I believe I can fly: Wonders and dangers of virtual reality

Braiding the Gap: Why EEG research needs to be more inclusive

Charité Mental Health Hackathon
Humanity is no stranger to tools of all kinds; first fire and stone, later horse-drawn plows and carriages, ledgers and letters. Today, we are familiar with – and to some point identify with – modern tools like cars, phones, and journals. The explosive discussions of Artificial Intelligence technologies has dominated newsrooms and Twitter feeds alike, and our most recent CNS Brainstorm was no exception. The appearance of these new tools, which might look as different as an electronic calculator to an abacus, prompted us to ponder the ways in which our brains are and will continue to be shaped by the tools we use.

We use our phones to navigate, work, and keep up-to-date on our social media. So too do our phones and social media accounts shape our moods and identities (p. 7). There are dark sides too. In the best case, constant occupation and entanglement with technology can erase any trace of boredom, and potentially our creative selves along with it (p. 4). In some of the worse cases, careless use of technologies can result in psychological damage and systemic biases (p. 17, 20). To get a better idea of what brain – or more precisely, cognitive – augmentation really looks like, we speak to postdoctoral fellow Dr. Inês Hipólito (p. 14). With her words of caution in your mind, consider the futuristic – yet very real – advances our world is making in the realm of immortality, both in vivo and in silico (p. 10, 12).

In the spirit of embracing the tools of the future – with a healthy dose of skepticism – join us for this issue on the “Augmented Brain.”

Your Editor-in-Chief,

Leandre
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Daydreaming is not all bad!

Picture this: you wake up in the morning and get out of your bed. You hop in the shower, get dressed, have your breakfast and rush outside to catch the tram, hoping that it’s not delayed (again!). Amidst all these typical morning tasks, how often do you catch your mind wandering?

At times you can count on your imagination for a creative boost. Yet at other times, you’d not want your mind racing around (especially mid-way through a conversation with someone!). With technology in the picture, mind-wandering is relevant now. Saturating our minds with notifications, tweets, and BeReal reminders seems to leave no space for the mind to wander at all. Are we losing our imaginative selves in the process?

We need a little bit of balance to protect and embrace our daydreaming selves.

"We spend over a third of our waking hours daydreaming [1]."

Not all minds that wander are lost but some wandering minds are in fact...lost

Everyone experiences mind-wandering, a phenomenon in which your current focus shifts toward a bunch of unrelated thoughts. The default mode network of the brain, consisting of the medial prefrontal cortex (mPFC), posterior cingulate cortex (PCC), inferior parietal lobe, lateral temporal cortex and hippocampal formation, underlies this [1]. Though a wandering mind sounds anything but productive, it is thought to inspire our creativity, connect our past and future selves and help us make meaningful long-term plans [2]. “Humans have a striking ability to immerse themselves in their own thinking,” says psychologist Aya Hatano of Kyoto University in Japan [3], and this keeps them stimulated even without external influences [4].

Mind-wandering can also take us to dark places, like lamenting over an argument [1], and is shown to be connected with impaired task performance [2] and low mood [5]. It remains unclear whether mind-wandering is a cause or consequence of low mood [6]. Poerio et al. found that sadness usually comes before mind-wandering and mind-wandering itself was not associated with low mood and poor well-being [6]. More significantly, they found that if the content of mind-wandering is negative, it predicted a worse mood [6].

Weighing the costs and benefits

Two hypotheses from cognitive and clinical psychology shed light on this [2]:

1. The context-regulation hypothesis = Whether mind-wandering yields costs or benefits is highly dependent on the context. When your mind wanders during a difficult task that requires a lot of attention, it is more likely to disrupt your performance and cognition. In contrast, mind-wandering is adaptive and beneficial (e.g. helps you think creatively, be patient, and have better cognitive control) in tasks that require minimal cognitive resources, like brushing your teeth.

Be mindful of the context in which you catch yourself drifting off. If it’s during simple tasks in the morning, it’s probably not too bad. But if it’s during a difficult lecture, it’s time to get yourself a cup of water or coffee and focus.

2. The content-regulation hypothesis = The content of your mind-wandering also decides if it’s beneficial or costly to you. Ruminating over the past and repetitive negative thoughts are associated with depression and anxiety. Adaptive mind-wandering content, like self-focusing to solve problems, is quite beneficial.

If you catch yourself spiralling with unproductive/repetitive negative thoughts, stop and take a breather, get some air.

Is technology a threat to my inner daydreamer?

Technology affects mind-wandering in context-specific ways:

Context 1: You are at a neuroscience talk. The topic sounds interesting but there are some things you don’t particularly understand. You try to listen and make sense of things. “beep” You hear a notification from your phone. You unlock your phone and find that it’s an Instagram notification from your best friend. She picked out your bridesmaid dress and sent a picture of it! It looks gorgeous! It makes you think of that make-up tutorial you saved in the morning that would go well with the dress. You keep scrolling through your saved videos on Instagram to find it. You come across a bunch of other wedding-related videos you saved. You can’t help but feel so excited for your best friend’s big day! ...15 minutes in and you realize you’ve missed out on most of the talk you attended.

This example demonstrates “smart-phone related mind-wandering,” which was studied recently in academic settings during lectures or whilst studying [7]. Using your smartphone during study sessions or lectures could sometimes produce self-generated off-task thoughts that affect your performance [7].

Context 2: You are on the train, riding back home from work. You are exhausted but you end up replying to your emails and text messages. You keep doing this while walking out of the train station all the way home. You don’t notice how it’s the opening of the restaurant next to your apartment. You walk straight past it and into your home.

In this example, you use external stimulation to “keep yourself busy” in a situation in which you had the option to sit with your own thoughts and let your mind wan-
der. “Our research suggests that individuals have difficulty appreciating just how engaging thinking can be,” says Aya Hatano, who conducted a study on mind-wandering and inward reflection published with the American Psychological Association [3, 4]. “That could explain why people prefer keeping themselves busy with devices and other distractions, rather than taking a moment for reflection and imagination in daily life.”

**Using (neuro)technology to make minds wander**

Brain disorders such as mild cognitive impairment show reduced mind-wandering, which affects the retrieval of spontaneous thoughts like free-flowing ideas as opposed to deliberate thinking [8]. Such spontaneity provides important self-insight and could help with making judgements and decisions [9]. Interestingly, some neurotechnologies such as noninvasive transcranial direct current stimulation (tDCS) have been used to externally modulate mind-wandering [10]. Using tDCS to stimulate the prefrontal cortex, Axelrod et al. showed enhanced mind wandering in participants who engaged in a monotonous task (Sustained Attention to Response Task), typically used in mind-wandering research [10]. Additionally, this technique provides insight into the brain regions involved in mind-wandering in a causal manner [9]. Potentially, such neurotechnologies may be useful in clinical situations like mild cognitive impairment, to improve mind-wandering abilities. Despite its exciting potential, conflicting evidence on the potential of prefrontal tDCS to modulate mind-wandering demonstrates a need for further research before any clinical translation [11].

While minimizing distracting thoughts during important, attention-demanding tasks, consider allowing your mind to wander on your way back home and reflect on life. You’d be surprised where daydreaming takes you next!

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Reviewed by Leandre Ravatt

[8] Niedźwieńska et al., Neuropsychology, 2018
How Our Gadgets Shape Us:

Where is my mind?

The impact of navigation technology on our brains.

"Head north from here, take the fourth right, then the second left, right after the local grocery, and my house is on the right."

When is the last time someone gave you directions this way? How many modern horror movie beginnings depict characters lost on the road at night – not due to a paper map and missed street signs in the dark, but instead because of their dead phone or lack of service?

In a famous 2000 study, neuroscientist Eleanor Maguire demonstrated that licensed London taxi drivers had an increased volume of posterior hippocampal grey matter [1]. The hippocampus is sometimes likened to our own "internal" GPS in that it stores spatial information and works together with the entorhinal cortex to help us explore and navigate [2].

