

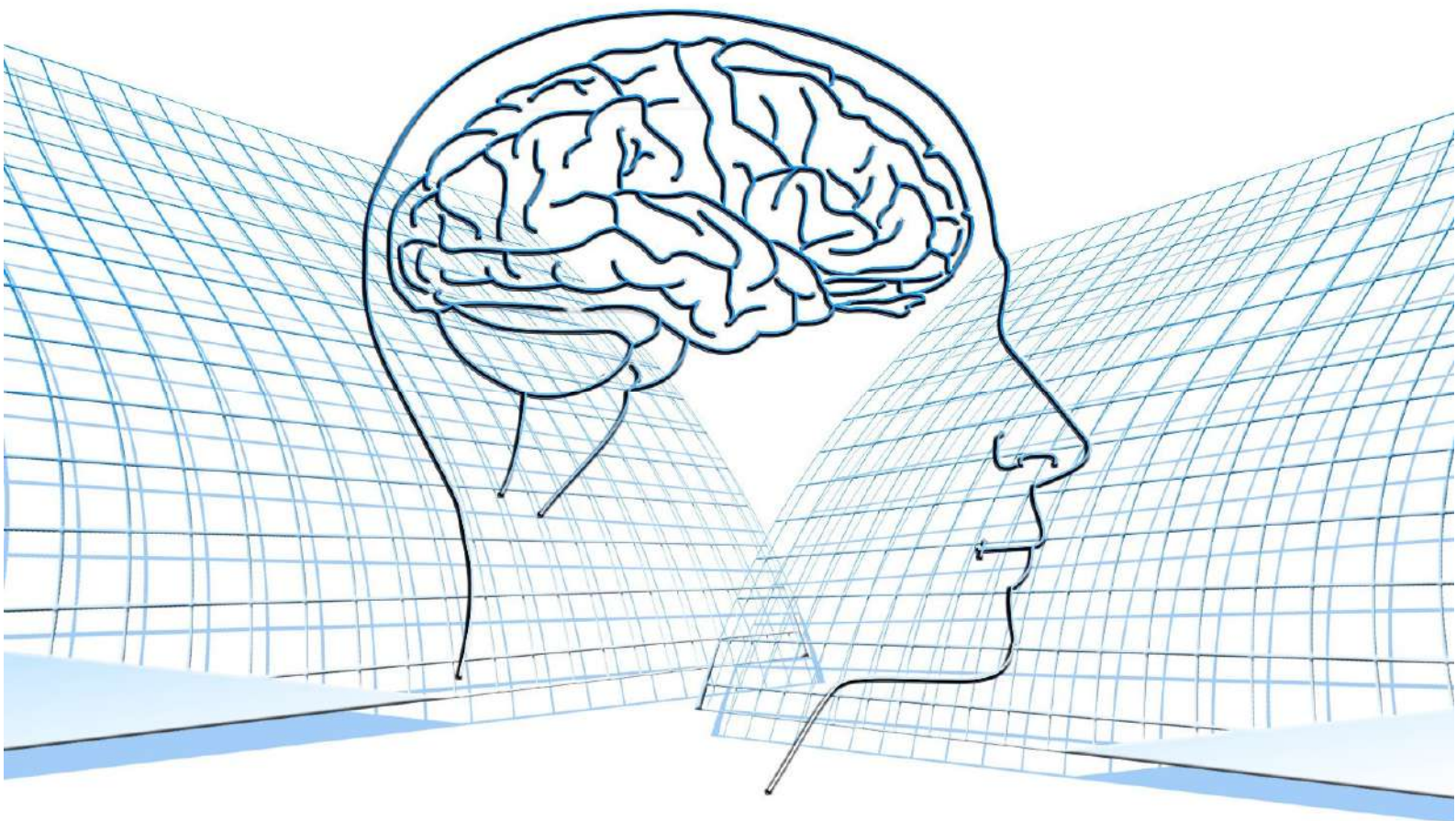
NeuroIS Retreat

The Annual Scientific Event on
Information Systems and Neuroscience

www.NeuroIS.org

10 Years Anniversary Book

René Riedl, Fred D. Davis, Thomas Fischer (Eds.)



