Duke University
Charting Individual Development
https://www.youtube.com/watch?v=2hTNAXdRqGc

June 25, 2020
Eric Turkheimer, University of Virginia
Gene–Environment Interplay

July 02, 2020
Lars Nyberg, Umea University
Lifespan Maintenance of Brain and Cognition: Fiction or Science?
https://www.youtube.com/watch?v=26cCG8B2EoA

July 09, 2020
Gerd Kempermann, Center for Regenerative Therapies Dresden
Adult Neurogenesis and the Neurobiology of Individuality
https://www.youtube.com/watch?v=viZvwbIQ8Do

July 16, 2020
Danielle Bassett, University of Pennsylvania
Network Architectures Supporting Learnability
https://www.youtube.com/watch?v=hBBna3-cknQ

July 23, 2020
Iyad Rahwan, Max Planck Institute for Human Development
Experiments in Machine Behavior: Cooperating With and Through Machines
https://www.youtube.com/watch?v=6smhDogcxlE

July 30, 2020
Ellen Hamaker, Utrecht University
Choices in Design and Analysis to Study Change
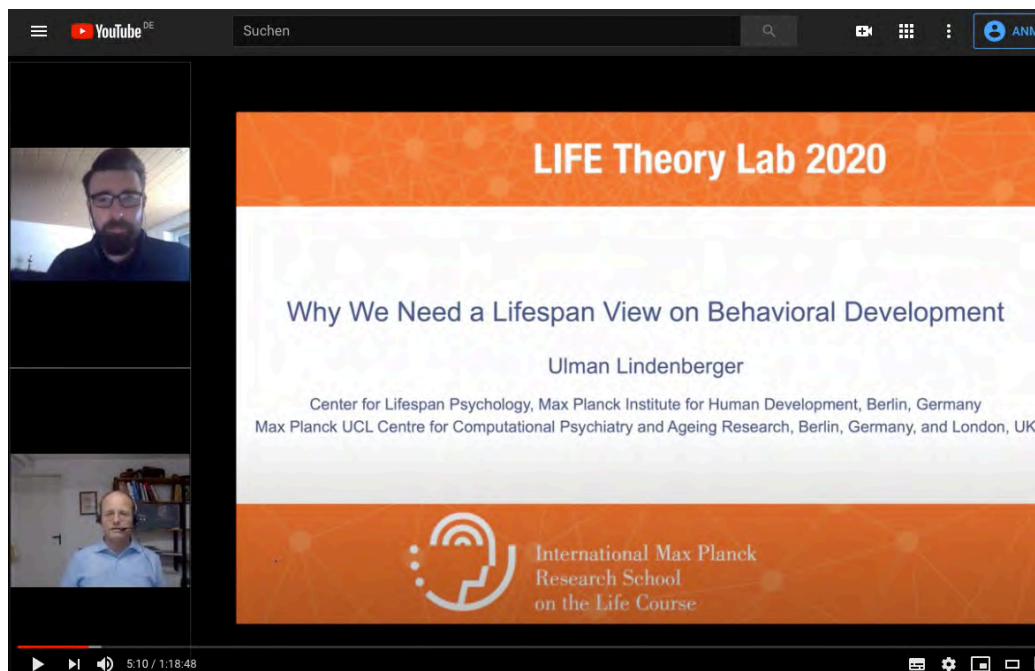https://www.youtube.com/watch?v=eCEX7AaX2bk

August 6, 2020
Ulman Lindenberger, Max Planck Institute for Human Development
Why We Need a Lifespan Approach to Developmental Change
https://www.youtube.com/watch?v=LucK4Lgvhs4

James S. Jackson (1944 – 2020)

Patricia A. Reuter-Lorenz
Department Chair and Professor of Psychology, University of Michigan

It is with a heavy heart that I share the news of LIFE faculty James Jackson's passing. After a long and heroic battle with pancreatic cancer, he passed away peacefully on September 1 with his wife, Toni Antonucci, and daughters Ariana and Kendra by his side.

As many of you know, Professor Jackson was a giant in social psychology, whose work and broad influence will endure for generations to come. He was the Daniel Katz Distinguished University Professor of Psychology Emeritus in the School of Literature, Science, and the Arts and Research Professor Emeritus, Research Center for Group Dynamics, Institute for Social Research. He founded the Program for Research on Black Americans in 1976 which focused on issues of racial and ethnic influences on life course development, attitude change, reciprocity, social support and coping and health among blacks in the Diaspora. He was past director of the Institute for Social Research and the Center for Afroamerican and African Studies, and past national president of the Black Students Psychological Association and Association of Black Psychologists. He was awarded the University of Michigan's inaugural Distinguished Diversity Scholar Career Award in 2017, an award that now bears his name: The James S. Jackson Distinguished Career Award for Diversity Scholarship. Professor Jackson has been honored with numerous awards, including the Distinguished Career Contributions to Research Award from the Society for the Psychological Study of Ethnic Minority Issues, American Psychological Association and the James McKeen Cattell Fellow Award for Distinguished Career Contributions in Applied Psychology from the Association for Psychological Sciences. He was an elected member of the Institute of Medicine of the National Academies of Sciences.

Professor Jackson directed the most extensive social, political behavior and mental and physical health surveys on African American and Black Caribbean populations ever conducted: "The National Survey of American Life" and "The Family Survey across Generations and Nations" as well as the National Science Foundation- and Carnegie Corporation-supported "National Study of Ethnic Pluralism and Politics." Recent publications include "African Americans in a Diversifying Nation" and "Age Cohort, Ancestry and Immigration Status Influences on Family Relations and Psychological Well-being among Three-generation Caribbean Black Families." Among many other service contributions, he served on several boards for the National Research Council and the National Academies of Science and is a founding member of the Aging Society Research Network of the MacArthur Foundation.

In the words of Vice Provost for Equity and Inclusion and Chief Diversity Officer, Robert Sellers: "James Jackson is probably the most important researcher on the life experiences of African Americans in the past 100 years… His work transcends the traditional fields of psychology, sociology, political science and public health to provide a rich picture of the strengths, challenges, and functioning that characterizes the breadth of experiences of the African American community. In doing so, James' work has been foundational to our understanding of the social determinants of health and well-being in our country."

Our warmest condolences to Toni Antonucci and and the entire Antonucci-Jackson family.

LIFE Outstanding Alumni Award 2020

The LIFE Steering Committee is pleased to announce the 2020 LIFE Outstanding Alumni Award competition. This annual award for LIFE alumni recognizing continued excellence in interdisciplinary developmental science post PhD was established to make use of the prize money LIFE received in connection with the APA Board of Educational Affairs Award to Advance Interdisciplinary Education and Training in Psychology. The LIFE Outstanding Alumni Award is focused specifically on the continued realization of the objectives of LIFE in the awardee's independent research career. The award winner will be invited to join the LIFE Spring Academy at the University of Michigan and to deliver an award lecture based on her/his research.

Eligibility Requirements

Applicants should have received their PhDs no earlier than three years ago and should not be more than 10 years beyond graduation. Criteria for selection will be the quality of publications, overall productivity, overall impact of research program, evidence of larger relevance of research, funding success, evidence of lifespan perspective, as well as quality, quantity, and outreach in mentoring.

Guidelines for Application

To apply please send Silke Schäfer <sschaefer@mpib-berlin.mpg.de> a PDF file containing the following materials by *September 25, 2020*:

- One-page synopsis of your relevant research program;
- Your CV;
- 2–3 representative publications;
- A statement about how your on-going research program, mentoring goals, and overall scholarship have been shaped by LIFE and continue to embody the goals of LIFE.

Those alumni who applied last year and continue to be eligible are encouraged to update their information and stay in the nomination pool.

For information on previous awardees, see https://www.imprs-life.mpg.de/en/life-program/outstanding-alumni-award

Towards More Sustainable Science and Life

Verena Sommer, LIFE alumna, Center for Lifespan Psychology, MPIB

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In the year 2100, when the current LIFE fellows' children will likely be alive, global temperatures could be as much as 4.8°C (8.6°F) above pre-industrial levels, according to the often-called "business-as-usual" scenario of the Intergovernmental Panel on Climate Change (Hausfather, 2019; IPCC, 2013). This means reaching the goal of keeping global warming at well below 2°C (3.6°F), better at 1.5°C (2.7°F)—a goal that almost all countries in the world agreed to in the Paris Agreement (United Nations Treaty Collection, 2015)—means anything but business as usual. The world has already heated up by more than 1°C (1.8°F) (IPCC, 2018a), with 2015–2019 being the warmest years in the last 140 years (NASA News, 2020; see Figure 1).