Recent on the ubiquitous GPS-based mobile navigation has found that these aids can "support wayfinding, but they do not support learning about the spatial configuration of an environment" [3]. In one specific paper, the use of turn-by-turn GPS instructions and "track-up" GPS was shown impaired the formation of cognitive maps [4]. Luckily, conscious software design can counteract some of this so-called cognitive deskilling [3].

A future filled with self-driving cars and increased space flight heightens the urgency with which we must address spatial deskilling. The hippocampus is an invaluable tool for 2000’s London taxi drivers as much as for the future’s astronaut explorers, and it is known to atrophy due to the ‘extreme spatial conditions’ of spaceflight [5]. In a striking example during the Apollo 14 mission, two astronauts struggled to recognize any landmarks while attempting to navigate to a crater less than 1 mile from their landing module. The assignment was ultimately aborted due to spatial disorientation [5]. Interested in learning more? Check out Charité’s very own Dr. Alexander Stahn, principal investigator with the Charité Center for Space Medicine and Extreme Environments, who investigates the impacts of artificial gravity and spaceflight on brain plasticity.

Conscious design of the spaces we inhabit and the tools we use to navigate through them will be essential. This is true more than ever as Artificial Intelligence technologies begin to permeate every aspect of our world. Do you want your surgeon navigating your appendectomy with GPS [6]?

Just Google It

Googling something has become as natural for most people as remembering something on their own. The world wide web provides a sheer unlimited source of knowledge about virtually anything. This enables people to learn about a topic within seconds and helps with the global dissemination of knowledge. However, studies have shown that information, which is acquired via a quick internet search, is processed and encoded differently from other information. It is not stored as accurately as facts obtained through book reading [1], and is forgotten much faster, probably due to the easy availability to obtain the information again [2]. The responsibility to store information is offloaded unto external storage devices and spaces. Transactive memory [3], has involved only family and the social environment for thousands of years and now extends to a new gigantic member: the internet.

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AG Wegmann, MedNEURO, ECN

Maguire, Proc Natl Acad Sci U S A, 2000
Münzer, J Exp Psychol Appl., 2012
Burnett, Traffic and Transport Psychology, 2005
Stahn, Cognitive Processing, 2021
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Sparrow et al., Science, 2011
Are You Your Instagram Account?

Today, almost everyone has a social media account, and an accompanying smartphone in their pockets to access that account from anywhere in the world. Out of the 746.4 million people living in Europe, an estimated 462.58 million are on Facebook [1].
Social media is a great way for people to stay in touch with distant family and friends. It can also be a great way to meet new and like-minded people, connections which otherwise might have been missed. Using social media like this can increase the magnitude of our social networks to distances that would otherwise be too difficult to maintain. All of it depends on what we post and say online. Is it always the truth?

Often, we may try to make our lives seem more interesting and exciting than they really might be offline. Does that happy and adventurous person presented on your social media profile reflect who you really are? Does it reflect who you think you need to be for social acceptance? Can we tell the difference? Knowing who we are is an important feature of our mental health. It shapes how we interact with the world around us, and how we place ourselves in that world. The influence of digital media on our imagined social perception may augment not just our identity, but also our reality.

How spending time online alters our brains offline

While no brain pathway has yet been discovered to explain how we synthesize our identities, scientists have uncovered some brain regions that play a role in how we perceive ourselves. One of those brain regions is the medial prefrontal cortex (MPFC) [2]. Researchers have found the MPFC to be active when people are engaging in self-reflecting thoughts [3]. A Finnish research group also found that the MPFC is responsible for processing received peer feedback from social media in teens [4]. This study suggests that for teenagers, whose brains are still developing, being on social media and reading the comments you receive from peers can go on to dramatically affect how they develop their perceptions of themselves. For adults, the study helps understand what changes in the brain can be expected to alter how they see themselves.

Who you are today is largely tied to what you have experienced in the past, in other words, your memories. Scientists have been able to show that people use the internet as an extension of their transactive memory. Transactive memory is used to describe when individuals rely on other people for remembering information content, so they do not have to be individually responsible for retaining the information [5]. For example, when I am in the lab going over a list of antibodies that I need, I say them out loud to my colleague next to me, so they can also help me remember when we need to search for them. The catch here is, I need to remember which colleague of mine I shared that information with. With the Internet however, there is no need for individuals to retain that information content, or where the information is stored in the first place. A simple Google search can take care of that instead. This phenomenon has been shown to decrease the activity of our brains in the regions responsible for long-term memory storage [6], as there is no cognitive burden to remember that information, when it can be accessed via the Internet. Overtime, this “use it or lose it” effect can occur and our memories would be shorter.

How active are you in your online world?

No current metric can be used to test how much of an individual’s identity can be tied to their online usage. We can, however, test ourselves with a good old-fashioned ‘knockout’ experiment: try deleting your social media accounts for a short time, and note any changes in how you perceive yourself and your surroundings. If this makes you nervous, or your first instinct is to say you can’t cut off your main source of communication with the outside world, maybe start with the first step: awareness.

To determine how often you use social media in your daily life, grab your smart phone. Open your settings. Go to the “screen time” page. Tap on “See All Activity” and then look at the “Most Used” section. How many hours are you spending on your phone? Where are you spending the most amount of time? When you tap on the “show apps & websites” are one of the top 3 apps you use a social media app, such as Facebook or Instagram? Consider checking in regularly to remain mindful of how you are spending your free time.

The next step is harder: delete the app you use most. As painful as this may be, aren’t you curious? How will you spend that time? In the absence of that app, be it a week or two, are you spending that time by making more plans with friends? Doing things that you always say you don’t have the time for, such as reading or going for a jog [7,8]? What if you are instead spending that time on another app? What would happen if you delete that one too and repeat the experiment?
Proceed with awareness

I am not trying to warn you all off of all digital media. That would be highly hypocritical of me. My hope is that you can go forward and understand more about yourselves and how your life may be tied to your online persona, be it more or less than you were expecting. This can be helpful, especially if you, like me, found yourself to be increasingly unhappy and unsatisfied with everyday life in the dark and gloomy Berlin winter and found yourself reaching more for your phone to distract you. As summer nears, maybe you can start to make note of the changes you wish to generate in your social media habits and apply them to your life to make your life that much brighter in the next winter.

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Reviewed by Manisha Biswas and Leandre Ravatt

The Quest for Immortality

How scientists are racing to cheat death

Human life expectancy has drastically improved over time, going from an average of 32 years in 1900 to 73 years as of 2019, thanks to medical advances and healthier lifestyles [1,2]. But for some people, this isn’t enough. While medical research has traditionally focused on treating disorders, a new wave of scientists is now fighting the root cause of many of them: aging. Old age is indeed the main risk factor for cancers, cardiovascular and neurodegenerative diseases, including Alzheimer’s and Parkinson’s disease [3,4]. A recent change of paradigm is leading some scientists to stop considering aging as a natural process of life, but as a disease to be cured [5]. For many, aging, and with it, death, are no longer considered inevitable. They thus find it natural, and even arguably necessary, to look for ways to prevent it. Here are some approaches scientists are investigating to push the limits of human life.

