COVER
STORY

Tech3Lab
HEC Montréal

IN THE
SPOTLIGHT

NeuroLab at
Copenhagen Business School

YOUNG
ACADEMICS

R. Stefan Greulich
Dresden Univ. of Technology

www.NeuroIS.org

Preface

Dear Readers!

In the current issue of our magazine, you can find several interesting contributions and reports. Pierre-Majorique Léger and Sylvain Sénécal, HEC Montréal and co-founders of Tech3Lab (Canada), provide the cover story. In November 2023, HEC Montréal's Tech3Lab announced that it received 18 million CAD in research funding. This enormous funding amount substantiates this lab's outstanding role in user experience and NeuroIS research. As outlined in the cover story, the co-founders convincingly argue that their research "is distinct, utilizing neuroscience tools to deeply understand the actual experiences of various users—consumers, employees, or citizens interacting with technology". The NeuroIS Society and the research community congratulate the co-directors and researchers at the Tech3Lab on this great success and emphasize that, based on this research funding, various opportunities will arise, particularly for young scientists, to conduct NeuroIS studies. This will significantly advance knowledge and technology development in the field of NeuroIS. Reflecting on the achievements of the Tech3Lab over the past decade, it can be claimed that likely no other laboratory worldwide has generated as many research and development impulses.

Furthermore, we would like to draw attention to the comprehensive report detailing the innovative research conducted at the NeuroLab located at Copenhagen Business School (Denmark). This research institute is dedicated to exploring the intricate connections between digital technologies, social behaviors, and the complexities of the human brain, shedding light on the nuanced interplay that exists within this fascinating intersection of fields. As outlined in the report in detail, this lab offers researchers an excellent infrastructure for NeuroIS and related research, based on various tools related to autonomic nervous system activity measurement like ECG and EDA, as well as EEG measurement. The lab's research topics include, for example, online altruism and charitable giving, online disclosure behaviors, online relationship formation, and creative problem solving. Furthermore, the visionary founder and director of the lab, Rob Gleasure, not only oversees the current research endeavors but also anticipates and envisions future studies exploring novel and diverse topics. Among these prospective areas of investigation are human-AI collaboration, delving into the intricacies of how humans and artificial intelligence systems can effectively collaborate; examinations of body image perceptions, probing the psychological dimensions of self-perception in the context of evolving societal standards; inquiries into sustainable consumption, exploring the behavioral and cognitive aspects of environmentally conscious choices; and investigations into emotion self-regulation, unraveling the mechanisms by which individuals manage and regulate their emotional responses.

A further noteworthy report in the current issue is an exploration of videoconference fatigue. Originating during lockdowns and the surge in remote work and schooling amid the COVID-19 crisis, this phenomenon has evolved into a substantial research focus since the spring of 2020. The insights garnered from researching this phenomenon hold particular significance for practitioners. Understanding the psychological and neurophysiological underpinnings of videoconference fatigue is indispensable for crafting effective coping strategies. The report examines this phenomenon and underscores a recent study that, pioneeringly, neurophysiologically substantiates videoconference fatigue using EEG and ECG. From a NeuroIS standpoint, this phenomenon presents substantial research opportunities. It is imperative to meticulously investigate the origins and ramifications of this emerging form of fatigue, aiming to provide practical knowledge for managers, system developers, and decision-makers at large. As we navigate the evolving landscape of virtual interactions, comprehending and addressing the complexities of videoconference fatigue becomes increasingly crucial for enhancing overall well-being and productivity in the digital era.

In the category "Young Academics" we interviewed R. Stefan Greulich, who works at Dresden University of Technology, Germany. In the interview, Stefan talks about his start with NeuroIS research, why he believes that this kind of research is important, and about challenges for young NeuroIS researchers. In the category "Looking Back" we present a brief report on a NeuroIS delegation that traveled to the Annual Meeting of the Society for Neuroscience in Chicago in October 2019. The objective was to promote scientific exchange with scholars from crucial reference disciplines, including neuroscience, medicine, biology, and psychology.

In the current issue, you will also find a detailed report on the highly successful NeuroIS Retreat 2023 held in Vienna, marking the 15th anniversary of this significant gathering for the community. For individuals unable to attend the event in person, we have created a comprehensive video showcasing the retreat's major highlights. This video is readily available for viewing on our website: www.NeuroIS.org. Moreover, our website hosts a rich assortment of photographs, offering a visual documentation of the positive and engaging atmosphere that permeated the entire conference, providing a virtual experience for those who could not be present in Vienna. Finally, we hope to see you in person at the upcoming NeuroIS Retreat in Vienna in June 2024.

Enjoy this issue of the NeuroIS Society Magazine!

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Pierre-Majorique Léger

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NeuroIS Research at HEC Montréal's Tech3Lab: New Funding and Research Opportunities

By Pierre-Majorique Léger and Sylvain Sénécal, HEC Montréal and Co-founders of Tech3Lab (Canada)

On November 10th, HEC Montréal's Tech3Lab (tech3lab. hec.ca/en/) made a landmark announcement, revealing it has received a significant 18 million CAD (~ 13 million USD and 12 million EURO) in research funding. This injection of funds is earmarked for cutting-edge research in user experience (UX) and Neuro-Information Systems (NeuroIS). This substantial investment, aimed at boosting UX innovation and accelerating digital transformation across various sectors, underscores Tech3Lab's world-class capabilities, international acclaim, and its pivotal role both in Canada and globally. The research at Tech3Lab is distinct, utilizing neuroscience tools to deeply understand the actual experiences of various users—consumers, employees, or citizens interacting with technology. This funding spotlights Tech3Lab's leadership in technological and UX research, establishing a new benchmark in the field. Contributions come from two public granting agencies—the Natural Sciences and Engineering Research Council of Canada (NSERC) and PROMPT—alongside 13 industrial partners. These partners are committed to closely collaborating with Tech3Lab's research team, aiming to enhance UX for their customers and employees across diverse sectors including traditional and electronic commerce, telecommunications, banking, transportation, procurement, online education, culture, and entertainment.