The climate crisis is not coming soon, we are already in it. The current temperature rise increases the likelihood of extreme weather conditions including strong precipitation and heatwaves, leading to higher rates of regional droughts, floods, wildfires, and stronger tropical storms (Emanuel, 2020; IPCC, 2012, 2018a; National Academies of Sciences, Engineering, and Medicine, 2016); already making Earth 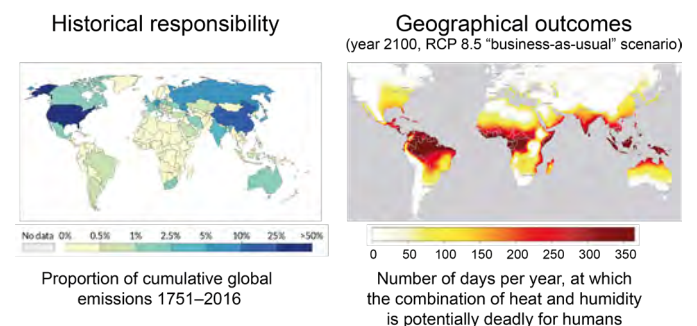a much less livable planet for many people. Sea level rise alone, which may exceed 2 m (6.6 ft) by the end of the century, will make massive amounts of land uninhabitable, forcing up to 187 million people to flee (Bamber, Oppenheimer, Kopp, Aspinall, & Cooke, 2019). The Ecological Threat Register 2020 furthermore predicts that 31 countries will be unable to adapt to the ecological crises they are facing, including food and water shortages, leading to displacement of more than one billion people by 2050 (Institute for Economics and Peace, 2020). These people mainly come from the Global South, being least responsible for the emissions causing climate change and already worse off due to (post-)colonialism, (modern) slavery, structural racism, and other forms of exploitation—and it's hard to imagine that Europe and the USA are likely to share their less affected land and wealth with these hundreds of millions of people in the future (Figure 2).

The scale of this climate catastrophe is so large and fighting it appears to be against economic and personal interests in the short term, that only political action and systematic changes can prevent it. Countries must not only agree to reaching their goal, but also act on it—the most important action is bringing greenhouse gas emission to net zero, which mainly means burning less fossil fuels.
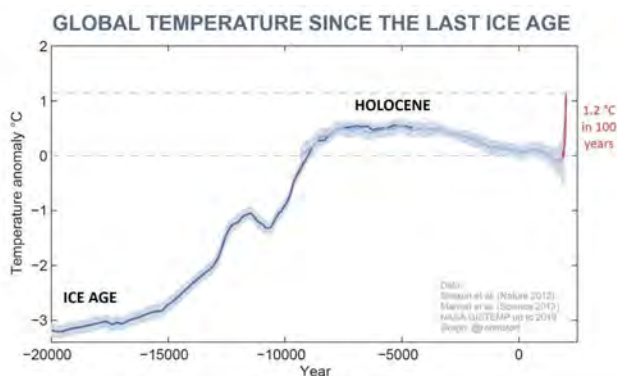
Figure 1. Stefan Rahmstorf (Potsdam Institute for Climate Impact Research): "In just 100 years, fossil fuel use has more than undone 5000 years of natural cooling. It's hotter now than any time in the history of human civilisation. We are catapulting ourselves out of the Holocene into uncharted territory. Current life on Earth is not adapted to this." https://twitter.com/rahmstorf/status/1220699044181368838?s=03
Source: *Scientists for Future,* S4F-24-Fakten_Illustriert, https://files.scientists4future.org

Climate (in)justice

Figure 2. Comparison between geography of historical responsibility and outcomes.
Source: Scientists for Future, S4F-24-Fakten_Illustriert, https://files.scientists4future.org; left: Data from the Global Carbon Project and Carbon Dioxide Information Analysis Center; right: University of Hawaii simulation (Mora et al., 2017), https://maps.esri.com/globalriskofdeadlyheat
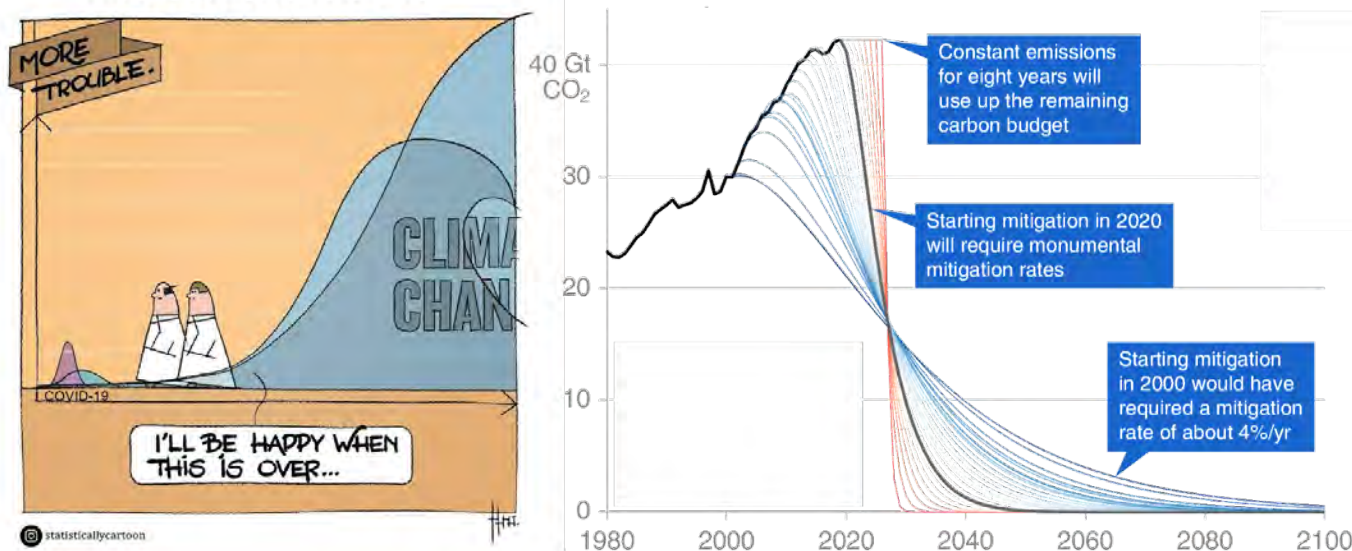
Figure 3. Left: Cartoon by "Statistically Insignificant"; right: Targets would have been easier to achieve if action had been taken earlier.

Sources: @komkomdoorn, https://www.instagram.com/statisticallycartoon; *Scientists for Future,* S4F-24-Fakten_Illustriert, https://files.scientists4future.org/

Political leaders are currently not making the decisions necessary to reach their self-defined goal, a goal that is becoming harder and more expensive to reach as the carbon dioxide (CO_2) budget to do so is shrinking (Figure 3): To stay below the 1.5°C target, the emission budget will likely be used up in 7 years (MCC, 2018). By now the required rate of mitigation is almost beyond reach without pulling CO_2 out of the air (i.e., negative emissions), the technologies for which do not exist yet (Andrew, 2019). And even if they'd be invented soon, it may well be that reaching certain tipping points will start feedback loops, leading to even steeper temperature rise, and making it impossible to return to today's temperatures, which makes the goal of 1.5–2°C so important (Schellnhuber, Rahmstorf, & Winkelmann, 2016). Currently, only two countries will reduce their emissions to be in line with limiting warming to 1.5°C (Morocco and Gambia) and only six more (all non-Western) will meet the 2°C limit of the Paris Agreement (Climate Action Tracker, 2020).

In light of such failures to act, with such devastating effects for humanity and nature (e.g., the current mass extinction; Barnosky, Matzke, Tomiya, Wogan, Swartz, Quental, Marshall, McGuire, Lindsey, Maguire, Mersey, & Ferrer, 2011), I ask myself how we as scientists or university administrators can use our position and privilege to demand the systematic changes that are needed to keep global warming's impact as small as possible. We need to take a clear stance for all the required action to reach internationally agreed goals and climate justice, and for this, we should use all the power and influence we have. Fortunately, we are not the first to do so. In addition to the protests of children and students worldwide, more and more employees at universities and research organizations are starting to demand action from their institutions, putting increasing pressure on those in power for real change: for example, those with influence on deciding where universities or institutes buy their electricity, how banks are investing the institutions' money[1], and whether solar panels can be built on their roofs, but also those who decide what food is served in canteens and at conferences, whether train rides rather than flights are encouraged and compensated, and whether carbon offsets are standard practice.