Slowing down time – Negligible senescence

Aging is not a universal process; some animals are not impacted by time the same way we are. Hydras, immortal jellyfish, or naked mole rats show what scientists call negligible senescence (biological aging). In other words, their reproductive capacity and organ function don’t decline with time, and their probability of dying doesn’t increase as they get older. This enables these animals to live extraordinarily long lives, or even be virtually immortal [6,7]. Many approaches, classified as Strategies for Engineered Negligible Senescence (SENS), are being tested to try and reproduce negligible senescence in humans by fighting the damage that accumulate in our bodies with age (such as mutations in the genome, loss of cells, or deterioration of the immune system) [8]. For example, several anti-aging drugs known as senolytic drugs have shown promising results in extending lifespan and healthspan in animals, usually in the range of 5 to 25% increase in mice [9,10]. The drugs work by clearing senescent cells, toxic mature cells that build up with age. Recently, a cocktail of senolytic drugs, dasatinib and quercetin, has been found to decrease the number of senescent cells, to improve overall physical health, as well as increase the lifespan of old mice by 36% [11]. These compounds, as well as other senolytic agents, are now being tested in several clinical trials to determine their safety and effectiveness on age-related diseases on humans [12]. A plethora of other treatment strategies aiming for negligible senescence have been suggested to fight age-related damage, including immune system stimulation, gene therapy, or genetically engineered muscles [8]. However, even though some results are promising, many of these strategies have been met with criticism from the scientific community, many arguing that the promises of many SENS approaches are too optimistic, and still very far from being applicable to humans. Indeed, we don’t only lack evidence that these treatments can change human life expectancy, but many SENS approaches haven’t shown a substantial effect on lifespan in any animal. In general, there is still of lot to understand about the fundamental mechanisms of aging, which makes many claims from SENS approaches unrealistic [13].

Going back in time – Cellular reprogramming

Instead of trying to slow down aging, why not try to reverse it completely? This unconventional idea is supported by scientists in the field of cellular reprogramming. The pioneering Dr. David Sinclair proposes an Information Theory of Aging, in which the loss of epigenetic information with time is responsible for the process of aging [14]. This epigenetic information comprises chemical markers on the DNA and associated
molecules, that regulate the expression of genes without changing the sequence of the genes themselves. Importantly, these markers are reversible and can change over time. In particular, a type of epigenetic marker, DNA methylation, has been found to increase with age in such a way that someone’s biological age can be predicted from an analysis of their DNA methylation pattern [15]. According to Sinclair’s theory, these epigenetic changes accumulating with time are the main cause of the cellular and organ dysfunctions underlying aging processes. Therefore, aging would be a result of the loss of youthful epigenetic information, and returning the epigenome – the collection of all epigenetic markers – to a more youthful state could result in a rejuvenated organism. Although rejuvenating a whole individual is still science fiction, this approach has already proven promising to reverse molecular and cellular hallmarks of aging in mice. For instance, scientists managed to partially reprogram aging neurons with a set of genes already known to play a role in converting mature cells into a more immature state. This cellular reprogramming led to a restored epigenome, associated with youthful neuronal features, recovered vision in a glaucoma model, as well as improved memory in aging mice [16-17]. Moreover, this technique was found to improve hallmarks of aging in other organs (skin, kidney, muscles) and to increase the lifespan of a premature aging mouse [18]. However, even though it also led to improvements in several molecular hallmarks of aging in human neurons [18], we are still far from being able to use this approach to extend our own lives. Indeed, when it is easy to measure the impact such a treatment has on the life expectancy of a short-lived mouse, it takes much longer to detect an effect on humans. In the meantime, Dr. Sinclair has been advocating for a supposedly anti-aging drug regimen based on his research, but its effect on human health is only supported by his own anecdotal evidence [19].

Detaching from time – Mind uploading

All the solutions described thus far are trying to fight against the effect of time on our bodies, but these complex biological machines are still fragile and bound to decay with time. Other scientists are therefore seeking to detach from this physical constraint and rely on a more long-lasting medium for their lives. The idea behind this is to create a copy of the exact content of their brains into a supercomputer, from individual synapses to global neuronal networks, and then to simulate their activity. In this way, people could go on to live not as human beings, but as virtual minds. This simulated copy could then exist forever – or as long as the computer can last – without having to worry about senescent cells, epigenetic disruptions, or painful joints.

Discover the promises of mind uploading by reading Brain in the clouds (p. 12).

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Reviewed by Nicola Chinchella

[2] UN, Department of Economic and Social Affairs, Population Division, 2022
[16] Lu et al., Nature, 2020
[17] Rodríguez-Matellán et al., Stem Cell Reports, 2020
[18] Ocampo et al., Cell, 2016
[19] Vujin, A. et al., HSI, 2020
It’s a warm Wednesday evening in the spring of 2083. You are on the 22nd floor of Charité Bettenhochhaus at the whole brain emulation specialty clinic for a consultation. You see heaps of consent forms in front of you and it is your time to decide if you want to upload your brain. Your sibling and your best friend have already decided to do it. What are you going to do? Are you ready to put your brain in the clouds and live forever?

This sounds like something out of a sci-fi movie, right? Believe it or not, several startups have already started pitching mind-uploading services, provoking backlash among scientists [1]. Given the ethical and cultural implication, it is no surprise that it has also attracted the attention of philosophers and ethicists. However, that aspect of the topic will have to wait for another time and article. For now, we focus on the question: Do we actually have the technology to upload our minds? Any potential mind-uploading process would involve several steps, each of which presents practical challenges that need to be overcome before mind-uploading can become a reality.

**Scanning the brain**

The first step in mind-uploading is scanning the brain, which involves creating a high-resolution map of the brain’s structure and connections using advanced imaging technologies. Many neuroscientists’ first choice of technology might be magnetic resonance imaging (MRI) or functional MRI, but these lack the resolution to capture the full complexity of the brain’s neural connections. However, a more promising technology could be used in the future: large-scale scanning with electron microscopes. Scientists from Allen Institute for Brain Science have recently mapped the 3D structure of all the neurons comprised in one cubic millimeter of mouse brain, which has about 100,000 neurons and a billion synapses. While electron microscopy has been around since its invention in 1933, the real innovation is in scale [2]. Five electron microscopes ran continuously for five months and collected more than 100 million images occupying two petabytes (or two million gigabytes of storage) [3]. This could potentially be replicated on a whole human brain in the future when we have better data storage technology as the data produced would be bigger than the current capacity of all data storage on earth.

**Modelling the brain**

Assuming we can produce a high-resolution map of the whole human brain, the next step is to identify structures. These can be thought of like the individual buildings, blocks and streets, which help us understand how the whole city works. This would involve processing the scanned images and interpreting the scans to identify the unique cell types, their connections and their functions. This is essential in achieving the goal as it allows for the precise mapping and modeling of the connections which make each brain unique.

Now, how far along are we in this process? Neuroscientists have already broadly identified the areas of the brain responsible for different functions such as language, memory and emotions. However, on a cellular level we often still lack the knowledge about specific functions. We would need to extract this information, for each individual, to be able to understand each puzzle piece of the map and the connections which are made. This information could then be further used to create a neuroimaging-based software model of the neural system. This is a complex task that requires expertise in both neuroscience and computer science, as the software model of the neural system must be built by creating a digital representation of each neuron and its connections using massive computational power. However, having a neuroimaging-based model of the brain essentially means that we have a complete digital map of the brain where we have identified the functions of each of the structures.
**Simulating the brain**

Now what? With our brain map in hand, we can use the bottom-up approach and use the information we have about each of the brain structure to simulate the behavior of individual neurons and then gradually building up to larger structures. This approach is more detailed and provides a clear simulation. However, it is also more computationally intensive and requires vast amounts of computing power.

The other approach would be to use the information available to us from neuro-imaging in a top-down approach. By simplifying the elements of our digital map into probabilistic models, we can conceivably simulate brain behavior, using a more manageable number of simpler systems.

Recent developments in artificial intelligence, specifically deep learning algorithms, can also be applied to brain simulation. These algorithms are capable of learning complex patterns from large datasets, making them well-suited for modelling the structure and function of the brain. They have already been used to create models that can perform tasks such as image recognition and natural language processing [4].