Founded in 2012 by Professors Pierre-Majorique Léger and Sylvain Sénécal at HEC Montréal, Tech3Lab's genesis was inspired by their involvement in an early NeuroIS Retreat. Thanks to funding from the Canadian Foundation for Innovation (CFI), Léger and Sénécal equipped and established Tech3Lab, focusing on evaluating UX within business technologies. The lab expanded to include

Professors Marc Fredette and Constantinos Coursaris as co-directors.

Over a decade after its inception, HEC Montréal's Tech3Lab has developed into the largest university laboratory for UX research globally. It boasts 13 experimental rooms, a fabrication laboratory (fab lab), and a comprehensive selection of neuroscientific equipment. The team at Tech3Lab has seen remarkable growth, now including 18 researchers, 20 research professionals, 15 doctoral students, and over 40 master's students yearly, solidifying its status as a field leader.

NeuroIS Research at Tech3Lab

Tech3Lab houses two research chairs: the Chair in User Experience (UX Chair) and the RBC Financial Group Chair of E-Commerce (RBC Chair). These Chairs not only collaborate closely with industry in UX innovation but also provide exceptional training opportunities for students of the new HEC Montréal Master's degree in UX, in partnership with edX[1], culminating their thesis within these industrial collaborations.

UX Chair

The UX Chair, led by Prof. Léger, is dedicated to thoroughly understanding and compiling precise UX measurements and fostering technological innovations. These efforts aim to boost and enrich UX research, supporting Canadian companies in competing globally. The UX Chair is financially backed by nine organizations, including Alloprof, Blue Yonder, D-BOX Technologies, Deloitte Digital, Desjardins, ServiceNow, Sobeys, Videotron, and Québecor.

Control Room at Tech3Lab,
HEC Montréal

The research program is structured according to three major research directions. The first seeks to develop new insights to enhance and refine UX research tools and methods. It focuses on creating valid, reliable, and robust implicit UX metrics to provide critical diagnostics for UX professionals. The second direction aims to expedite and optimize the UX research cycle using these advanced methods. Its objective is to innovate scientifically at various stages of the enriched UX research cycle for timely information provision to UX professionals. The third direction strives to facilitate the application of enriched UX measures in authentic, real-world contexts, aiming to boost the ecological validity of UX assessments, thereby improving their reliability and applicability in natural usage settings and enabling their use in self-adaptive contexts. The research program also encompasses the enhancement of Tech3Lab's Cobalt ecosystem[2] for physiological measurement, which numerous researchers in the NeuroIS community have utilized in recent years[3].

RBC Chair

The RBC Chair, overseen by Professor Sénécal, complements the UX Chair's program. Its focus is to assist organizations in developing user-friendly technological interfaces, ensuring users are adequately prepared to utilize these interfaces[4]. The RBC Chair is supported financially by five organizations: National Bank of Canada, CAE, Canadian National, LRDG, and Radio-Canada.

Its research agenda revolves around three key themes: cognitive readiness, interface learnability, and personalization. Employing neurophysiological and machine learning methods, this research aims to discern users' cognitive readiness for optimal interface use and identify learning moments. Additionally, leveraging a Brain-Computer Interface (BCI) platform, it explores adapting interfaces in real-time to enhance user learning experiences. The outcomes of this research are set to enable organizations to implement practices that optimize interface learnability. The strategic significance of information technologies and digital transformation in Canada's economy means a wide array of stakeholders, including employees, suppliers, customers, and citizens, will benefit from this research.

One Million CAD for the New Tech3Lab Office in Downtown Montréal

Moreover, Tech3Lab has recently been awarded a 1 million CAD grant by the Canada Foundation for Innovation (CFI)'s John R. Evans Leaders Fund and the Ministère de l'Économie et de l'Innovation du Québec. This grant is designated for new research infrastructure, aimed at fostering a deeper understanding of UX through a multi-method approach, encompassing neurophysiological measures of visual attention, cognitive load, and emotional valence.

Specifically, this infrastructure will feature cutting-edge equipment, enhancing the lab's capabilities with 5 scientific data collection rooms, spanning 174 m². These new facilities and equipment will be located in HEC Montréal's new building in the downtown business district. The equipment includes advanced virtual reality technology for real-time analysis of customer and employee interactions.

This project is expected to significantly impact scientific research in UX, positively influence student training in this field, and contribute to optimizing organizational practices in employee training and customer interactions.

Research Opportunities

These new funds are linked to ambitious research objectives over the next five years. To achieve these goals, the research team will rely on the support of numerous master's students, doctoral candidates, and postdoctoral fellows, alongside the lab's research professionals. Most of the funding will be allocated to graduate student scholarships and postdoctoral fellowships. Consequently, we encourage interested graduate students from the NeuroIS community to reach out to us for further details about research opportunities at the lab.

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References

1   https://www.edx.org/masters/micromasters/hecmontrealx-ux-design-and-evaluation.

2   Léger, P-M., et al. (2022). Caption and Observation Based on the Algorithm for Triangulation (COBALT): Preliminary results from a beta trial. in Information Systems and Neuroscience: NeuroIS Retreat 2022. F.D. Davis, R. Riedl, J. vom Brocke, P. Léger, A.B. Randolph, G.R. Müller-Putz (Eds), Springer, 229–235.

3   Saigot, M. (2022). Leveraging affective friction to improve online creative collaboration: An experimental design. in Information Systems and Neuroscience: NeuroIS Retreat 2022. F.D. Davis, R. Riedl, J. vom Brocke, P. Léger, A.B. Randolph, G.R. Müller-Putz (Eds), Springer, 237–250.

4   Guertin-Lahoud, S., et al. (2023). User experience evaluation in shared interactive virtual reality. Cyberpsychology, Behavior, and Social Networking, 26(4), 263-272.