I don't think it should be up to students, scientists, or university staff to ensure the adherence to international agreements that already clearly acknowledge what needs to be done. In the same way, the "choice" for or against environmentally friendly products should not be left (exclusively) to consumers (by the way, the 'carbon footprint'

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[1] Find out how different banks are doing with respect to investments in climate-(un-)friendly industries but also the arms industry, and regarding human rights, corruption, child labor, and other aspects: https://www.fairfinanceguide.de (for Germany); see also https://fairfinanceguide.org.

is an invention by the multinational oil and gas company bp, which greatly benefits from focusing on individual lifestyle decisions rather than on "big oil's" responsibility [Kaufman, n.d.; Yoder, 2020], a fact they knowingly hid over decades of misinformation [Byskov, 2019; Hall, 2015]). However, while the political enforcement is not in the hands of the scientific community, we engage in many aspects towards raising awareness. And the commitment in the scientific community is growing enormously, with ample opportunities to become active. For example, the Max Planck Sustainability Network (https://www.nachhaltigkeitsnetzwerk.mpg.de), a grassroots organization within the Max Planck Society (MPS), which was founded last year, held its first workshop in 2019 as well as a virtual meeting in 2020. Members of more than 30 Max Planck Institutes discussed and shared ideas how to decrease their work's impact on the environment through less resource-intensive scientific and everyday practices. Their work includes providing a catalogue of recommendations for measures and best-practices for the MPS, prioritized according to their impact, feasibility, and costs. For this, five working groups have been established, concerned with energy, mobility, biodiversity & food, supplies & waste, as well as coordination & assessment. At the MPIB, you can also join several working groups aiming to improve the ecological impact of the institute (https://intra.mpib-berlin.mpg.de/en/i/committees/sustainability-at-work). You can engage in similar initiatives at FU (https://www.fu-berlin.de/en/sites/nachhaltigkeit/mitmachen), HU (https://www.nachhaltigkeitsbuero.hu-berlin.de/en), UM (http://sustainability.umich.edu/engage), UVA (https://sustainability.virginia.edu/engage), and UZH (https://www.sustainability.uzh.ch/en/tips.html).

Furthermore, in March 2019, more than 26,800 German-speaking scientists signed a statement supporting the youth protestors by declaring that their concerns are justified and backed by the best available science (Hagedorn, Loew, et al., 2019). A

Figure 4. Max Planck Sustainability Workshop, 16–17 May 2019 at MPI for Dynamics and Complex Technical Systems, Magdeburg.
Source: https://twitter.com/sustainable_mpg/status/1223256991906385923?s=20

similar international letter has been published in *Science* (Hagedorn, Kalmus, et al., 2019) and is still open for signatures (https://scientists.developers-forfuture.org/campaign-subscription). In addition, the organizers, *Scientists for Future*, provide useful information for non-experts on their website, including climate facts, recommendations, and lectures. They invite everyone to join their regional or themed working groups in many German cities as well as Austria and Switzerland, other European countries, and Canada, or to found new groups. Cognitive scientists and neuroscientists have also started to take responsibility, demanding that their fields take climate change seriously in recent articles in *Trends in Cognitive Sciences* (Aron, 2019) and *Neuron* (Aron, Ivry, Jeffery, Poldrack, Schmidt, Summerfield, & Urai, 2020) as well as in an open letter to the Society for Neuroscience (Petition to Society for Neuroscience to Act on the Climate Crisis, 2019).

In addition to making scientific results themselves more sustainable, open science practices also help to reduce research's climate impact. For example, sharing data reduces the need to collect more and more data (e.g., the emissions produced by MRI machines are immense; Kouropoulos, 2018), preprints and open access ensure that findings are shared earlier and more widely, open source software enables resource intensity to be improved collectively (e.g., training an artificial intelligence model has been estimated to emit as much CO_2 as five cars in their lifetimes; Hao, 2019).

All these ideas and initiatives and, most importantly, their implementation, give hope that real change is possible. There is no single practice that needs to be changed but the problem has to be tackled from different angles, each of which having an impact. Nevertheless, some actions have greater significance than others, and the inconvenient truth is that there is hardly any single factor having more impact than flying. Although carbon offsets do help in reaching the goal of making those who actually cause the damage pay for it (currently the costs of environmental impacts are not included in flight tickets but left to coming generations), there is no way around the simple fact that humans need to fly less. Although flying

Table 1. Metric tons of CO_2 emissions: Overview.

Annual emissions per capita in India[a]	1.9
Annual emissions per capita on Earth to meet the Paris Agreement[b]	**2.3**
Return flight Berlin – New York City[c]	3.0
Using a car for one year[d] (10,000 km / 6,213 miles)	3.1
Annual emissions per capita in Switzerland[a]	4.8
Return flight Berlin – Sydney via Qatar[c]	9.1
Annual emissions per capita in Germany[a]	9.1
Annual emissions per capita in the USA[a]	16.1

[a] In 2018; https://en.wikipedia.org/wiki/List_of_countries_by_carbon_dioxide_emissions_per_capita
[b] Assuming an emission budget of 750 billion t of CO_2 and an average world population from 2010 until 2050 of 8.2 billion people; https://www.atmosfair.de/en/green_travel/annual_climate_budget
[c] For 1 passenger in economy class; https://www.atmosfair.de/en/offset
[d] Medium-sized vehicle (8 l petrol/km); https://co2.myclimate.org/en/car_calculators/new

accounted for only 2.4% of global annual emissions from fossil fuel use in 2018 (Graver, Zhang, & Rutherford, 2019), more than 80% of people are estimated to never enter a plane in their lifetimes (Zeiss, 2019), even less fly for long distances, but air travel continues to grow rapidly (Boeing, 2014). If we truly want living standards to go up and more people to be able to live a life we do, this is incompatible with meeting the Paris Agreement. While the poorest will (rightfully) afford (to emit) more, the richest, who produced more of, and benefitted more from, previous emissions, must decrease their emissions immensely (Hagedorn, Kalmus, et al., 2019). And, unfortunately for the way we like to do science, the single biggest impact we can have on our own emissions is to fly less. Flying from Berlin to all other three LIFE sites and back (in economy class) creates 6.9 t (15,212 lb) of CO_2 emissions per passenger[2]. This is more than an average Swiss citizen emits in one year (see Table 1) and you would need to abstain from eating 115 kg (253.5 lb) of beef[3] or from driving 12,600 km (7,829 miles) with an SUV[4] to make up for these flights. In comparison, to reach the target of staying below 2°C global warming, each person on Earth has a yearly

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[2] Atmosfair, https://www.atmosfair.de
[3] Assuming 60 kg CO_2 for 1 kg beef (cf. Ritchie, 2020).
[4] Assuming 55 kg CO_2 for 100 km (with petrol; Myclimate, https://co2.myclimate.org).

budget of approximately 2.3 t of CO_2 equivalents until 2050.[5]

Scientists worldwide have realized that these numbers are simply not compatible with each other and have signed self-commitments to voluntarily agree to fly less and, for example, not to fly for distances less than 1,000 km (621 miles).[6] And this realization does not spare LIFE. For the last Fall Academy in Zurich, 13 LIFE fellows from Berlin took the night train and thus "saved" a total of more than 4.2 t of CO_2 emissions.[7] Such efforts by a graduate school at one of the most prestigious research institutions could have huge impact on other scientists' travel choices as well as on policies such as re-introducing night trains by the Deutsche Bahn (the major German railway company). This is of course only possible for institutes and universities that can afford the often more expensive train tickets (again, the true costs of flying are not included in ticket prices) and for scientists

who are prepared to invest longer travel times. In any case, institutions and politics should strongly encourage such decisions and compensate the "lost time" by, for example, increasing the number of private holidays allowed to be taken before or after conferences. Furthermore, emissions should be compensated by default. Importantly, such carbon offsets should not be understood as "indulgences," ransoming us from all responsibility, but as efforts *in addition* to the efforts to reduce flying overall. The emissions we produce are part of the price for the great privilege to do science, to build invaluable international communities, to network, to exchange ideas, and to have fun together. Right now, we are not paying for this, but we are leaving the costs to our children and grandchildren as well as poorer parts of the world. In the last few months that were dominated by the COVID-19 pandemic, we learned that virtual meetings and conferences are possible. Of course, it is not the same as see-