The overall goal of simulation, using different approaches, is to create a model that accurately reproduces the patterns of neural activity that occur in the individual’s brain. One of the challenges of simulating neural activity is the sheer scale of the task. The human brain contains around 100 billion neurons, each with thousands of synapses to other neurons. Simulating this level of complexity would require a computational capacity of 36.8 petaflops (a petaflop is a thousand trillion floating point operations per second- a single petaflop can perform about a quadrillion calculations per second, which is equivalent to the computing power of about 100,000 high-end laptops working together) and a memory capacity of 3.2 petabytes (a petabyte is equal to 1,000 terabytes, and it stores about 1,250,000 hours of music) [5].

**Just 3 steps?**

Scan, model, simulate. The process of living forever as a digital copy of yourself can never truly be boiled down into these three simple steps. This highly hypothetical article relies on the hotly debated assumption that your identity and mind can be reduced to the brain’s structure and biochemistry [6,7].

Once the technology is accessible, there are innumerable societal, ethical, and philosophical consequences waiting in the wings. In today’s world, social media already impacts our sense of self and society.* The ability to create digital copies of individuals has the potential to further transform or warp personal identity, privacy, and the very nature of what it means to be human. Further, the existence of such a digital copy raises the question: is a digital copy itself conscious, or is it merely a simulation? What are the implications of creating digital immortality? These questions must be addressed before the creation of digital consciousness becomes a reality.

*read more on the impact of social media on sense of self from Rina Patel (p. 7).

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Reviewed by Felicitas Brüntgens

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1. https://tinyurl.com/2v3tsfey  
2. https://tinyurl.com/tct2eut1  
3. https://tinyurl.com/z6cyurve2  
4. https://tinyurl.com/58parb64  
5. https://tinyurl.com/2ateokzn  
I had the distinct pleasure of interviewing Dr. Inês Hipólito, a postdoctoral fellow and a lecturer at the Berlin School of Mind and Brain whose diverse interests range from the free-energy principle, active inference to E-cognition, frameworks that she employs to develop her theory on augmented cognition. In her recent research, she contemplates the extended mind hypothesis (see BOX 1) that dominated much of the early thinking on human augmentation. "While the extended mind has been crucial in bringing cognition out of the brain, at some point I move away from the extended mind, because it gives an explanation of the way that we interact, relate, and incorporate technology into our identity that is too intellectualist because it comes down to information processing. While it claims weak embodiment because it takes cognition as information processing, we are back at disembodied inference machines, which leaves little to no room to think about how AI shapes and fundamentally impacts our experiential identities," she says.

Our conversation evolved around two interconnected perils as we approach the phenomena of augmentation, both of which arise from treating the brain as the object of augmentation. The first peril is a theoretical one; by reducing cognition to the brain, we are prevented from fully appreciating the scope of impact resulting from augmentation. Once cognition can be understood as an emergent property from the reciprocal complex interactions between the brain, body, and environment, it is clear that technological augmentation would completely reshape our cognitive systems. The second peril is the risk of homogenising augmented minds. Thought of as brains, we all appear as equal apparatus for augmentation; this glosses over the differences that our culturally and environmentally entangled bodies necessarily face when it comes to augmentation.

An edited script of the interview follows.

CNS: How would you define the 'augmented brain'?

I would rather use the term cognitive augmentation because I’m not neuro-reductive. Socio-cultural settings play a fundamental role in shaping our identities and relationship with technology. The first step to never losing sight of socio-cultural biases is to avoid a neuro-reductive uniform view of human thinking. The second step is to understand that we experience the world not only by thinking about it but also experience it from our own very specific embodied perspective. Thus, I would not endorse brain augmentation.

The extended mind hypothesis is a philosophical idea that suggests that human cognition extends beyond the boundaries of the brain and into the individual’s environment. It proposes that tools such as computers, smartphones, and even writing devices that we use in our daily lives are a part of our cognitive system, just like the brain itself.

Our interactions with technology create a coupled system, where the individual and the technology together form a cognitive entity that is more than the sum of its parts. The famous thought experiment proposed to illustrate this point is the case of Otto and Inga. Inga and Otto both hear about an intriguing exhibition at the MOMA, Inga retrieves the information about the exhibition from her memory and sets off. Otto, who suffers from a mild form of Alzheimer’s, always writes new information in his notebook. When he hears of the exhibition at the MOMA, he writes the address in his trusty notebook and later retrieves the address to make his way to the museum.

Clark argues that the only difference in these two cases is that Inga’s memory is internally processed by the brain, while Otto’s memory is served by the notebook. Thus, Otto’s mind has been extended to include the notebook as the source of his memory [1, 2].
but cognitive augmentation, here I define cognition as what emerges from an organism’s interaction with the environment. One’s experience of dealing with technology is determined by the body that is situated in a certain social-cultural setting that they’re born into (Heidegger would say “thrown at”) and enculturated with during development. If you reduce it to the brain and equate it to a computer, you lose sight of the inequalities that exist in the potentiality of it to tailored and individualised augmentation."

CNS: Is this the insight provided by the extended mind hypothesis?

"In the 90s, the novelty of the extended mind is a complete rupture from the paradigm at the time which was based on a reduction of the mind to the brain. As technology becomes more available on an individual level and we’re starting to have laptops and smartphones, as opposed to having big computers that take up the size of a room, [The extended mind] idea comes up with an interesting point, which is that cognition does not reduce to neuronal activity. It brings in the view that there is a role of the body, specifically how the body mediates between the brain and the environment. It allows us to integrate technological gadgets into our cognition by playing a function. This idea was extremely important to embodied robotics and E-cognition movement."

CNS: How does the present decade of technology impact our sense of self?

"We as a species have been developing technological tools since we started playing around with sticks and stones, and by doing so changing the environment completely. Technology has always been a part of what it means to be human, shaping everything that we do, and thereby our identity and collective identities. The slight but important detail is that today’s technology places us in a mixed reality, always shifting between online and offline worlds. It’s not just that we have a notebook where we can take our notes, and then use it, this was the old extended mind. Now, these gadgets are learning about us and promising to access a cloud of continuously growing knowledge to predict our needs. Social media places us in an algorithmic bubble that by collecting our data, then throws back at us, all of this information that we have not necessarily selected but that serves someone’s political or market agendas. How can this feedback loop not continuously, completely, and utterly shape who you are, what you think, your personality, and your identity?"

CNS: What are some of the dangers of integrating technology into our everyday lives?

"The techno-scientific virtuous endeavour is supposedly to improve human life. The paradox is that it is not necessarily always the case that it’s going to improve human life across the board, it might actually be a tool of more segregation. So, are we really adapting and evolving through the use of technology?"

Feminist techno-science offers some very cool insights surrounding this. There are two sides to the problem. Techno-science advances not in an encapsulated manner, but at the hands of cultural communities that bring forth problems to be solved. It starts off with a research community defining which problems need our attention and at this point, you already see how cultural dominant narratives may play out. Our embodied prejudices live on as we think about prob-
lems and design the solutions worth pursuing. It is no secret that techo-scientific fields are male-dominated, it is with no surprise that infinite lines of code serve a male gaze, explicitly and implicitly. Additionally, technology is developed to serve the wealthy and not to solve problems that are more basic necessities of people that struggle, economically and socially. In these first stages of technological development, you already see all the inequalities in the fabric of who we are a cultural society. A technological development made freely available without any sort of guidelines or limitations will typically reinforce bias because people are going to interact with these technologies by virtue of a continuation of the patterns in which this technology has been created.

The other side is how the mere existence of new technologies will necessarily shape the identities of the people that either have or have not access to it and how using it is determined by their sociocultural status. For example, some people have access whereas others don’t and this gulf fundamentally alters the relationship between these groups.

Therefore, you can see the two sides playing out: the generation of technology, which is telling of the culture, and secondly, the propagation of the technology in the culture and its impact on us. Technology is extremely powerful and you can use it to either reinforce certain social norms, or you can break them. The question is, what is it that we’re going to do? That’s going to be a defining moment for the human species."