Pierre Majorique Léger, Sylvain Sénécal, Marc Fredette, Constantinos K. Coursaris (from left to right)

Skin Conductance Measurement based on Cobalt Ecosystem
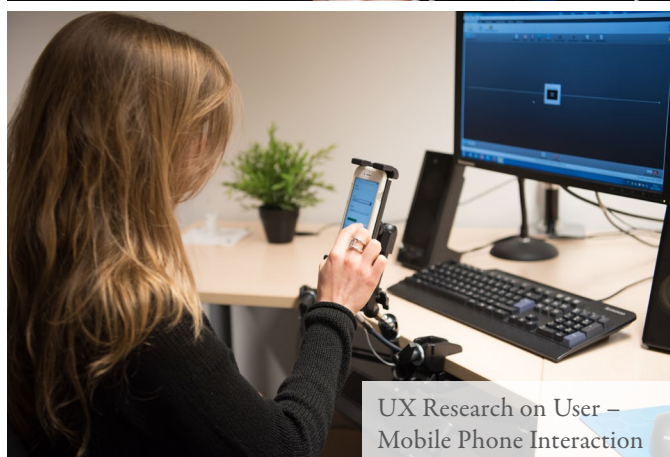
UX Research on User – Mobile Phone Interaction

Tech3Lab ResearchGroup

The NeuroLab at Copenhagen Business School: Studying the Relationship Between Digital Technologies, Social Behaviors, and the Brain

by Rob Gleasure, Founder and Director of the NeuroLab at Copenhagen Business School (Denmark)

Digital systems allow individuals to connect with others across the world, pursue a wide range of professional opportunities, and build communities around specific values and interests. Despite these new capabilities, many people who interact using digital systems complain of feeling isolated, disengaged, and even lonely.

Part of the problem is that the loss of physical proximity can limit individuals' ability to empathize and to appreciate others' perspectives. This can occur for multiple reasons. First, individuals may communicate via digital media that limit subtle, often unconscious social information, such as changes in posture or intonation. Second, individuals can experience contrasting environmental conditions, such as different weather or local events, and these may place individuals in diverging moods. Third, digital networks can lend themselves to social relationships that are more modular and less multiplex.

So how do we study the social and emotional impact of digitalization, given the complex and evolving relationship between interfaces, physiology, information, emotion, and empathy in these systems? And, maybe most importantly, how do we make sure our research contributes to positive change?

To pursue these questions, we are pleased to present the newly established NeuroLab at the Department of Digitalization (DIGI) at Copenhagen Business School. DIGI is one of the largest and most diverse IS departments in the world, with over forty full-time faculty members researching a wide range of topics and using a wide range of methods. What ties this large group of researchers together (apart from a shared love of little cakes) is a fascination with emerging technologies, and the complex and often unpredictable ways these technologies interact with existing systems to produce new social structures, behaviors, and outcomes.

This is why, at the NeuroLab, we seek to combine NeuroIS theories and methods with a socio-technical approach. Within this framework, NeuroIS theories and methods allow us to study emotional and cognitive processes that may not be visible through observation or self-report alone, while the socio-technical approach allows us to contextualize our research within specific social and organizational environments. This is key to creating robust and integrated theory, with strong practical implications.

We have implemented this socio-technical NeuroIS approach in a range of ways. For some research, we have involved industry partners who can provide realistic test scenarios and guide us towards relevant practical problems. For other research, we combined controlled NeuroIS experiments with other studies that can triangulate results, such as quantitative studies of large observational datasets. This allows us to both isolate effects of interest and ensure these effects remain relevant in complex, real-world systems. In other research, we have studied parallel physiological changes in collaborating individuals, and contrasted this with individuals collaborating using digital media. This allows us to model dynamic effects that may evolve over time as individuals respond to one another.

To date, we have researched topics such as online altruism and charitable giving, online disclosure behaviors, online relationship formation, and creative problem solving. Building on these studies, we are planning new projects in the coming months related to human-AI collaboration, body image perceptions, sustainable consumption, and emotion self-regulation. This ability to engage with a wide range of topics is a benefit of positioning the lab within such a large and diverse department.

The infrastructure of the NeuroLab is intentionally simple. At the heart of the lab, we have a control room with two stations for developing protocols and observing participants in other rooms. Next, we have two observation

Dr. Rob Gleasure is Associate Professor and Vice Head at the Department of Digitalization at Copenhagen Business School, Founder and Director of the NeuroLab, and a Carlsberg Young Researcher Fellow.

Ongoing research at the NeuroLab

The Department of Digitalization (DIGI) at Copenhagen Business School

rooms, each of which includes two test stations (meaning up to four subjects can participate at once). Each test station includes eye-tracking, electrocardiography (ECG), electrodermal activity (EDA), and facial expression analysis (FEA). Two stations are also equipped with electroencephalography (EEG). We also have a room dedicated to virtual reality, which also includes embedded eye tracking and mobile ECG. For analysis, we combine a range of software solutions, each with distinct advantages. For ease of use, we run multiple iMotions test stations. For studying parallel physiological changes, we run multiple Noldus Hub test stations.

The response to the NeuroLab has been very positive among faculty, students, and industry partners. It's clear that many people see the potential to engage with interesting problems using this new infrastructure, and to focus more attention on the physiological and neurophysiological aspects of socio-technical systems.

Clearly, the field of NeuroIS is no longer a "new field". Many top studies have appeared in high profile outlets,

and events like the NeuroIS Retreat have enabled a rapid growth in both the number of people doing NeuroIS research, and the sophistication of the research they are doing. However, perhaps the biggest learning so far from setting up the NeuroLab is that there is still so much more potential for the field to grow.

We're excited to play our part in this growth, explore interesting new problems, expand our research group, and help bring through the next generation of NeuroIS researchers.

Many thanks to the Editors of the NeuroIS Magazine for inviting us the opportunity to talk about the NeuroLab, and for all the work they do for the community.

If you would like to know more about us and the work we are doing, then please email me at rg.digi@cbs.dk or go to the website at www.cbs.dk/en/research/departments-and-centres/department-of-digitalization/neurolab.