Figure 5. Scientists from MPIB at the Global Climate Strike, 20 September 2019, in Berlin. Note that the next Global Climate Strike (depending on COVID-19 circumstances) will be on 25 September 2020.
Source: https://twitter.com/TheCharleyWu/status/1175030294472269824?s=20

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[5] Assuming a budget of 750 billion t of CO_2 and an average world population of 8.2 billion people from 2010 until 2050 (Atmosfair, https://www.atmosfair.de/en/green_travel/annual_climate_budget).
[6] https://unter1000.scientists4future.org; FU: https://ssl2.cms.fu-berlin.de/fu-berlin/sites/nachhaltigkeit/handlungs-felder/campus/mobilitaet/PM_selbstverpflichtung; HU: https://www.projekte.hu-berlin.de/en/selbstverpflichtung; UZH: https://www.sustainability.uzh.ch/en/tips.html
[7] Assuming 4,292 kg CO_2 for 13 economy flight passengers (https://www.atmosfair.de/en/offset) minus 13 kg CO_2 for 13 train passengers (according to Deutsche Bahn and assuming a train ride of 1,000 km; however, emissions for night trains may differ; https://gruen. deutschebahn.com/en/measures/environmental-mobility-check).

ing each other in-person and we miss out on many great aspects of our usual academic lives. But maybe it opens up the possibility for the future to participate in fewer conferences in person and to attend more virtual events, saving time as well as resources.

This article is not supposed to be about criticizing individual decisions or about personal or collective shaming. Yes, perhaps doing science and finding out about the "truth" do justify our emitting more than an average citizen. Scientists' contributions to understanding nature, society, or human behavior, characterizing the problems of our times, and finding solutions for them, are in principle unrelated to scientists' individual lives and decisions (everything else would be argumentum ad hominem). But who should be leading examples if not scientists? Who is able to convince the public and policy makers of the great dangers associated with further warming and the urgency of collective action if not those who understand the scientific principles behind these models? Who can show others that a different way of living and working is possible if not the most educated, privileged, rich, and powerful? This includes of course political and economic leaders, but it also includes scientists. If we, as part of the MPS and influential European and US-American universities, actually take responsibility and show that change and more environmentally friendly science is possible, we can be role models. No one ever wants to be the first, but others will likely follow, not least because sustainability is a "hot topic" and good for everyone's image. Change is coming, that is for sure, but we may be able to influence its direction if we dismiss "business as usual."

Perhaps I'm way too idealistic and it's too optimistic to think we can make a difference. Perhaps the goal of 1.5°C warming is already unreachable. But the consequences of warming multiply as the temperature rises, and every prevented decimal point can make a big difference. According to the IPCC, it is the next few years that count and those are probably the most important in our history (IPCC, 2018b; Watts, 2018) determining Earth's climate for the next 10,000 years (Clark et al., 2016). And soon, the results of our responses to the climate crisis will be visible and we will be made accountable by those who will be the ones to suffer and pay for our (in)actions. This will be the generation of children and grandchildren of today's LIFE fellows.

Don't we want to be able to tell them we tried everything we could?

Take-home messages

Let's
- educate ourselves and talk about climate change and climate (in)justice,
- use our position (especially as faculty) to demand and enable action by political and other leaders against further climate warming and for climate justice,
- be role models by reducing our own and our work's emissions, perhaps most importantly by flying less, and encourage others to do the same,
- not underestimate our influence!

Recommended further information

- *The Future of Our Climate.* Talk by Johan Rockström (Potsdam Institute for Climate Impact Research) at Fritz Session of the Fritz Haber Institute, Berlin, in August 2019. In-depth overview of the latest climate science:
  https://www.youtube.com/watch?v=JCMqUNWak5U
- The most important climate facts, summarized by Scientists for Future in 2019:
  https://www.scientists4future.org/stellungnahme/facts-2019-03
- Two articles on the deep connection between racism and climate change, and the importance of climate justice:
  https://www.opendemocracy.net/en/why-dont-we-take-climate-change-seriously-racism-is-the-answer and
  https://e360.yale.edu/features/unequal-impact-the-deep-links-between-inequality-and-climate-change
- WWF (2020). *Living Planet Report 2020: Bending the curve of biodiversity loss.* Report on the serious loss of biodiversity caused by climate change among other threats:
  https://f.hubspotusercontent20.net/hubfs/4783129/LPR/PDFs/ENGLISH-FULL.pdf
- *Drilled.* Podcast by Amy Westervelt investigating the propaganda campaign of the century —the creation of climate denial:
  https://www.criticalfrequency.org/drilled

- *EN-Roads*. Climate scenario simulations: https://en-roads.climateinteractive.org/scenario.html?v=2.7.29

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Identifying mediators of the association between testosterone and relationship quality

Kristi Chin, UM
Advisor: Robin Edelstein

Testosterone is a steroid hormone that is important for close relationship processes (Edelstein & Chin, 2018). For instance, people who have lower testosterone generally report higher relationship quality; these associations also extend to partners, such that people also report higher relationship quality when their partners have lower testosterone (Edelstein, van Anders, Chopik, Goldey, & Wardecker, 2014). The mechanisms underlying these associations remain largely unknown; however, testosterone is thought to decrease in social contexts that involve nurturant intimacy and caregiving (van Anders, Goldey, & Kuo, 2011; Wingfield, Hegner, Dufty, & Ball, 1990). The proposed study will redress this gap in the literature by examining experiences of nurturance, care, and overall investment in one's relationship as potential mechanisms underlying links between testosterone and relationship quality. We will analyze data from a sample of 478 couples drawn from three studies that include measures of testosterone, self-reported relationship quality, and partner interactions. We expect that testosterone will be negatively related to one's own and one's partner's relationship quality. We also expect that higher responsiveness and more supportive behavior during the partner interactions will contribute to (i.e., mediate) negative associations between testosterone and relationship quality for both couple members. Findings from the proposed study will contribute important new information about the mechanisms that contribute to relationship–hormone links. We also advance previous work by replicating extant findings in larger samples and by examining one research question across multiple samples of couples.

A novel method for quantifying transitions within multivariate binary time series data

Katharine E. Daniel, UVA
Co-Authors: Robert G. Moulder, Steven M. Boker, & Bethany A. Teachman

I will present a novel method for quantifying transitions within multivariate binary timeseries data to derive metrics of stability and spread. Stability is the proportion of observations along the trace of a transition matrix relative to all observed elements within that matrix. Spread is the proportion of all non-zero elements in a transition matrix relative to all possible elements in that matrix. To demonstrate this method in real data, I calculated a series of stability and spread metrics for $N = 110$ high socially anxious people across four weeks of ecological momentary assessment data. This application allowed us to test whether the manner in which people switch between 19 different emotion regulation strategies (or report no use of emotion regulation) predicts their next timepoint self-reports of in-the-moment affect and anxiety. Results show that stability and spread in short-term emotion regulation behaviors are unique constructs that each predict next timepoint affect and anxiety, even after accounting for autoregressive and cross-lagged effects of affect and anxiety. Results suggest that greater instability in short-term emotion regulation behavior at one timepoint is associated with greater anxiety and negative affect at the next timepoint. Meanwhile, greater spread in short-term emotion regulation behavior at one timepoint is associated with lower negative affect, but greater anxiety, at the next timepoint. This method shows promise as a meaningful way to quantify two unique aspects of switching behavior in multivariate binary time series data.

Cultural differences in normative cognition during childhood

Natascha Helbling, UZH
Advisors: Moritz M. Daum, Urs Maurer

Social norms play a significant role in everyday life because these informal regulations structure interactions between people and provide important guidelines for living in a society. In the wake of globalization, more and more people with diverse cultural backgrounds live closely together. People with different cultural backgrounds adhere to various norms that may conflict with each other. For this reason, it is essential to understand the social norms that people with different cultural backgrounds live by. This project will investigate whether there are cultural differences in normative cognitions during childhood. Specifically, it will examine the norm distribution across different cultures, children's acceptance of culture-specific and cross-cultural norms as well as their reactions to norm violations. Currently, we are assessing cultural norms from different countries in Europe as well as Asia with questionnaires. In a second step, these norms will be used in a norm acceptance task with 4- to 8-year-old mono- and bicultural children. In this task, they will be presented with a protagonist having two different action options (norm-compliant or norm-violating). Children will be asked about the options, and their reaction to the protagonist's choice will be assessed.