CNS: Do you think pre-coded answers to sensitive topics coded on platforms such as ChatGPT will suffice to mitigate any issues?

"Pre-coded responses are extremely problematic. Some responses can be pre-coded, but what if you ask "Give me an overview of research in social cognition in the last 10 years." Most likely the overview will be male-dominated. White and male-dominated narratives because these populations have been the ones benefiting from the status quo. Thus, pre-coded responses are the bare minimum."

CNS: How can we mitigate these issues?

"Two things need to be done: regulation and education. The argument for regulation comes from within an interesting philosophical argument: a debate about whether technology is neutral or social. Back in the day, there was this argument that technology is neutral, along the lines of ‘Guns don’t kill people, people kill people.’ This argument mostly favoured the free markets. Proponents of this argument were all against regulation because if you want to sell as much technology as you can, you are going to fight against regulation. The neutrality of technology only serves profit-oriented companies. More recently, as recently as 2021, the EU and other institutions have started regulating because of research on the worrisome developments of unregulated AI and information technology. UNESCO and the European Union Commission have developed new guidelines to raise awareness of this. However, biases are so pervasive that even with the best of intentions, the systems and data used to inform these guidelines are flawed in themselves.

This brings us to the second point that I want to refer to — we need education. We need to educate people that are in our universities, learning artificial intelligence, robotics, and information technology. The study of cognitive biases, philosophical problems, and ethics needs to be a core part of their curriculum, not an option in the program, it needs to be made central. If you are going to code then you will influence the lives of people every day. You have responsibility and duty, in the same way as medical doctors when they take the Hippocratic oath. Developers or anyone that is anywhere near the development of technology or AI systems, need to be aware of the impact that their code is going to have on everybody’s lives."

As we approach a period in human history that holds the potential to fundamentally alter and extend human cognition and capabilities, taking into account the concerns raised by Dr. Hipólito in her current and future work can help us focus on implementing sustainable AI designs and technological interventions that center societal well-being and empower individuals to pursue a positive impact on the world. The QR code below will take you to her website where you can continue the conversation and find out more about pioneering work on cognitive augmentation:

Manisha Biswas  
Ph.D. candidate 
Social Intelligence Lab, Mind&Brain

Reviewed by Leandre Ravatt

The dream of flying like a bird is as old as humanity. It has been realized in some ways in the form of airplanes, parasailing, Jetpacks, and soon perhaps flying cars – however, the latter are rather unattainable for the broad population and the former do not convey the true feeling of flying freely. Emerging technological advances in the field of virtual reality (VR) bring this dream within the reach of one’s living room. Flying over the Great Wall of China or circling above a herd of elephants in the Okavango Delta can be experienced as vividly as seeing the sceneries with one’s own eyes. But as VR is integrated into more and more areas of life, the borders between actual and virtual reality begin to blur – with dangerous consequences. If children for example spend a lot of time flying in VR, they might at some point believe that they can do it in real life as well and jump with the best of intentions to their own death. The wonders and dangers of VR must be carefully considered from a psychological point of view, now that VR is on its way to permeate large portions of society.

**State of the VR**

VR technologies are developing at a rapid pace and appear in more and more areas of life. The art scene is seeing an increasing number of installations and exhibitions integrating VR as a medium [1], while some artists express themselves wholly in VR (e.g. Chloé Lee). During the COVID-19 pandemic several biotechnology companies employed remote VR training for vaccination production, to already train employees while vaccination factories were still under construction [2]. Similar educational applications are also in development for schools, universities and even hospitals, where apprentice surgeons can practice virtual brain surgeries [3].

In addition, neuroscience and psychology researchers are employing VR-based paradigms to investigate a wide range of topics, like social interpretation of faces and empathy [4, 5] or neural basis of spatial navigation [6] - the latter in healthy and diseased humans, as well as animal models [7].

In the realm of leisure, VR gaming has made exceptional progress in the last years and is the commercially most accessible application of VR technology [8]. While VR-headsets have been available for purchase for a few years, their enhancement towards more immersive VR-setups is in the last stages of development right now. Several companies are currently beta-testing VR treadmill setups (e.g. KAT Walk C by KAT VR [9], Infinadeck by Infinadeck [10]). These expand on the standard headsets with a mounted body harness and omnidirectional tread-
mill, adding new sensory and active motor features to the VR experience. The next step towards fully immersive VR would be the addition of haptic and tactile feedback to the whole body, which is currently limited to the hands which hold the controllers. This has been implemented by the company VR Electronics and resulted in the development of the TESLASUIT, a full-body VR haptic suit with motion capture and biometric analysis [11]. Although the suit is currently at a retail price of €13,000, the estimated commercial trajectory of VR technologies and accessories projects that many of them will become attainable for the broad masses not too far in the future [12].

If one projects this emerging trend into the future, at some point most households in industrialized countries will probably possess a VR system in some form. There are to date no extensive studies investigating if or how repeated exposure to VR over a long period of time influences and changes the brain on a structural and on a meta-cognitive level. A lasting effect on the mental constitution does not seem unreasonable and might occur especially in children and adolescents, whose brains are still developing and who are also among the main audience of video games [13].

What could be the consequences of excessive VR exposure for the mental constitution of this target group?

**Wonders and dangers**

The educational aspect of VR would surely have great effect in children and spark excitement about topics, that would otherwise seem boring if only experienced through a textbook. Furthermore, the experience of other cultures and regions of the world via VR might foster inclusive and tolerant behavior [14]. Children from lower socioeconomic backgrounds could travel to remote places and see wonders of nature, which they might never have the possibility to see in real life.

In addition, the experience of fantasy worlds as they appear in VR video games is by itself extraordinary and could promote creativity and imagination.

But when one starts to live in fantastic virtual worlds, that appear as vivid as reality and where almost anything is possible, then the drab reality of everyday life looks bleak in comparison. Why would one want to go outside and take a walk around the block, if one can “walk” through futuristic utopias in outer space? Or go to work if one can spend the day flying over valleys full of dragons and go on adventures with mythical creatures? While escapism undoubtedly has merit for the mind and well-being, it can compromise one’s life if present excessively.

The realistic experience of any programmable environment in VR is its largest selling point – and biggest danger. VR gamers can live out violence in a way, that is very different from normal computer games, where the difference between game and reality is clear. This can lead to desensitization to violence, as well as promotion of violent actions, that are executed in VR like they would be in real life [15].

This pertains not only to violence, but also to realistic fear-inducing situations.

**I believe I will die**

Many video games contain not only magical, but also dark, scary, and brutal elements. It makes a huge difference if one explores a dungeon full of zombies on a computer screen while sitting comfortably on the couch, or if one really feels like they are sneaking through an abandoned monster-ridden cave. One can still always remove the VR headset and take comfort in being safely at home, but the VR-induced levels of fear and stress should not be underestimated. The inherent responsive fear system cannot distinguish between a real and a virtual threat and reacts to them the same way – with a strong activation of the sympathetic nervous system and the emotion of fear [16].

Especially the still developing brain of children and adolescents is at a higher risk of psychological damage from threatening VR-situations and might develop specialized phobias, traumata, or generalized anxiety disorders [17].

At the same time VR can be used to support treatment of these psychiatric conditions via exposure therapy to feared objects and situations, which has been proven effective in several meta-analyses [18, 19]. However, here the appropriate supervision by a therapist or medical professional is crucial to improve and not worsen the condition.

**How to move forward?**

As with most technology, VR can be aiding and destructive at the same time – depending on whose head it is. Regarding children and adolescents, the responsibility of monitoring the content, use and effects of VR applications like gaming falls into the hands of the legal guardians. If they themselves can properly estimate and judge the impact of their VR setups is a whole different
topic and raises an important point. For society to be able to engage with VR sensibly, educational work about this wholly different world is vital. Especially older generations struggle to keep up with advancing technology and need to be integrated into the discourse and education about VR.