The NeuroLab team for the
Mood Synchronicity project

The Practitioner's Perspective

Understanding videoconference fatigue: A topic of utmost practical relevance that should be addressed by NeuroIS researchers

In the wake of the COVID-19 pandemic, the surge in virtual interactions has brought to light a novel challenge: videoconference fatigue. This phenomenon, characterized by a sense of exhaustion and disengagement resulting from prolonged and/or inappropriate video-based communication, has garnered significant attention in both academic and professional circles. Understanding the psychological and physiological mechanisms underlying this fatigue is crucial in facilitating the development of effective strategies to mitigate its impact. This article provides a synthesis of videoconference fatigue, highlighting its impact on contemporary communication dynamics. Through a synthesis of recent research findings, it explores the multifaceted nature of this phenomenon and delves into its implications for both individual well-being and organizational productivity. Importantly, this is not only of global relevance and high practical importance, but also constitutes a promising topic for NeuroIS researchers.

The ubiquitous nature of videoconferencing in the contemporary digital landscape has revolutionized communication, enabling seamless connectivity across geographical boundaries. While tools like Zoom, Teams, Webex, or Skype have undeniably facilitated remote collaboration and communication, its widespread adoption has led to the emergence of a previously underexplored psychophysiological phenomenon: videoconference fatigue. This complex issue, characterized by a range of cognitive, emotional, and physiological responses, has significant implications for individuals and organizations alike. As such, an in-depth exploration of videoconference fatigue is imperative to comprehend its multifaceted nature and devise effective strategies to mitigate its detrimental effects.

Videoconference fatigue refers to the psychological and physical exhaustion experienced by individuals as a result of prolonged engagement in video-based communication platforms[1]. It encompasses a spectrum of symptoms, including but not limited to increased stress levels, reduced
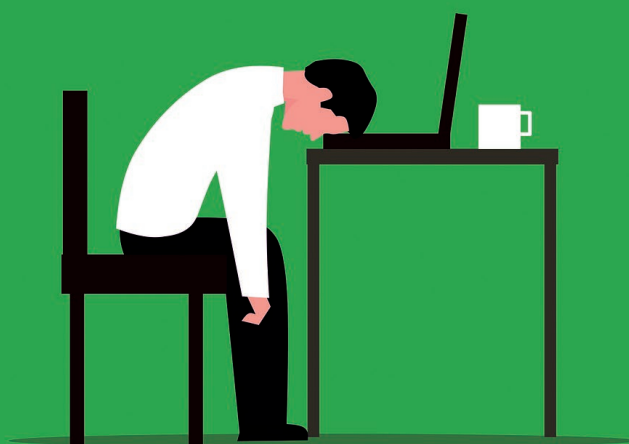
cognitive focus, diminished emotional connection, and heightened feelings of detachment. This phenomenon is primarily attributed to the unique challenges posed by virtual interactions, which often lack the nuanced social cues and nonverbal communication cues present in face-to-face encounters[2].

The significance of understanding videoconference fatigue lies in its pervasive impact on individual well-being, interpersonal relationships, and organizational dynamics. As remote work and virtual communication continue to shape contemporary work environments, recognizing and addressing the challenges associated with videoconference fatigue is crucial in fostering sustainable work practices and promoting employee welfare. Moreover, the implications of this phenomenon extend beyond the realm of individual experiences, encompassing broader organizational productivity, team dynamics, and overall communication efficacy.

A comprehensive understanding of videoconference fatigue necessitates an exploration of the underlying psychological and physiological mechanisms at play. Psychologically, the absence of tangible social presence and the cognitive overload resulting from sustained attention to screens contribute to heightened stress levels, emotional disengagement, and depression and burnout tendencies[3]. Moreover, the cognitive dissonance arising from the incongruence between verbal and nonverbal cues can further exacerbate the sense of detachment and emotional fatigue. Physiologically, the prolonged exposure to digital screens and the sedentary nature of virtual interactions can lead to physical strain, including ocular discomfort, musculoskeletal issues, and increased incidence of headaches[4].

Recent studies have shed light on various aspects of videoconference fatigue. However, to date mostly self-report evidence has shown that videoconference fatigue is a serious issue. Importantly, based on self-reports alone it is hardly possible to provide a comprehensive understanding of a cognitive phenomenon such as videoconference fatigue. Therefore, Riedl et al. examined videoconference fatigue also from a neurophysiological perspective[5].

They used electroencephalography (continuous and event-related) and electrocardiography (heart rate and heart rate variability) to study whether videoconference fatigue can also be proven on a neurophysiological level. A laboratory experiment was conducted and the study context was a university lecture, which was given in a face-to-face and videoconferencing format. The neurophysiological data—together with self-report data—indicate that videoconferencing, if compared to a face-to-face condition, results in changes in the human nervous system which can be interpreted as fatigue. What follows is that individuals and organizations must not ignore the fatigue potential of videoconferencing. A major implication of this NeuroIS study is that videoconferencing should be considered as a possible complement to face-to-face interaction, but not as a substitute.
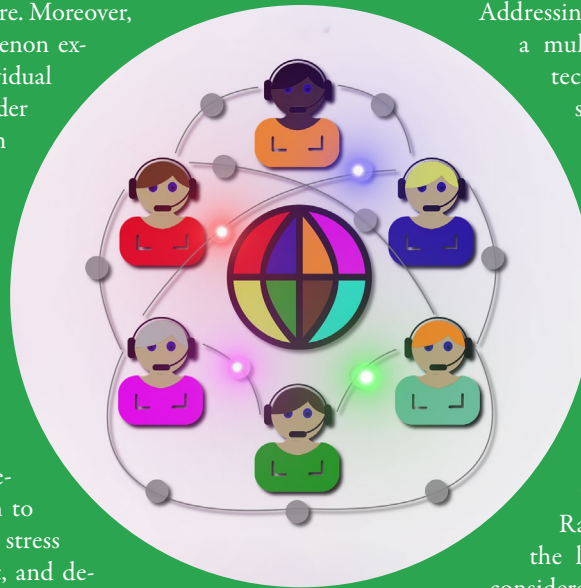
Addressing videoconference fatigue requires a multifaceted approach that combines technological interventions, behavioral strategies, and organizational policies. Implementing frequent screen breaks, incorporating relaxation exercises during virtual meetings, and encouraging offline communication for certain tasks can alleviate the physical and psychological strain associated with prolonged videoconferencing. However, there is a paucity of empirical evidence studying the efficacy of these interventions, strategies, and policies. Rather, current recommendations in the literature are based on conceptual considerations and some indirect evidence from related research fields. As an example, no empirical study to date has explored the efficacy of breaks during videoconferencing. Research in human–computer interaction has already revealed useful insights that should be considered by practitioners. In essence, based on parameters related to the autonomic nervous system activity (e.g., heart rate variability, electrodermal activity, and blood pressure) evidence indicates that a 10 min break during longer interaction with digital technologies may effectively reduce user stress[6-7]. However, these results were not directly established in a videoconferencing context and hence should be directly examined by NeuroIS researchers based on neurophysiological measurement tools and self-report instruments. In the NeuroIS Retreat Proceedings 2023, research-in-progress papers were already published on different aspects of videoconference fatigue[8-10].