Changes in hippocampal volume and cognitive performance after moderate at-home aerobic exercise

Sarah Polk, MPIB
Advisors: Sandra Düzel, Ulman Lindenberger

Many aspects of brain structure and cognitive functioning decline in healthy aging, but physical exercise has been shown to promote maintenance and gains in both domains. We conducted a six-month intervention study to (i) investigate effects of at-home exercise on hippocampal subfield volume and cognitive performance; (ii) explore biological substrates that might mediate these effects, including insulin-like growth factor-1 (IGF-1).
Seventy-five healthy older adults (63–76 years) completed the intervention in either an exercise group (EG; ergometer training) or active control group (ACG; reading). MRI and cognitive measures were acquired pre-, mid-, and post-intervention, and physiological measures were acquired pre- and post-intervention. Change–change associations between variables showing mean difference in change between groups were investigated using structural equation modeling (SEM), examining whether fitness and growth or neurotrophic factor changes were associated with hippocampal and cognition changes.
Significant group-by-time interactions indicated increased fitness in the EG and not the ACG. Fitness changes were positively associated with subiculum volume. Changes in the subiculum and dentate gyrus were positively associated with Digit Symbol Substitution performance change (group-by-time $p < .05$, uncorrected), which indexes perceptual speed and associative learning. We are currently examining whether changes in latent perceptual speed, episodic memory, and working memory show similar associations to volume change. IGF-1 reactivity to acute exercise was associated with changes in the subiculum and dentate gyrus.
Moderate at-home aerobic exercise can induce changes in cardiovascular fitness, hippocampal subfield volume, and a marker of perceptual speed and associative learning. Greater IGF-1 reactivity at baseline is associated with greater hippocampus volume increase.

Aging-related decline in cognitive flexibility: Does the thalamus contribute?

Alexander Skowron, MPIB
Advisor: Douglas D. Garrett

Cognitive aging has been associated with declines in various executive functions. These changes have often been attributed to altered functioning in higher-order prefrontal cortical areas. However, some work suggests that these prefrontal computations are critically supported by bidirectional fronto-thalamic connections. For example, recent studies in rodents demonstrated that the mediodorsal thalamus stabilizes prefrontal working memory representations and suppresses context-irrelevant representations in attentional control tasks. I will present initial ideas for a dynamic state inference task designed to isolate computations proposed to be supported by the thalamus. I will discuss potential age-related differences in behavioral and neural patterns on this task that could hint at changes

in thalamic functioning across the adult lifespan. Finally, I want to discuss the role of the dopaminergic neurotransmitter system, which has often been linked to age-related changes in cognitive flexibility.

Co-development of internalizing and externalizing behaviors and adolescent substance use: Leveraging data from multiple reporters

Sean Womack, UVA
Advisor: Melvin Wilson

Background: There is considerable variability in developmental trajectories of internalizing (Davis et al., 2015) and externalizing (Bongers et al., 2004) behaviors across childhood. While both internalizing and externalizing behaviors are thought to contribute to the initiation of substance use in adolescence (Hussong et al., 2011), previous research is equivocal about the role of internalizing symptoms in the development of substance use behaviors (Colder et al., 2013; Womack et al., 2016). As there tends to be poor reliability in assessing internalizing symptoms across reporters, failure to find associations between internalizing behaviors and substance use after accounting for externalizing behaviors may be due to an overreliance on single-reporters. The present study seeks to fill this gap by leveraging latent variables to aggregate information on internalizing and externalizing behaviors across primary caregiver, alternate caregiver, and teacher reports.

Methods: Participants were 568 families recruited as a part of the Early Steps Multisite Study, who completed at least one assessment between target child age 7.5 and 14. Internalizing and externalizing behaviors were assessed based on primary caregiver, alternate caregiver, and teacher reports at child ages 7.5, 8.5, 9.5, 10.5, and 14. At the age 16 assessment, target youth reported on the frequency and quantity of their nicotine, alcohol, and marijuana use.

Results: The best fitting growth mixture model was a six-group solution. Youth who displayed moderate levels of externalizing behaviors and low internalizing behaviors were most likely to endorse having ever tried alcohol, and marijuana. Additionally, youth displaying moderate level of externalizing behaviors and low internalizing behaviors reported consuming alcohol more frequently and consuming a greater amount of alcohol at each drinking occasion. Youth displaying high levels of externalizing behaviors and low levels of internalizing behaviors reported the most frequent marijuana use.

Conclusions: Moderate externalizing behaviors in the context of low internalizing behaviors was a risk factor for alcohol use, while high externalizing behaviors in the context of low internalizing behaviors was a risk factor for more frequent marijuana use. Congruent with extant research, internalizing behaviors appear to be a protective factor against substance use in adolescence.

All coral reefs will be dead by 2100 if warming continues as before. http://whc.unesco.org/en/news/1676

Source for both photos: Pixabay

Global warming to turn Mediterranean into desert by the end of the century. https://www.nature.com/news/climate-change-could-flip-mediterranean-lands-to-desert-1.20894
https://www.independent.co.uk/news/world/europe/global-warming-turning-europe-desert-2100-mediterranean-spain-portugal-italy-sicily-turkey-syria-fossil-fuels-a7383931.html

10 Questions

Myriam C. Sander, Minerva Research Group Leader, Center for Lifespan Psychology, Max Planck Institute for Human Development, Berlin

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How did you get involved in the study of memory?

Originally, I was (and actually still am) very much interested in how we perceive information from our environment and how this is linked to cognition, and in particular, memory. This interest was sparked long ago by a lecture by Ulman Lindenberger during my undergraduate studies at Saarland University. He was talking with great enthusiasm about one of his then quite recent studies with Paul Baltes on the effects of perceptual degradation on cognition. I was fascinated by that study, in which young participants wore goggles and headphones limiting sensory perception in order to simulate visual and auditory decline in older age (Lindenberger et al., 2001). Until then, I hadn't thought about how losing the ease of perception during aging might actually have detrimental effects on cognition. Combining this interest in perception with my interest for the aging brain, I chose to investigate how stimulus properties like its color or size affect neural activity in younger and older adults in my diploma thesis. Yet, neural correlates of stimulus size are still quite a far cry from cognition. This is why it was clear to me that I wanted to continue this line of research as a PhD. To me, undoubtedly, working memory, which is closest to perception, was the natural choice as my primary research topic. I have since delved even deeper into the memory domain and am currently studying long-term memory. Still, I have kept a focus on how information representation contributes to age differences in memory performance.

Could you name books or articles that have profoundly influenced your own thinking about memory across the lifespan?

As I just said, the study by Lindenberger et al. (2001) was the pivotal study in my career, which motivated me to start thinking about aging and cognition, and I was of course very much influenced by the general agenda of the Center for Lifespan Psychology (LIP) at MPIB, that has been seeking to identify the key players in brain–behavior dynamics across the lifespan (as, e.g., delineated in Lindenberger et al., 2006).

Other than that, a book I like a lot is "*Science of Memory: Concepts*" (edited by Roediger et al., 2007), which is a collection of short papers by various brilliant memory researchers defining the core concepts of memory as each of them sees it. It is a great overview that illustrates the breadth and variety of views on the very same concept and makes you reflect on your own definitions.

What do you consider the "hot topics" within the field?

In my view, one long-standing question of MPIB researchers (e.g., Li et al., 2001), is currently becoming a hot topic again, namely whether neural dedifferentiation underlies age-related cognitive decline—and I think several other LIFE faculty members share my interest in this question, e.g., Thad Polk (UM) or Nicolas Schuck (MPIB). I can highly recommend a recent *TiCs* paper by Koen and Rugg (2019) that gives a great overview on the current state of knowledge. A related hot topic is the tension between pattern separation and pattern completion in memory systems, and lifespan age differences in the interplay of these component processes of memory. For a great review, see the *TiCs* paper by our colleagues Keresztes et al. (2018).

What research topics have been neglected or have not received enough attention so far?

In my view, the cognitive neuroscience of aging, despite being introduced as a branch of research almost two decades ago (see, e.g., the book "*Cognitive Neuroscience of Aging*", Cabeza et al., 2005), does still not receive the attention of the general audience of cognitive neuroscientists that it should. I am often surprised by the general disinterest in neural changes across the lifespan. How can we presume to understand neural mechanisms if these are studied only in a very specific group of the population, such as young students? Also, real lifespan approaches are still extremely rare in cognitive neuroscience, with a clear division of labor between developmental and aging

researchers, which is a pity. This is certainly not only due to differences in interest, but also to the immense challenges of conducting studies with different age groups. However, lifespan approaches in cognitive neuroscience could lead us to a more comprehensive view on memory and cognition in general.