Starting points for this could be the establishment of public research spaces, where technological advances are developed and simultaneously communicated to the public. Visitors can interact with technology and are included in the developmental dialogue by raising questions and concerns before new tech is released unto the unassuming public.

How our VR-infused future will look like is hard to predict. Will most people spend their leisure time exploring VR worlds while the real world has become severely damaged by effects of climate change? Or will the promising potentials of VR aid research and general education to foster an advanced, sane, inclusive and creative society, that can combat climate change?

**Lilly von Kalckreuth**  
**Integrated M.Sc. / PhD Fellow**  
**AG Ott, MedNeuro, ECN**

Reviewed by Felicitas Brüntgens

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[13] Jerdan SW et al., JMIR serious games, 2018  
[15] Lavoie R et al., Virtual Reality, 2021  
[16] Lin JHT, Computers Hum Behav, 2017  
As we enter a prime era in neuroscience and come closer than ever to understanding the brain’s cognitive abilities, brain disorders and bridge the gap between brain and behaviour - let’s take a minute to reflect on a very serious bias that has crept into this thrilling field.

The key to the progress in neuroscience revolves around the premise of producing logical conclusions that are a reflection of “universal truths”, which seems to unfortunately not be the case. Increasing evidence indicates that we have overlooked biases in human-centred science which has been conducted with a focus on Western, educated, industrialised, rich and democratic (WEIRD) populations [1].

**EEG: The method**

The electroencephalogram, or EEG, as a method has been a priceless asset to the field of neuroscience. It is a neuroimaging method to measure cortical brain activity by using electrodes placed on the scalp [2]. The method has a high temporal resolution and is a powerful technique that provides researchers with an insight into the brain. Fluctuations in electricity, as captured by the EEG are reflective of neuronal activity in the brain as neurons fire together to communicate. EEG is widely used for stroke diagnosis, epilepsy diagnosis and care, as well as in the understanding of mental disorders such as schizophrenia, anxiety and depression [3].

If you happen to volunteer as a participant for research involving EEG, here’s what happens (spoiler alert!). The researcher preps your scalp with a conductive gel, pushes your hair out of the way and places small electrodes (metal discs) on your scalp. The electrodes capture brain signals and are presented as waves on a computer. The setting seems futuristic and straight out of a movie but also involves some down-to-earth hair washing post-appointment, to get the gel off.

**Systemic Bias in EEG research**

Since the quality of EEG data is highly dependent on the contact between the electrode and skin, people with coarse and curly hair are often neglected.

A glimpse of what an EEG looks like.
Impedance is a measure of the resistance to the flow of current in an EEG electrode, a lot of factors can contribute to the impedance in EEG [4]. These include hair oils, hair products and even the hair itself. Higher the impedance, more pronounced is the noise and lower is the EEG signal. When it comes to curly, thick and coarse hair, the electrodes do not make the required contact to the scalp and the impedance is increased as a result. Consequently, the black population is extremely underrepresented in EEG research.

This could have serious consequences as our fundamental understanding of the brain is distorted and limited to specific populations. The exclusion of black, indigenous and people of colour (BIPOC) populations from basic EEG research is widespread but sadly not spoken about enough. The scientific community fails to acknowledge this exclusion and its implications on their research. If this is bias is translated into healthcare solutions, BIPOC populations will not receive the right treatment or diagnosis since there is no data collected from these populations. Hair texture should not be the reason why certain populations have a reduced access and quality of healthcare.

**Solutions?**

At the moment unfortunately not a lot of solutions exist, but there have been steps towards increasing awareness of this bias and combatting it. For instance, Etienne and colleagues found that braiding hair in cornrows (a conventional black hairstyle) can expose the scalp and reduce impedance, they have also designed innovative electrodes termed SEVO electrodes that can be harnessed to these braids. The duo of these electrodes and the braids reduced impedance by 95% and is a great first step towards improving EEG research [5]. SEVO electrodes use the strength of coarse hair as an advantage rather than an obstacle, they are wing-shaped electrodes that are placed on the scalp and leverage the strength of braided hair. This dramatically increases the EEG quality and constantly reduces the impedance. Attempts are in progress to further improve SEVO electrodes, so they do not require braiding, and designing systems that can be used on all hair types [6]. Providing research training on hair types and styles can help researchers understand the difference between hair textures, they can prepare the hair more effectively and communicate the steps to their participants to promote an inclusive environment.

In the meantime, simple yet effective steps towards inclusivity can prevent these challenges and biases from creeping into other research. Increasing collaborations with BIPOC researchers will aid in diversity in thought and allow scientists and doctors to understand the fundamental issue from their colleagues. Collaborations aid in improving scientific methods and research questions, and in turn allow us to develop novel solutions [7].

In conclusion, a combined effort must be made by the scientific community to alter methods and equipment to include populations of all ethnicities. Restricting access due to the limitations of protocols can severely underrepresent samples and hinder the practice of good science. While we strive to achieve the best scientific advancements, we must also critically reflect on unacknowledged biases and promote inclusivity and diversity within the scientific realm.

**Marula Mathew**  
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Reviewed by Nicola Chinchella and Martha Luk

[2] Penner F et al., Cogn Affect Behav Neurosci, 2022  
[3] https://tinyurl.com/5eksh2pd  
[6] https://tinyurl.com/4v9x8ru  
[7] Louis CC et al., Front Hum Neurosci, 2022
Author’s Page

**Poornima Anantha Subramanian**
Poornima is a fast-track PhD student at the Shoichet lab. When she’s not serenading her cells in the lab, she can be found gazing out the window, dreaming about sunny skies, sandy beaches, and the perfect playlist to match.

**Shehani Jayalath Mudiyanselage**
Shehani moved to Berlin from the beautiful island called Sri Lanka on the other side of the world. She is a first-year Medical Neurosciences master’s student (Neurasmus) who finds brain plasticity absolutely fascinating. She loves testing her own brain’s plasticity with new and challenging things (e.g. joining ballet at 23), and telling everyone she knows about how awesome the brain is.

**Leandre Ravatt**
Originally from California, Leandre moved to Berlin in 2020 and joined A.G. Wegmann, where she works the biochemistry behind nuclear transport defects in neurodegenerative diseases. She is eagerly awaiting sunnier days fit for hiking trips or lazy afternoons by the Spree.

**Rina Patel**
I am a medical neuroscience doctoral candidate in the Viana da Silva and Haberl Labs which are studying the cellular circuitry of Alzheimer’s Disease. When I am not in the lab hanging out with my mousies, I am most likely eating good food with friends! I love to explore new places as well, inside or (mostly) outside Berlin. I also enjoy cooking and reading in my spare time.

**Marula Mathew**
I am an ECN fast-track student currently working with high content microscopy in AG Mergenthaler. I love to paint and travel and am looking forward to some much awaited sunshine!

**Manisha Biswas**
Manisha Biswas is a doctoral candidate at the Social Intelligence Lab Berlin investigating social conformity, ostracism and ritual behaviour in VR. Besides this, she attempts watercolour painting and strives to be a good cat-mom.

**Lilly von Kalckreuth**
I’m a fast-track PhD student in the AG of Torben Ott, where I investigate how our favorite neuromodulator serotonin influences decision making. Besides neuroscience my biggest scientific interest is physical cosmology, which also sparked my love for science fiction. In my free time I enjoy playing video games, cooking and going to techno raves.

**Manish Patil**
Since its founding in 2017, EuroTau has been a venue for scientific exchange on the European stage in the struggle against Alzheimer's disease and other Tauopathies. Occurring on odd-numbered years, EuroTau trades off with the Tau conference which takes place in the United States on even-numbered years. Lille is a charming venue for any conference. It is also home to EuroTau series founder and Chair Luc Buée, Head of the Inserm laboratory "Lille Neuroscience & Cognition” at the local university. After months of grey Berlin winter, the soft spring sun warmed us, and the daily fresh croissants were plenty motivation to climb out of bed in time for the early speakers, scheduled at 8am the next morning.