To sum up, videoconference fatigue represents a significant challenge in the contemporary digital landscape, necessitating a nuanced understanding of its multifaceted nature and implications. As virtual communication continues to redefine the dynamics of interpersonal interactions and professional collaborations, recognizing the psychological and neurophysiological mechanisms underpinning this phenomenon is essential in devising effective interventions to promote sustainable work practices and foster employee welfare. By acknowledging the complex interplay between technology, human behavior, and organizational dynamics, stakeholders can strive to create an environment conducive to meaningful virtual engagement and mitigate the adverse effects of videoconference fatigue on individual and collective well-being. NeuroIS researchers should actively contribute to better understanding the potential negative effects of using digital technologies, such as video conferencing tools, in order to prevent or at least mitigate adverse impacts. This way, research in the NeuroIS field, as it has done many times in the past, would make an effective contribution to a better world.

References

1. Riedl, R. (2022). On the stress potential of videoconferencing: Definition and root causes of Zoom fatigue. Electronic Markets, 32, 153-177.

2. Bailenson, J. N. (2021). Nonverbal overload: A theoretical argument for the causes of Zoom fatigue. Technology, Mind, and Behavior, 2(1), 1-16.

3. Montag, C. et al. (2022). On the associations between videoconference fatigue, burnout and depression including personality associations. Journal of Affective Disorders Reports, 10(100409), 1-5.

4. Anderson, K., & Looi, J. C. (2020). Chronic Zoom syndrome: Emergence of an insidious and debilitating mental health disorder during COVID-19. Australasian Psychiatry, 28(6), 669.

5. Riedl, R. et al. (2023). Videoconference fatigue from a neurophysiological perspective: Experimental evidence based on electroencephalography (EEG) and electrocardiography (ECG). Scientific Reports, 13(18371), 1-19.

6. Boucsein, W., & Thum, M. (1997). Design of work/rest schedules for computer work based on psychophysiological recovery measures. International Journal of Industrial Ergonomics, 20(1), 51–57.

7. Hjortskov, N. et al. (2004). The effect of mental stress on heart rate variability and blood pressure during computer work. European Journal of Applied Physiology, 92(1–2), 84–89.

8. Öçlü, B., et al. (2023). Combating videoconference fatigue: A pilot study on the efects of video layouts. in Information Systems and Neuroscience: NeuroIS Retreat 2023, Vienna, Austria, F.D. Davis, R. Riedl, J. vom Brocke, P. Léger, A.B. Randolph, G.R. Müller-Putz (Eds), Springer.

9. Stangl, F.J., et al. (2023). Fatigue and stress levels in digital collaboration: A pilot study with video conferencing and the metaverse. in Information Systems and Neuroscience: NeuroIS Retreat 2023, Vienna, Austria, F.D. Davis, R. Riedl, J. vom Brocke, P. Léger, A.B. Randolph, G.R. Müller-Putz (Eds), Springer.

10. Xu, J., et al. (2023). Does self-view mode generate video conferencing fatigue? An experiment using EEG signals. in Information Systems and Neuroscience: NeuroIS Retreat 2023, Vienna, Austria, F.D. Davis, R. Riedl, J. vom Brocke, P. Léger, A.B. Randolph, G.R. Müller-Putz (Eds), Springer.

NeuroIS Retreat:
2023 Review and 2024 Outlook

With the NeuroIS Retreat 2023, the research community celebrated its 15th anniversary. The conference was first held in Gmunden, Austria, in 2009, and this year's anniversary celebration, as in the past few years, took place in Vienna. On the following pages, you will find a summary of the highlights of the 2023 anniversary retreat. Additionally, we provide a preview of the NeuroIS Retreat 2024, which will take place in Vienna from June 9 to 11.

In celebration of its 15th anniversary, the NeuroIS Society has produced a video documenting key facts and highlights from the past. This video is available in both long and short versions at www.neurois.org/neurois-anniversary-video. The following impressive numbers are reported in the video (based on analysis of the period 2009-2022): A total of 322 different individuals from all continents participated at the NeuroIS Retreats. The blend of scholars who presented their work ranges from senior researchers to ambitious students who have realized the enormous potential of neuroscience for IS research. Moreover, a total of 313 scientific papers were presented, and 25 keynotes and hot topic talks were given, predominantly by neuroscience scholars and psychologists. Furthermore, 4 panel discussions were held on major topics in the NeuroIS field and several live demos of neuroscience tools (e.g., EEG) were given.