You are focusing on the lifespan changes in memory representations. Can you tell us more about this topic?

In cognitive neuroscience, the term "neural representation" refers to the relation between features of the environment and neural activity in response to these features. We and others think that what happens during aging is that the neural activity less reliably reflects these features. In our research we find evidence for this idea: For example, we find that in older adults the neural representations of different stimuli are less distinct than in younger adults, and neural representations of identical stimuli that should always evoke a highly similar neural representation are less similar (e.g., Sommer et al., 2019). Importantly, the reliability of this relation between stimulus features and neural activity seems to be highly relevant for memory performance. Participants with lower distinctiveness and stability of neural representations also show worse memory performance. Although this seems to hold independent of age, older adults clearly more often belong to that group of participants. We therefore think that determining age-related changes in representational properties is key to understanding memory decline in aging. We address this and related questions in empirical studies that bring together questions, methods, and models from lifespan psychology, cognitive neuroscience, and computational neuroscience.

How can your research be applied to everyday life?

Understanding which factors influence successful memory retrieval will help us to create conditions that facilitate learning. For example, we know that we can increase the quality or precision of memories during encoding by asking people to repeatedly encode information or by providing them with strategies. Across studies, we have recently shown that in contrast, when encoding processes are impaired, the formed memories of lower quality pose a large burden on consolidation processes as well as on moni-toring and control processes during retrieval, particularly placing older adults in double jeopardy. Thus, ensuring that information is encoded in the best possible way, i.e., by creating appropriate learning conditions, may alleviate memory problems even in face of declining consolidation and retrieval processes.

What are you currently working on?

I am currently working on several projects that aim to understand how the distinctiveness and stability of neural representations contribute to age differences in memory performance, and how learning alters representational properties. For example, contextual information is crucial for episodic memory, but older adults seem to have difficulties in forming and retrieving item–context associations. Using brain imaging techniques such as EEG and fMRI we are currently trying to ascertain the changes in representations that occur due to learning of context associations using pattern similarity on fMRI data, and we also try to capture the binding process itself by looking at oscillatory activity during learning. We thereby hope to derive a comprehensive understanding of how contextual information is processed and integrated with item information in later adulthood.

What do you like most about being a Minerva Research Group Leader?

I very much like the opportunity to be able to follow my own ideas and to work on them with lots of bright and likeable people. It is simply great to have colleagues that share your enthusiasm for a research program. Of course, the MPIB is a great environment for our research, providing facilities of any kind one could wish for. I continue to be impressed by the development of each doctoral student across the course of their dissertation, and very much enjoy being a mentor for them and learning new things together every day.

What do you get out of LIFE?

I like the fact that ideas, born within small research groups, can be exposed to a large, diverse community of people with different foci and backgrounds in a friendly and constructive atmosphere. Sometimes, it may be challenging to appeal to such a broad audience with specific and narrow research questions, but it offers a rare opportunity to see your research from a different perspective.

What is the added value of LIFE's internationality?

In my view, the internationality of LIFE makes you aware that we as researchers are part of a large, and diverse worldwide community. I felt that this spirit was very much present over the last months, thanks to the attendance of the virtual "LIFE Theory Lab" by LIFE fellows and faculty from all four sites, despite different time zones. Even though we are spread across different continents, we were nevertheless united—driven by the same aim, namely to understand lifespan development in all its facets.

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Hurricanes are already getting stronger. https://www.pnas.org/content/117/24/13194

Heat waves and drought in Brandenburg, Germany, led to big crop failures in 2018 and 2019. https://www.deutschlandfunkkultur.de/duerre-in-brandenburg-noch-schlimmer-als-letztes-jahr.1001.de.html?dram:article_id=459517

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New LIFE Faculty in Zurich

Nora Maria Raschle is an Assistant Professor of Psychology of Childhood and Adolescence at the Jacobs Center for Productive Youth Development at UZH. Her background is in developmental cognitive and affective neuroscience. Nora Raschle conducted her doctoral studies at the Laboratories of Cognitive Neuroscience and Children's Hospital in Boston. In 2011, she defended her PhD thesis which investigated early neural and behavioral correlates of developmental dyslexia at UZH. Nora Raschle continued as a postdoctoral researcher at Children's Hospital and Harvard Medical School in Boston until 2013, when she moved to Switzerland to work as a senior research scientist and neuroimaging group leader at the Department of Child and Adolescent Psychiatry of the Psychiatric University Hospital Basel and University of Basel in Switzerland. In 2019 she joined the Jacobs Center for Productive Youth Development at UZH as a principal investigator of the Developmental Neuroscience Unit. Her work to date has focused on the investigation of typical and atypical brain development, with a particular focus on the early detection and characterization of developmental and mental health disorders through the use of structural and functional neuroimaging.

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Key publications

Klapwijk, E., van den Bos, W., Tamnes, C. K., Raschle, N. M., & Mills, K. L. (2020). Opportunities for increased reproducibility and replicability of developmental cognitive neuroscience. *PsyArXiv*. https://doi.org/10.31234/osf.io/fxjzt

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The probability of wildfires is increasing with global warming (IPPC, 2012).
https://www.ipcc.ch/report/managing-the-risks-of-extreme-events-and-disasters-to-advance-climate-change-adaptation

Source: Pixabay

New LIFE Fellows in Ann Arbor and Zurich

Esra Ascigil. I am a doctoral candidate in Personality and Social Contexts Psychology at UM, and I work with Robin Edelstein and Amie Gordon. I am broadly interested in studying romantic relationships within stressful contexts. My primary research aim is to understand how people can have better relationship quality, health, and well-being throughout stressful experiences. In one line of research, I examine how relationship dynamics change during stressful times (e.g., changes in division of labor during the transition to parenthood and the shelter-in-place order), and how these changes may impact relationship quality and well-being. In a second line of research, I try to understand which couples have better relationship quality, health, and well-being by examining personality and support provision. I am a Fulbright Scholar representing Turkey as part of their 2016/17 cohort.

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Sofia Carrera. I am a PhD candidate in Biopsychology at UM working with Jacinta Beehner. I am interested in how the early-life environment impacts individual health and development from infancy through adulthood. I currently conduct research in a population of wild non-human primates (geladas), prospectively measuring maternal hormone levels during pregnancy and lactation, observing maternal behavior, and quantifying various aspects of offspring development. Although my dissertation does not focus on human subjects, my interests are driven by a desire to understand human development, specifically the evolutionary explanations for ontogenetic changes in humans. As close relatives of humans, geladas provide an opportunity to longitudinally and intensively study offspring developmental plasticity in response to cues of early-life adversity. My dissertation research is supported by the NSF and Leakey Foundation.

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Plamina Dimanova. I am a doctoral student in Nora M. Raschle's team at the Developmental Neuroscience Lab at the Jacobs Center for Productive Youth Development at UZH. I obtained my Bachelor's degree in Chemistry at Goethe University in Frankfurt. In 2019, I graduated as Master of Science in Translational Neuroscience, a joint program of Heinrich-Heine University in Düsseldorf and Research Center Jülich. During my Master's studies, I was involved in different projects employing neuroimaging methods to investigate embodied cognition, working memory, decision making, emotion recognition, incentive processing, and reinforcement learning. For my graduate studies, I seek to embrace the challenges in conducting research particularly with children and in this way to foster valuable scientific progress in the research area of developmental neuroimaging. My projects will throw the spotlight on the intergenerational transfer effects of socioemotional and cognitive brain development. In particular, I will tackle questions on brain similarity, in terms of structure and function, between children and their parents and how this changes over the course of their developmental trajectories. I am also involved in a meta-analysis study examining the effect of neural synchrony between children and their caregivers as a predictor of learning and cognitive outcomes.

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Hyesue Jang. I am a doctoral candidate in the Cognition and Cognitive Neuroscience area of the Psychology Department at UM under the supervision of Cindy Lustig and Richard Lewis. I am interested in understanding cognitive aging as adaptive changes in computations needed to perform a task in response to the psychological and neurological changes accompanied by aging. My current research investigates how performance incentives affect cognition and motivation, and

how those effects differ for young and older adults.

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Dalia Khammash. I joined the Cognition and Cognitive Neuroscience area as a PhD student in 2017 and am working under the supervision of Thad Polk. I received my Bachelor of Science from UM in Biopsychology, Cognition, and Neuroscience in 2016. In my research I use a noninvasive neurostimulation technique called transcranial magnetic stimulation to probe inhibitory function in the motor and visual areas of the brain. I am interested in understanding how inhibitory function changes with age, and how these measures relate to both behavior and an in vivo spectroscopy measure of GABA concentration.