**Tau: the Protein**

**Tauopathy: the Disease**

If you have worked in the field of neurodegeneration, chances are good that you have heard the name Tau. For those unfamiliar, Tau is a member of an exclusive group known as intrinsically disordered, aggregation-prone proteins. This means that Tau has no permanent structure, as made clear by the low-confidence AlphaFold structure prediction in Figure 3. While still a topic of debate at Tau conferences, it is largely accepted that Tau is bound to axonal microtubules in healthy neurons. Through unknown mechanisms of disease, Tau seems to detach from the microtubule and migrate into the soma, where it eventually aggregates into the infamous neurofibrillary tangles. Tauopathy is an umbrella term for neurodegenerative diseases which involve the aggregation of Tau into neurofibrillary tangles.

**The Rainwater Prize**

The first day of the EuroTau convention was funded by a Texas-based organization, The Rainwater Charitable Foundation (RCF) Tau Consortium. As part of the conference events, the RCF awarded two prizes for advances in neurogenerative disease research.

For her work on Tau aggregation and liquid droplets, Berlin’s very own Susanne Wegmann was awarded the Rainwater Prize for Innovative Early Career Scientist. Dr. Wegmann’s lab focuses on investigating the actions of Tau in the cell, both under healthy conditions and neurodegenerative conditions. She has found that Tau functions in three modes: soluble monomolecular Tau, “liquid-like” associations of many Tau molecules (through a process of liquid-liquid phase separation), and solid aggregates of misfolded Tau molecules. The Wegmann lab operates at the boundaries of these phases, demonstrating that these phases interact with other proteins and cellular structures in unique ways.

A second prize for Outstanding Innovation in Neurodegenerative Disease Research was awarded to a three-person team for their joint work in “directly targeting Tau for neurodegenerative diseases.” This powerhouse of a team is comprised of Frank Bennett, Chief Scientific Officer at Ionis Therapeutics; Don Cleveland, Chair and Distinguished Professor of Cellular and Molecular Medicine at UC San Diego, and Tim Miller, Vice Chair of Research and Pro-
Professor at Washington University School of Medicine in St. Louis. Despite textbook knowledge stating that oligonucleotides would never cross the blood-brain barrier, the team forged ahead with their antisense oligonucleotide (ASO) therapeutic approach, and the risk has paid off in spades. ASOs have been shown to decrease the cellular levels of problematic proteins, Tau among them. To lend further credibility to their accomplishments, an ASO developed jointly by Ionis and Biogen to target SOD1-linked ALS gained FDA approval that very day. If their talk is to be believed, a Tau-targeted ASO may be on the same path very soon.

Highlights

Tau researchers will know the Mandelkow name well. Eckhard and Eva-Maria Mandelkow pioneered ground-breaking research on the aggregating properties of Tau and its capacity to cause synapse loss under pathological conditions. Despite having retired a short while ago, Eckard joined EuroTau to give a talk, pointedly named "Some Issues in Tau Research." To this end, Eckard urged caution regarding the models used in the field, many of which ignore the manifold post-translational modifications (native mass spectrometry research indicates an average of 8 phosphorylation sites per molecule of Tau!) or the structural implications of fluorescent tags.

One speaker highlighted a less-oft discussed topic: what, in fact, are the roles of Tau in healthy neurons? Having traveled all the way from University of California Davis, USA, Richard McKinney gave a glimpse into his recently published paper in Nature Chemical Biology, which identifies a new role for Tau liquid phases: so-called Tau envelopes. McKinney and colleagues propose that Tau liquid phases, or "envelopes," form on the microtubules, not only to stabilize the structures but also to control the access of other microtubule-modifying proteins.

Regardless of how much or little the field learns about Tauopathies, a significant, separate challenge persists: diagnosing the disease in patients. The field has long focused on the purported pathological form of Tau: insoluble aggregates. However, as this pursuit has so far yielded little in the way of diagnostic signatures, Bernard Hanseeuw of Harvard Medical School focused instead on the soluble Tau fraction of cerebrospinal fluid. Specifically, Hanseeuw and colleagues identified specific patterns of post-translational modifications of soluble Tau which were predictive of a given tauopathy.

Two Days of Research and Reminders

As a second year doctoral student and first-time EuroTau attendee, I was moved by the breadth of research and incredible progress towards therapies for Tau-related neurodegenerative diseases. While I was familiar with many topics presented at the conference, I always found something new to learn. More sobering was the repeated acknowledgement of the field’s motivations. Patient portraits, incidence rates, and projected case numbers populated the background section of several talks. I left the conference with renewed respect and heightened optimism. The Tau field has its hurdles to contend with, but between fresh research approaches from early career researchers and rising therapeutic avenues, it is clear that the field is inching ever closer to breaking new ground.

Leandre Ravatt
Ph.D. candidate
AG Wegmann, MedNeuro, ECN

Fluorescent tags are frequently attached to proteins in order to visualize them inside cells. The trouble here is that these tags sometimes interfere with the protein’s normal function. For example, it has been shown that GFP hinders the formation of Tau beta-strands, often studied as Tau aggregation. Image reproduced from Kaniyapapan, Mol Neurodegen 2020.
The spaces we live in/move through affect our mood, well-being and behaviour. You can’t deny that the “starry sky” at "Museumsinsel" puts a smile on your face or that buildings with good lighting, ample ventilation and rooftops with great views make that lunch break better! Urban designs that are created with mental health in mind are crucial. What better way to do this than to bring a diverse group of people with expertise in the neurobiology of mood/emotion, experience in mental health/well-being and architectural design?

On Friday the 17th of March, a group from various disciplines such as neuroscience, urban design, architecture, philosophy, psychology, psychiatry, and healthcare got together to design neighbourhoods that promote better mental health and well-being. This “design hackathon” was conceptualized by Charité’s postdoc researcher Prateep Beed, as part of the Brain Awareness Week 2023, with support from the Einstein Center for Neurosciences Berlin and the NeuroCure Cluster of Excellence. Volunteers Margarita Sison, Jeehye An, Shehani Jayalath and Paula Eberhard helped with the organization.

After a fun icebreaker of human bingo and coffee, participants were introduced to the goals and tasks of the hackathon.

Goals:
1. To design neighbourhoods, especially in urban areas that cater to the mental well-being of citizens.
2. To bring together bright minds from diverse areas such as neuroscience, urban design and psychology to work on a challenge together.
3. To ideate, design and integrate different solutions for the hackathon challenge, thereby learning from and complementing each other’s specializations.
4. To set in motion a continuity within this hackathon community to carry on collaborating on such societal issues of utmost importance.

The broader task of this hackathon was to create urban designs for better mental well-being for which three themes of focus were presented:

1. Diversity and Inclusivity: creating designs for diverse communities (i.e., youth, elderly, differently-abled, women, etc...) thereby promoting inclusivity.
2. Climate Neutrality: designs that incorporate aspects of sustainability.
3. Mobility and Flow: modifying the transportation systems within urban spaces (i.e., incorporating car-free zones/squares within cities, etc.)

6 groups of participants were randomly allocated into one of the above themes. Groups 5, 6, and 1 worked on the “Diversity and Inclusivity” theme, group 4 worked on the “Climate Neutrality” theme and groups 2 and 3 worked on the “Mobility and Flow” theme.

The initial brainstorming phase of the hackathon involved identifying the challenge/s in each specific theme, in a neighbourhood of their choice. The fine-tuning phase dealt with contextualizing the chosen environment in relation to mental health by pooling in...
interdisciplinary ideas. The solutions phase involved applying their ideas to scalable and feasible designs.