It was critical for the prosperous development of the research community that tutorials and training courses for young scientists were initiated as pre-retreat events over a decade ago. This provided these individuals with the opportunity to learn from established scientists and gain practical experience. The main goal of these tutorials is to provide knowledge on foundations and advances in neuroscience theories, methods, and tools.

It was also stressed during the anniversary event that in 2015 the conference organizers started publishing the NeuroIS Retreat Proceedings as Springer Lecture Notes, a milestone in the development of the conference. Importantly, several papers which were originally presented at the retreat were ultimately published in top journals such as Management Information Systems Quarterly, Information Systems Research, or Journal of the Association for Information Systems. In preparation for the anniversary event, the download numbers of the Springer Proceedings were analyzed in detail, revealing 240,779 downloads as of April 2023 (source: Springer Link). The fact that these proceedings have been downloaded nearly a quarter of a million times since their initial publication in 2015 demonstrates the successful work of the conference organizers and the NeuroIS Society in general.

Group picture of NeuroIS training course

Dr. Hasan Ayaz (keynote)

Christian Rauscher (Springer)

Honors for outstanding services and achievements in the NeuroIS field

Honors for outstanding services and achievements in the NeuroIS field

Also, it follows that the research presented at the NeuroIS Retreat and published in the proceedings has significant impact. The conference organizers were delighted that Christian Rauscher from Springer, corporate headquarters in Germany, also attended the anniversary event. As part of the celebrations, he delivered a speech, stating, among other things: "I've been really excited to be back at the NeuroIS Retreat this time. And once again, I've seen the spirit of collaboration and of friendship amongst the organizers and the openness towards the young researchers and this sense of value. I really appreciate that."

The NeuroIS Retreat 2023 was a great success

A number of scholars with established reputation, as well as aspiring young students who were eager to carve their own academic paths, participated at the retreat. Together, their collective efforts not only contributed to the advancement of knowledge but also played a significant role in shaping the design of innovative systems. In his summary of the retreat, René Riedl, conference co-chair, expressed great satisfaction and emphasized the remarkable progress in the field. Fred D. Davis, also conference co-chair, summarized the quality of the paper submissions and highlighted that many new young participants presented their research at the retreat and that this circumstance is a very good sign for the future of the field. Gernot R. Müller-Putz, board member of the NeuroIS Society, shared similar sentiments. Jan vom Brocke and Pierre-Majorique Léger, program co-chairs, passionately expressed their feelings about the event, highlighting the strong sense of community among scientists who are eager to share and receive constructive feedback on their research. Pierre-Majorique Léger emphasized that a main objective of the NeuroIS Retreat is to support each other's growth, fostering a thriving scientific community. Adriane B. Randolph, also program co-chair, described the exchange of ideas and new knowledge during the event as simply wonderful. In total, 32 papers were presented during the retreat. As is the case every year, the research topics and applied methods were diverse and stimulating. For example, this year there were several presentations on ChatGPT and its effects and the underlying neurophysiology.

These 32 paper presentations were complemented by a wonderful keynote speech, which was given by Dr. Hasan Ayaz from Drexel University, United States. Furthermore, we had a hot topic talk given by Dr. Thorsten O. Zander from Brandenburg University of Technology, Germany, on neuroadaptive systems.

The title of this year's keynote was "Observing the "Brain at Work" in Everyday Life using Optical Brain Imaging: Challenges and Opportunities for NeuroIS." The understanding of the brain functioning and its utilization for real-world applications including interactions with digital technologies require continuous, safe, accessible, mobile and minimally intrusive monitoring. Dr. Ayaz outlined that existing studies with traditional neuroimaging approaches have accumulated overwhelming knowledge but are limited in scope, i.e. only in artificial lab settings and with simplified parametric tasks. However, it is critical to also understanding the brain in the wild, its activity during real-world tasks in everyday life contexts. In his talk, he explored the latest developments in the growing research area of mobile optical brain imaging, specifically functional near-infrared spectroscopy (fNIRS) and he discussed emerging trends for fNIRS applications, from aerospace to medicine. Also, he outlined that various recent synergistic fNIRS applications for human-human and human-machine interaction, interpersonal neural synchronization, highlight the potential use for NeuroIS and are ushering the dawn of a new age in neuroscience, neuroengineering, and neuroergonomics. During an interview at the retreat, Dr. Ayaz stated when he "came to NeuroIS for the first time, I immediately felt at home. It's not just a warm welcome and great people, but the context and the topics are synergistically aligned with what we have been doing. I'm so happy to hear all this interesting work that is focused on applying neuroscientific methods to real-world

Dr. Thorsten O. Zander (hot topic talk)

problems. I think that is really what matters and how we can make an impact in the real world. I'm so glad to be here and listen to all these great talks. Hopefully, there will be much more collaboration with all the colleagues that I met."

The title of this year's hot topic talk was "Embracing Neuroadaptive Technologies: Shaping the Future of Human-Computer Interaction." Dr. Zander outlined that as we progress into the future, the technologies we adopt and their applications will significantly influence the course of humanity and that effective communication between humans and technology is critical in determining how we utilize these advancements. Brain-Computer Interfaces (BCIs) revolutionized this communication, initially enabling users to transmit direct commands without any muscular involvement. Moreover, he indicated that more than ten years ago, the emergence of Passive BCIs redefined the landscape by extracting information about users' states without the need for intentional communication and today novel human-computer interaction paradigms have emerged, built upon Passive BCIs. In this hot topic talk, it was further indicted that neuroadaptive systems, which develop an understanding of their users and autonomously adapt to their requirements, signify a convergence of human and artificial intelligence. Moreover, various neuroadaptive technologies were presented and it was stressed that the prediction of the legal and ethical implications of this technology is challenging.

All in all, it was concluded that neuroadaptive systems could significantly impact humanity's future, both positively and negatively. Reflecting on his impressions, Dr. Zander stated at the retreat that he is "really happy to be here. I met wonderful people and the surroundings are amazing and I will definitely return."