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India could become uninhabitable in the course of this century. https://theswaddle.com/study-india-could-become-uninhabitable-in-50-years-if-greenhouse-emissions-continue/

Source: Pixabay

LIFE-Related Publications

Allen, J. P., Loeb, E. L., **Kansky, J.**, & Davis, A. A. (2020). Beyond susceptibility: Openness to peer influence is predicted by adaptive social relationships. *International Journal of Behavioral Development*. Advance online publication. https://doi.org/10.1177/0165025420922616

Ascigil, E., Wardecker, B. M., **Chopik, W. J.**, **Edelstein, R. S.** (in press). Division of baby care in heterosexual and lesbian couples: Expectations versus reality. *Journal of Marriage and Family*.

Ascigil, E., Selcuk, E., Gunaydin, G., & Ong, A. (2020). Integrating models of marital functioning to understand the mental health consequences of the Great Recession. *Journal of Social and Personal Relationships, 37*(7), 2118–2135. https://doi.org/10.1177/0265407520918938

Beeler-Duden, S. G., **Yucel, M.**, & **Vaish, A.** (2020). The role of affect in feelings of obligation [Commentary]. *Brain and Behavioral Sciences, 43,* Article e60. https://doi.org/10.1017/S0140525X19002449

Beltz, A. M., **Kelly, D. P.**, & Berenbaum, S. A. (2020). Sex differences in brain and behavioral development. In H. Tager-Flusberg (Ed.), *Comprehensive developmental neuroscience: Vol. 3. Neural circuit development and function in the healthy and diseased brain* (2nd ed., pp. 585–638). Elsevier. https://doi.org/10.1016/B978-0-12-814411-4.00027-5

Böger, A., & **Huxhold, O.** (2020). The changing relationship between partnership status and loneliness: Effects related to aging and historical time. *Journals of Gerontology: Series B, 75*(7), 1423–1432. https://doi.org/10.1093/geronb/gby153

Boker, S. M., **Moulder, R. G.**, & Sjobeck, G. R. (2020). Constrained fourth order latent differential equation reduces parameter estimation bias for damped linear oscillator models. *Structural Equation Modeling, 27*(2), 202–218. https://doi.org/10.1080/10705511.2019.1641816

Butler, O., Herr, K., Willmund, G., Gallinat, J., **Kühn, S.**, & Zimmermann, P. (2020). Trauma, treatment and Tetris: Video gaming increases hippocam-

pal volume in combat-related post-traumatic stress disorder. *Journal of Psychiatry and Neuroscience, 45*(4), 279–287. https://doi.org/10.1503/jpn.190027

Cardini, B. B., & **Freund, A. M.** (2020). More or less energy with age? A motivational life-span perspective on subjective energy, exhaustion, and opportunity costs. *Psychology and Aging, 35*(3), 369–384. https://doi.org/10.1037/pag0000445

Cardini, B. B., & **Freund, A. M.** (2020). Recovery from accumulated strain: The role of daily mood and opportunity costs during a vacation. *Psychology & Health.* Advance online publication. https://doi.org/10.1080/08870446.2020.1809661

Carrera, S. C., Sen, S., Heistermann, M., Lu, A., & Beehner, J. C. (2020). Low rank and primiparity increase fecal glucocorticoid metabolites across gestation in wild geladas. *General and Comparative Endocrinology, 293,* Article 113494. https://doi.org/10.1016/j.ygcen.2020.113494

Chin, K., **Chopik, W. J.**, Wardecker, B. M., LaBelle, O. P., Moors, A. C., & **Edelstein, R. S.** (2020). Longitudinal associations between prenatal testosterone and postpartum outcomes in a sample of first-time expectant lesbian couples. *Hormones and Behavior, 125,* Article 104810. https://doi.org/10.1016/j.yhbeh.2020.104810

Chopik, W. J., Oh, J., Kim, E. S., Schwaba, T., **Krämer, M. D.**, **Richter, D.**, & **Smith, J.** (2020). Changes in optimism and pessimism in response to life events: Evidence from three large panel studies. *Journal of Research in Personality, 88,* Article 103985. https://doi.org/10.1016/j.jrp.2020.103985

Daniel, K. E., Daros, A. R., **Beltzer, M. L.**, Boukhechba, M., Barnes, L. E., & **Teachman, B. A.** (2020). How anxious are you right now? Using ecological momentary assessment to evaluate the effects of cognitive bias modification for social threat interpretations. *Cognitive Therapy and Research, 44,* 538–556. https://doi.org/10.1007/s10608-020-10088-2

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Dickinson, D., Zaidman, S. R., **Giangrande, E. J.**, Eisenberg, D. P., Gregory, M. D., & Berman, K. F. (2020). Distinct polygenic score profiles in schizophrenia subgroups exhibiting different trajectories of cognitive development. *American Journal of Psychiatry, 177*(4), 298–307. https://doi.org/10.1176/appi.ajp.2019.19050527

Dotterer, H. L., **Hyde, L. W.**, Shaw, D. S., Rodgers, E. L., Forbes, E. E., & **Beltz, A. M.** (2020). Connections that characterize callousness: Affective features of psychopathy are associated with personalized patterns of resting-state network connectivity. *NeuroImage: Clinical, 28,* Article 102402. https://doi.org/10.1016/j.nicl.2020.102402

Dotterer, H. L., Waller, R., Hein, T. C., Pardon, A., Mitchell, C., Lopez-Duran, N., **Monk, C. S.**, & **Hyde, L. W.** (2020). Clarifying the link between amygdala functioning during emotion processing and antisocial behaviors versus callous-unemotional traits within a population-based community sample. *Clinical Psychological Science, 8*(5), 918–935. https://doi.org/10.1177/2167702620922829

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Frank, C. C., Iordan, A. I., Ballouz, T. L., Mikels, J. A., & **Reuter-Lorenz, P. A.** (2020). Affective forecasting: A selective relationship with working memory for emotion. *Journal of Experimental Psychology: General.* Advance online publication. https://doi.org/10.1037/xge0000780

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Source: Pixabay

Beef and dairy are among the least climate-friendly food products. https://ourworldindata.org/food-choice-vs-eating-local
Meat production produces less than one fifth of the calories used worldwide on more than four fifths of the agricultural area. More than one third of the global grain harvest is used currently as animal feed. https://www.scientists4future.org/stellungnahme/facts-2019-03

LIFE News

- The *Spring Academy 2020* took place online at UVA on May 27 (see pp. 22ff. for fellows' abstracts).
- The virtual *Fall Academy 2020* is in planning in Berlin and will take place on October 8 and 9, 2020.

Exchanges

- All exchange activities are currently on hold due to COVID-19. We hope they can be resumed in the not-too-distant future.

LIFE Berlin

- LIFE Speaker *Ulman Lindenberger* was elected as the new Vice President of the Human Sciences Section of the Max Planck Society. He will advise President Martin Stratmann and prepare important decisions for the Society.
- FU alumna *Elisa Oppermann* has taken up a research scientist position at the University of Bamberg and is working on various projects with Yvonne Anders. One is on the effects of the COVID-19 measures on families with small children who could not attend their childcare facilities.
- DIW alumna *Julia Rohrer* has received the 2019 Tanaka Dissertation Award of the Association for Research in Personality (ARP). From October, she will be "Akademische Assistentin" (comparable to a lecturer) in Personality Psychology and Psychological Assessment at the Department of Psychology, Universität Leipzig, Germany.
- MPIB fellow *Verena Sommer* submitted her dissertation entitled "The Fidelity of Neural Representations Shapes Episodic Memory Across the Human Lifespan" to the FU in June.
- LIFE Berlin organized the LIFE Theory Lab that took place in June and July. Most talks are available on the MPIB's LIFE channel on YouTube (cf. pp. 10f.).
- Next semester's LIFE seminar "Education Across the Lifespan" is being organized by faculty Martin Brunner (Universität Potsdam) and will be held online from October.