The designs were judged by an interdisciplinary panel on the following criteria:

1. Innovative
2. Originality
3. Feasibility
4. Interdisciplinarity
5. Scalability

After a dinner break, participants pitched their ideas to each other and the judges. It was evident that the room was filled with a talented bunch of creative thinkers! Their interdisciplinary ideas that were translated into designs (some based on actual Berlin neighbourhoods!) showed promising urban spaces for mental well-being in the near future!

Group 1 emerged as the winner while groups 3 and 6 were tied for 2nd and 3rd places. All three groups will receive mentoring from professionals to navigate obstacles in making their pitch a reality.

This design hackathon was the perfect place for innovative ideas to be born. Gathering minds from different walks of life allow issues to be looked at from multiple perspectives, which helps to solve multidimensional problems! We hope the participants were stimulated by this experience (the onlookers surely were!) and continue to appreciate and be involved in collaboration across cross-disciplinary tasks.

Shehani Jayalath Mudiyanselage
M.Sc. student
MedNeuro (Neurasmus)
Group 1: Mindful maps for exclusivity and diversity: What if your Google map could also tell you where the well-lit paths to go back home are, or what is the best way for someone in a wheelchair to navigate? How awesome is that?

Group 2: Maximum connectivity at a minimum cost, “cities within cities” The brain has many local connections akin to a walkable city where basic needs are accessible within 15 minutes of walking.

Group 3: Combatting sensory overload! Using green images, bird songs and floral scents at U Potsdamer Platz.

Group 4: Recycling what already exists Roofs that produce renewable energy using angled solar panels, with lovely roof gardens that are connected to other rooftops via little walkways, is a win-win for sustainability and better mental health!

Group 5: Socialization within a neighbourhood Satellite buildings for schools and pavilions, using underused green areas into social hubs and introducing city buddies who can show newbies around the city.

Group 6: Mental health support points “Zen domes” (inspired by domes in Japanese gardens) for mental health support with counsellors and spaces for meditation or power naps.
The Class of 2023: Highlights from Master’s Program Applications

This year’s call for applications has received a tremendous response, with almost 100 complete submissions from 52 countries. This is a new record high since the introduction of tuition fees in 2017. The top five countries of origin for the applicants were India (25), Iran (20), Germany (18), Pakistan (18), and Turkey (18). Unsurprisingly, most applicants sought information about the program online through various platforms (98%), rather than relying on traditional poster presentations or fairs.

For those who enjoy statistics, here are some additional figures: 112 women and 68 men began the application process, with 49 ultimately being shortlisted (38 women and 11 men). The top three disciplines among the applicants were Medicine, Biology, and Psychology (112), followed by Neuroscience (5) and other fields (42).

Overall, the program is delighted with the high level of interest and the caliber of the applicants. The selection process was highly competitive, and the program looks forward to welcoming the top candidates, as well as those on the waiting list, to this year’s program.
Impressive Master Thesis Defenses and Project Proposals Presented at MedNeuro

On March 14th of this year, we welcomed senior master’s students to present their thesis projects, alongside their PIs, supervisors, guests, and of course, our junior students. The presentations were divided into hour-long segments, allowing attendees to take breaks to enjoy coffee and snacks while engaging in enthusiastic discussions about the projects. While many projects were presented orally, some ongoing and planned projects were presented as posters due to time constraints, providing even more opportunities for networking during coffee breaks.

Furthermore, three master’s students defended their theses, which, in addition to the proposals, was the second major event of the day. We extend our congratulations to all of the students from our office!

The review panel and the office staff enjoyed the event as much as the students themselves. Overall, the project proposals were extremely impressive.

Introducing the Latest Additions to the MedNeuro Ph.D. Family

On January 15, 2023, just one applicant successfully presented a project on the “Study of cerebral small vessel disease, especially white matter hyperintensities, in association with arterial stiffness and brain histology using MRI” as part of the application process. The applicant, Huma Fatima Ali, has been accepted to conduct her research under the guidance of Prof. Fiebach, Dr. Ivana Galinovic, and Dr. Ahmed Khalil.

Ivana and Ahmed — both alumni of the MedNeuro MSc and Ph.D. program — will provide valuable guidance and support to the applicant during the research project. Huma completed her master’s degree at our partner program, Mind and Brain, and we warmly welcome her to our program’s family.
Hey, Alexa!

Kids who were born in the early-mid 2000s grew up with smart voice activated home assistants like Alexa from Amazon (https://www.amazon.de/b?node=14100226031) and treat it as an integral gadget in their environment. While I would look at my watch to set a mental reminder for 30 minutes or would manually set a timer with my phone, kids these days just say "Alexa, set a timer for 30 minutes". Or give this home assistant other "menial" tasks via voice command. It surely is a phenomenon of habituation, that would probably set in if I owned an Alexa for some time as well, but for this new generation it possesses a whole different implicitness in their lives.

Lilly von Kalckreuth
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DeepL, Google Translate, and AI Text Classifier?

The rise of ChatGPT and other text-generation AI’s has been at the forefront of our societal consciousness for the last months. With teachers, recruiters, and publishers wondering how to best fend off tidal waves of AI-generated text, I wondered how the use of AI-detection strategies might clash with translation software, arguably a very innocent use of AI text generation. When signing up for an account with OpenAI to use their AI Text Classifier tool, I was bemused by their insistence on 1) establishing that I was human, and 2) connecting me with a phone number for security purposes [1]. Once I accessed the tool, which OpenAI’s press release stresses as “not fully reliable” [2], I first submitted the first 5000 words of my article “Mismatched Genes” from the CNS Volume 15, Issue 03. Reassuringly, the result stated: “The classifier considers the text to be very unlikely AI-generated.” I then ran my text through the DeepL free translator [3], a tool which I often use to help me write emails in German and consider to be quite reliable, and suddenly the tool was less sure. The DeepL translation was considered “unclear if it is AI-generated.” By contrast, the classifier regained confidence with a Google Translate-generated German translation, again confirming that the text is “very unlikely AI-generated.”

As AI text generators begin to augment every aspect of our lives, I wonder what tools or authorities we will look to in drawing the lines between human and AI.

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Imprint

Charité NeuroScience (CNS) Newsletter

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Volume 16, Issue 01. Stand: 05/2023

[1] https://tINYURL.com/24pfp4t2
[2] https://tINYURL.com/24r7dxfh
**April**

26.04 | Einstein in the dome: Project KopfKino at Zeiss-Großplanetarium

**May**

01.–02. | ENCODS 2023
02. | 37th European Neurology Congress: The Rise of the Neuronovel and Human Behaviour
04. | Berlin Stem Cell Club (BSCC) Talk: Miki Ebisuya and Thomas Hildebrandt
07. | Performance of the HU Chamber Choir in the Berlin Philharmonie Chamber Hall
09. | 2nd Berlin Networking Event “Human 3D Organ Models” by Charité 3R and Einstein Center 3R
11. | ICNNS 2023: 17. International Conference on Neurorobotics and Neural Systems
22.–24. | Pint of Science Festival

**June**

12.–16. | Women in Memory Research at Ruhr University Bochum
13.–21. | Summer Institute on Bounded Rationality from the MPI for Human Development
17. | Lange Nacht der Wissenschaft
19.–21. | 15th Annual International Conference on Systems Biology of Human Disease (SBHD 2023)
24. | Soapbox Science Berlin
28. | How to prevent predatory publishing? Lecture by Dr. Armin Glatzmeier, online
30. | Serotonin 20-Years-After Conference at the Max Delbrück Center in Berlin-Buch

**August**

31.08.–03.09. | INSIGHT 2023: Psychedelics; Bridging Therapy, Research, and Society

**September**

09.–13. | 11th IBRO World Congress of Neuroscience
13.–16. | 20th International Congress of Neuropathology (ICN2023)
25.–27. | Charting the Course: Open Science Fair in Madrid, Spain
26.–29. | Bernstein Conference
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