A video summarizing the NeuroIS Retreat 2023 is available via the NeuroIS.org website. Also, you can find many conference pictures on the website.

www.neurois.org/
neurois-retreat-2023/

Award Winners

A further highlight of the conference was the award session, with the following winners: The Dr. Hermann Zemlicka Award for the most visionary paper was given to Tobias Weiß, Lukas Merkl, and Jella Pfeiffer, Justus Liebig University Gießen (Germany) for their paper entitled "Customer Decision-Making Processes Revisited: Insights from an Eye Tracking and ECG Study using a Hidden Markov Model". Moreover, Rob Gleasure, Copenhagen Business School (Denmark), received the best reviewer award. Also, during the anniversary several individuals were honored for their contributions to the successful development of the NeuroIS field and the NeuroIS Retreat.

Handover of the best reviewer award to Rob Gleasure (left) by Fred D. Davis (right)

Handover of the Dr. Hermann Zemlicka Award by members of the organizing committee (on the picture: Pierre-Majorique Léger, René Riedl, and Adriane B. Randolph) to Tobias Weiß

NeuroIS Retreat 2024

We invite scientists, as well as practitioners with an interest in academic research, to participate at the NeuroIS Retreat 2024. Specifically, the organizing committee welcomes not only completed research, but also work in progress. If you are interested in presenting your research or development project, please submit your paper (please see the submission guidelines at www.NeuroIS.org). English is the language of the conference and of all submissions.

NeuroIS studies comprise conceptual and empirical works, as well as theoretical and design science research. It includes research based on all types of neuroscience and physiological methods. Submissions must be original, and they cannot have been published in another publication outlet. Contributions may address the following topics, among others:

» Employment of neurophysiological tools to study IS phenomena (e.g., technology adoption, mental workload, website design, flow, virtual worlds and metaverse, emotions and human-computer interaction, e-commerce, biofeedback, social networks, information behavior, trust, IT security, usability, avatars, music and user interfaces, multitasking, memory, attention, IS design science, risk, knowledge processes, business process modeling, ERP systems, and AI systems such as ChatGPT)

» Application of psychophysiological approaches to study technostress, videoconference fatigue, information overload, and IT addiction

» Identification of the neural correlates of IS constructs based on neuroscience methods

» Neuroadaptive systems and software prototypes of NeuroIS applications, which use biosignals (e.g., EEG, skin conductance, pupil dilation) as system input

» Discussion of methodological and ethical issues and evaluation of the status of the NeuroIS field

The NeuroIS Retreat 2024 will take place in Vienna, Austria, June 9-11. The deadline for paper submission will be in spring 2024 (for details, please see the information on the website). In case of questions, please do not hesitate to contact us at info@neurois.org.

Young Academics

R. Stefan Greulich

Dresden University of Technology (Germany)

Why did you start NeuroIS research?

My interest started early on. Since childhood, I immersed myself in science fiction and popular science books. I was fascinated with the concept of a cyborg, brain-computer interfaces, and implanted devices. I used to joke that I would someday develop a brain-implantable calculator to help me with math calculations. Since I achieved high marks in the science courses, I decided to approach this dream from a natural science direction. I chose to study biophysics since both those subjects were my strong suit. During my undergrad studies, I took every available course in neuroscience.

In my bachelor thesis, I investigated light-gated ion channels, a novel tool for neuroscience, with electrophysiological recordings. Furthermore, in my master's thesis, I utilized another recently established method called multi-voxel pattern analysis, which combines fMRI with machine learning.

After my doctoral thesis, I felt the need to turn my knowledge of neuroscience methods into action. This goal is what ultimately led me to NeuroIS.

How did you start with NeuroIS?

After my Ph.D. thesis, I had the opportunity to join Professor Brendel. He wanted to expand his Information Systems (IS) research by including interdisciplinary approaches. His goal matched my interest and drive to apply my knowledge in a more applied direction. Early on, we had to overcome some challenges. For instance, I had to immerse myself in the IS community and research traditions. I had to learn the language of IS researchers, the importance of context, and what proved to be the biggest challenge: the switch from a data-driven to a theory-driven field. On the other hand, we had to learn that NeuroIS experiments require more time and resource investments than other IS research methods. We established a NeuroIS lab at the TUD Dresden University of Technology equipped for various neuromethods, such as EEG and eye tracking. We have now concluded the first experiments. For instance, we are investigating how an-
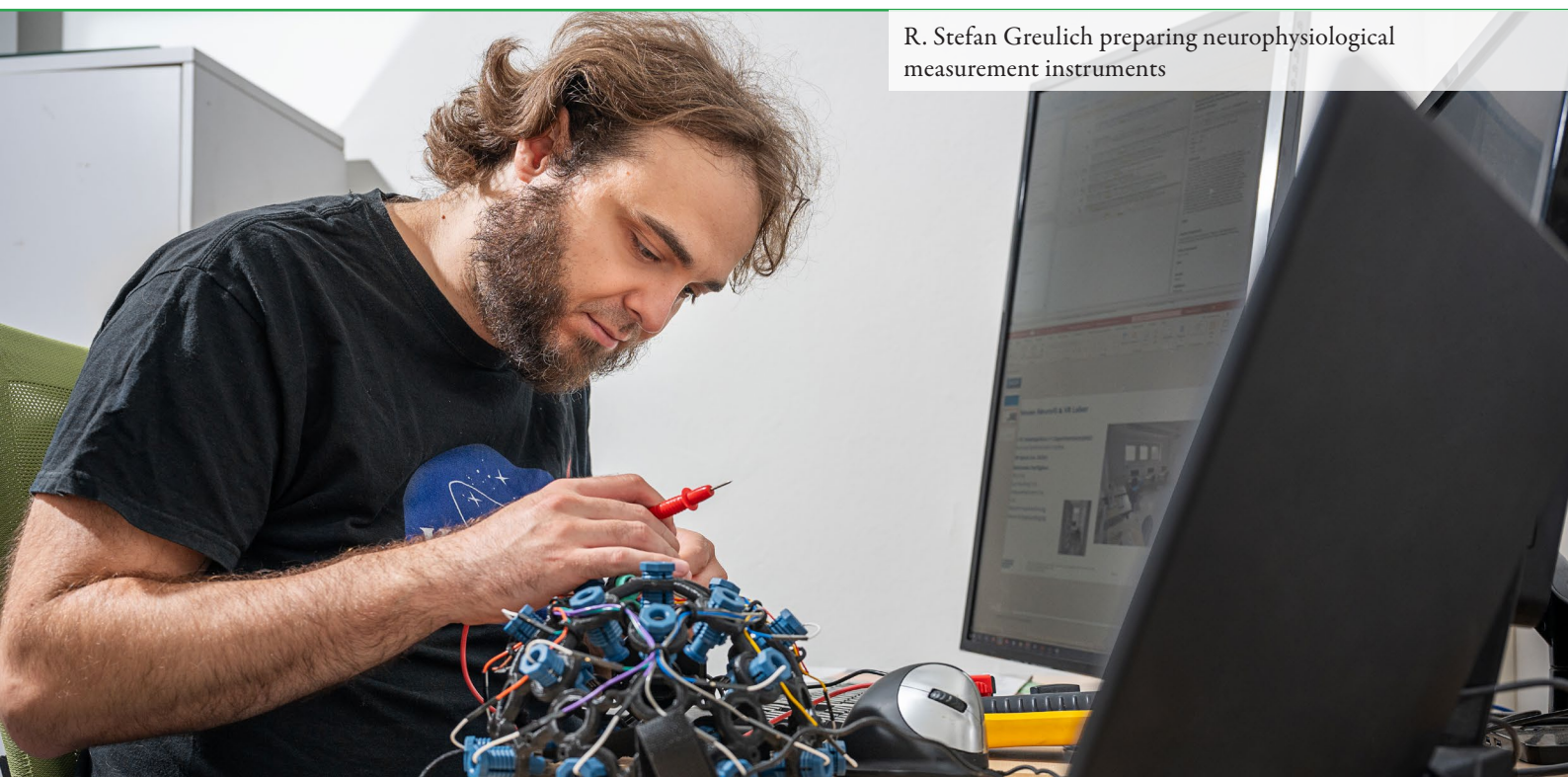