LIFE Michigan

- *Esra Ascigil*, *Sofia Carrera*, *Hyesue Jang*, & *Dalia Khammash* have joined LIFE Michigan as new fellows (for more information, see pp. 29f.).
- Faculty *Toni Antonucci* gave the Distinguished Lecture at the 2020 NIH Matilda White Riley Behavioral and Social Sciences Honors event in June.
- Fellow *Esra Ascigil* has received the Evolution and Human Adaptation Program Research Award and an Hough Summer Research Fellowship.
- Fellow *Lilian Cabrera-Haro* has received the Department of Psychology's Outstanding Graduate Student Instructor Award for her excellent teaching.
- Fellow *Sofia Carrera* has been awarded an NSF DDRIG Biological Anthropology Research Grant.
- Fellow *Todd Chan* has successfully defended his dissertation entitled "Modesty or Secrecy? The Costs of Being Modest in Close Relationships." He is now working as a quantitative researcher for Facebook.
- Fellow *Kristi Chin* has received an Honorable Mention for the Psychology Student Diversity Research Award.
- Fellow *Hyesue Jang* has been awarded a Clyde Hamilton Coombs Scholarship in Mathematical Psychology.
- Fellow *Dominic Kelly* received the Nan Donald Award based on his research into the ways that "gender-related individual differences in emotion and personality are reflected in social media and messaging." It encourages continuing interdisciplinary study in Psychology and Sociology.
- Fellow *Dalia Khammash* has received UM's Pillsbury Graduate Research Award.
- Fellow *Zarina Kraal* has won the Graduate Research Award from the American Psychological Association Division 20 (Adult Development and Aging Division) based on her symposium paper titled "Childhood adversity associations with later-life cognition via education and physical health."

- Fellow *Poortata Lalwani* has received a NIH Transition to Aging Research for Predoctoral Students Award, the Barbara Perry Roberson Award, a Rackham Graduate Research Grant, and an Honorable Mention for Psychology Student Diversity Service Award.

- Faculty *Priti Shah* has received the Rackham's Master's Mentoring Award. It honors mentors who demonstrate commitment to fostering the intellectual, creative, and professional growth of their master's students.

- Faculty *Jacqui Smith* has received the APA Baltes Distinguished Research Achievement Award, Division 20's most prestigious award. It was established to honor researchers with distinguished careers that have made exceptional theoretical and empirical contributions to the psychological science of aging.

LIFE Virginia

- Fellow *Katie Daniel* was made a John S. Lillard Jefferson Fellow by the UVA Jefferson Scholars Foundation, she was elected as Student Representative to the Council of University Directors of Clinical Psychology (CUDCP) Board, and became Instructor of Record for "The Art & Science of Persuasive Statistics" course for UVA undergraduates.

- Fellow *Sierra Eisen* has successfully defended her dissertation entitled "The Role of Play and Adult Guidance in Children's Spatial Development." She started a postdoc at the Department of Psychology, Wesleyan University in Connecticut, in July and is working with Anna Shusterman and Hilary Barth to study children's learning from mathematical games and social interactions.

- Fellow *Jesse Grabman* was awarded the UVA's Jefferson Scholars' Fellowship.

- Fellow *Jessica Kansky* defended her dissertation entitled "Romantic Relationship Predictors of Adolescent and Adult Mental Health" in May and started her predoctoral clinical internship at the Charleston Consortium (Medical University of South Carolina and Ralph H Johnson VA Medical Center) focusing on couples therapy and adult psychopathology.

- Fellow *Caroline Kelsey* has successfully defended her dissertation entitled "Exploring the Gut–Brain Axis in Infancy." She has recently started a postdoc at Boston Children's Hospital/Harvard Medical School with Charles Nelson III.

- Fellow *Robert Moulder* has successfully defended his dissertation entitled "Latent Multivariate Maximal Lyapunov Exponents."

- Fellow *Shannon Savell* won a Distinguished Teaching Fellowship, is the Psychology Department's selectee for the American Psychological Foundation Grad Student Award and has become a member of the Raven Distinguished Student Society.

- Fellow *Jessica Taggart* has successfully defended her dissertation entitled "As Good as the Real Thing? A Mixed Methods Study of the Perceived Impact of Pretend Play on Children's Self-Efficacy and Competence." She has started as a postdoctoral research associate at the UVA's Center for Teaching Excellence. She was also inducted into the Raven Society and received a Faculty Student Interaction Grant from UVA College Council, an APA Dissertation Research Award, a Professional and Organizational Development Career Development Grant, as well as Small Grants for Teaching Projects from the APS Fund for Teaching and Public Understanding of Psychological Science.

- Fellow *Tara Valladares* has taken over from *Evan Giangrande* as UVA fellow speaker. She joins *Sean Womack*. She was also awarded a Jefferson Fellowship.

- Fellow *Alexandra Werntz* has successfully defended her dissertation entitled "Experimental Examination of Message Framing to Increase Dissemination of Evidence-Based Treatments" and is now working as a postdoctoral research associate with both the Center for Evidence-Based Mentoring at the University of Massachusetts Boston (with Jean Rhodes) and the UVA's Department of Psychology (with Bethany Teachman). She also received the Association for Behavioral and Cognitive Therapy's (ABCT) Virginia A. Roswell Student Dissertation Award.

- Fellow *Meltem Yucel* received the 2020 Albert Bandura Graduate Research Award from the Association for Psychological Science (APS)/ Psi Chi International Honor Society in Psychology, UVA Graduate School of Arts and Sciences, Dean's Dissertation Completion

Fellowship and Dean's Summer Support, a Dissertation Grant from the UVA Democracy Initiative, Corruption Laboratory on Ethics, Accountability, and the Rule of Law, and a Raven Scholarship.

LIFE Zurich

- *Plamina Dimanova* has joined LIFE Zurich as a fellow (see p. 30 for more information).

- *Nora Raschle* has joined the LIFE Zurich faculty (see p. 28 for more information).

- As of August 1, faculty *Moritz Daum* was appointed as a Co-Director for Research at the Jacobs Center for Productive Youth Development at UZH and is now affiliated with both the Department of Psychology and the Jacobs Center.

- Fellow *Ira Kurthen* successfully completed her dissertation "Hearing Loss and Cognition in Old Age: A Fine-Grained Investigation of Speech Processing Under Adverse Listening Conditions" in July.

- Fellow *Tabea Meier* was awarded this year's Open Science Prize of the UZH Psychology Department in the doctoral students' paper category for:
Meier, T., Boyd, R. L., Mehl, M. R., Milek, A., Pennebaker, J. W., Martin, M., Wolf, M., & Horn, A. B. (2020). (Not) lost in translation: Psychological adaptation occurs during speech translation. *Social Psychological and Personality Science*. Advance online publication. https://doi.org/10.1177/1948550619899258

- Fellow *Lea Mörsdorf* has successfully defended her dissertation entitled "Investigating Goal Focus Across the Lifespan: Insights, Challenges, and the Unknown."

- Faculty *Jana Nikitin* has accepted the position of full professor for the psychology of aging at the University of Vienna, Austria. She started her new position in August.

- Faculty *Urte Scholz* and *Alexandra M. Freund* are jointly conducting a representative Covid-19 study on risk perception and health behavior in the Swiss population. They received third-party funds from various donors: The first survey at the beginning of the lockdown in Switzerland was financed by the UZH. The second survey, which started with the second phase of relaxing the lockdown in Switzerland on May 11, was financed by the Suzanne and Hans Biäsch Foundation zur Förderung der Angewandten Psychologie and by funds raised by the UZH Foundation. A further six points of measurement for the coming months are funded by the Swiss National Science Foundation. The project has been preregistered on the Open Science Framework at https://doi.org/10.17605/OSF.IO/G6EHD (first point of measurement) and https://doi.org/10.17605/OSF.IO/3JV52 (longitudinal analyses).

Source: Verena Sommer

Other forms of protest had to be found in times of a pandemic!

Frequently used acronyms in LIFE

CRTD: Center for Regenerative Therapies Dresden

DIW: Deutsches Institut für Wirtschaftsforschung [German Institute for Economic Research]

DZA: Deutsches Zentrum für Altersfragen [German Centre of Gerontology]

FU: Freie Universität Berlin

HU: Humboldt-Universität zu Berlin

LIFE: International Max Planck Research School on the Life Course

UM: University of Michigan

UVA: University of Virginia

UZH: University of Zurich

MPIB: Max-Planck-Institut für Bildungsforschung [Max Planck Institute for Human Development]

LIFE Newsletter

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Aim of the newsletter
The LIFE newsletter encourages collaboration and interaction among people
within the LIFE program. It provides an information platform where fellows, alumni,
and faculty members can learn more about each other's research, and identify
colleagues with similar interests and possible projects for collaboration.

Contributions
Please send contributions, suggestions, and input to the editor.

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