R. Stefan Greulich with a study participant

R. Stefan Greulich presenting his research at the NeuroIS Retreat 2023

R. Stefan Greulich preparing neurophysiological measurement instruments

thropomorphic user interfaces can either present a source of stress or act as a destressor.

Additionally, I learned that my background is beneficial in the context of digital health. Here, my knowledge of human physiology helps with understanding the needs of the stakeholders. I plan to combine NeuroIS and digital health by expanding into assistive technology utilizing affective computing and brain-computer interfaces.

What are challenges for young NeuroIS researchers?

NeuroIS shares the same challenges for young researchers as other fields. Young researchers struggle with the challenging academic career landscape. For instance, I struggle with the "publish or perish" pressure. Neuroscience methods require a heavy investment of time and other resources. Therefore, the rate at which one can publish NeuroIS papers is necessarily low. The lower publication rate makes career progression difficult, especially for me, who joined the field from a different academic background and did not already have publications in high-ranking IS journals.

Another challenge I faced (and other NeuroIS researchers presumably, too) is related to acquiring, installing, and using equipment. On the one hand, we have to find the most cost-efficient hardware available on the market. On the other hand, we have to follow the constant

methodological advancement of the field. Overall, for my NeuroIS research, I cannot utilize off-the-shelf consumer hardware. Therefore, I have to acquire specialized recording hardware and consumables.

Also, presenting to the greater IS community is a challenge. The methods we use are foreign to most IS researchers. However, a balance has to be struck between understandability and reporting methodological rigor. Personally, I am still in the process of figuring out how to present NeuroIS research projects within the page limitations of conferences and journals.

What were the most important moments in your academic career?

After my Ph.D., I almost left academia to follow the private sector's call since I was disillusioned with neuroscience. However, Professor Brendel rekindled that researcher spark by introducing me to NeuroIS.

Of course, after switching to NeuroIS, my first NeuroIS retreat was a definite highlight. There are many opportunities to socialize, connect, and get to know each other. I love the strong sense of community this fosters, spanning junior and senior researchers.

Looking Back

On this last page, we look back to a highlight in the history of NeuroIS.

A NeuroIS delegation travelled to the Annual Meeting of the Society for Neuroscience in Chicago in October 2019 to foster scientific exchange with scholars from important reference disciplines such as neuroscience, medicine, biology, and psychology.

From October 19-23, 2019, the Annual Meeting of the Society for Neuroscience took place in Chicago, USA. The Society for Neuroscience (SfN) was founded in 1969 and now has nearly 35,000 members in almost 100 countries. SfN's objectives are: advance scientific exchange, support the neuroscience community, educate and engage the public, and advocate for the field (see sfn.org). Several NeuroIS community members participated at this conference in the fall of 2019. Among others, the four board members of the NeuroIS Society participated: René Riedl, Gernot R. Müller-Putz, Fred D. Davis, and Pierre-Majorique Léger. Also, further well-known NeuroIS scholars like Adriane B. Randolph, Colin Conrad, Sylvain Sénécal, and Jared Boasen attended the meeting. There, they presented current NeuroIS research projects and established valuable contacts with neuroscientists as well as manufacturers of neurophysiological measurement devic-

es. Thus, this conference participation fostered an exchange that benefitted both the NeuroIS community and scientists in the field of neuroscience. Notably, several neuroscientists showed a keen interest in investigating the neurophysiological effects of the application of digital technologies in the realms of economy and society. This is not surprising, considering that a vast majority of the global population currently utilizes such digital technologies in both professional and private contexts. Consequently, there exist numerous significant phenomena that warrant exploration. Important examples include trust in and acceptance of digital technologies, as well as the potential negative impacts that can arise from the use of information and communication technologies, such as addiction and stress.