Message from the President of Austria



Bundespräsident
Alexander Van der Bellen

Dear Professors, Researchers, and Esteemed Readers,

Science is a fundamental endeavor in human society,
shaping our understanding of the world and the technological progress.
As a former academic I fully appreciate and respect researchers
who significantly contribute to the development of knowledge
and its use and applicability in society.

Neuro-Information-Systems (NeuroIS) with its focus
on the neurophysiological consequences of human interaction
with information and communication technologies
is at the cutting edge of developments affecting science and society today.

The impact of progress in communication and information technology
must not ignore the "human aspects"
including those related to information processing in the brain.
NeuroIS is playing a vital role in this area including the work on innovative systems
that support computer users in their task execution
in a user-friendly way.

The NeuroIS research field has been significantly shaped by the NeuroIS Retreat,
an annual academic conference that has been taking place in our country, Austria.
This scientific conference started in 2009, and this year, in 2018, the event celebrates
its 10 years anniversary with the Vienna Retreat.

I congratulate the conference organisers, and the research community in general,
to this achievement, and I wish the entire field all the best for the future development!

A. Van der Bellen



We thank the following institutions for their support of the publication of this book and the 10 Years Anniversary NeuroIS Retreat.

Main Sponsors



Sponsors



We thank the Town of Gmunden and Andreas Murray (tourism director of the Traunsee region) for their support of the NeuroIS Retreats 2009-2017.



Message from the Main Sponsors

Ladies and Gentlemen,

as Chief Executive Officer of two large software / IT companies in Austria I have experienced various developments in the information and communication industry during the past three decades. Currently, the increasing trend towards digitalization and digital transformation causes significant changes in many organizations worldwide. To cope with these and future challenges it is critical for companies to collaborate with universities and other research institutions. This fact is particularly true for industries that are highly dependent on information and communication technologies.



Some time ago I became aware of the research field of Neuro-Information-Systems (NeuroIS). Using insights and methods from neuroscience to better understand human behavior in the contexts of IT and to design innovative information systems constitutes a new and revolutionary way in IT-related research and engineering. Much of what has been achieved in NeuroIS research is already highly relevant to industry. It is our great pleasure to provide support for this groundbreaking research and the NeuroIS Retreat, the leading academic conference in this research domain worldwide.

In addition to my responsibilities as Chief Executive Officer, I also serve as Honorary Professor in academia and have published several papers on IT topics. Therefore, I appreciate the high-quality articles published by NeuroIS scholars in leading IS as well as multidisciplinary journals. I firmly believe that with the growing of this field more of these high-quality publications can be expected in the future.

I would like to congratulate the NeuroIS Retreat organizers for their achievement, reaching a 10-year milestone of quality research in this field. I wish you all the best for the future!

Sincerely,

Honorary Professor Dr. Hermann Sikora

Chief Executive Officer

Raiffeisen Software GmbH and GRZ IT Center GmbH

Welcome to this book commemorating the 10th annual NeuroIS Retreat

by Fred D. Davis and René Riedl

The NeuroIS Retreat is an annual meeting which first took place in 2009 that brings together interdisciplinary researchers from around the world to discuss research that leverages neuroscience theories and methods to tackle research problems in Information Systems (IS). As we reach this 10-year milestone, we reflect on the emergence and development of NeuroIS as a distinct research area within IS. In this book, we share experiences and impressions of past NeuroIS Retreats as we contemplate the future.

”
*From the beginning, we
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”

The term “NeuroIS” first emerged in a paper presented at the 2007 International Conference on Information Systems (ICIS) in Montréal¹. The “standing room only” attendance at the presentation illustrated the growing interest in brain sciences, stimulated by rapid advances in neuroscience research, particularly in fields such as Neuroeconomics and Cognitive Social Neuroscience. The rapidly growing enthusiasm for neuroscience was underscored by the fact that several other presentations in the context of ICIS 2007 discussed the intersection of neuroscience and IS research.

This initial interest led to the 2009 NeuroIS Retreat in Gmunden, Austria, which brought together a small group of IS and neuroscience researchers to consider the promise of leveraging neuroscience theories and methods in IS research. The Town of Gmunden supported the NeuroIS Retreat from 2009 through 2017.

The 2009 NeuroIS Retreat participants sketched a research agenda^{2,3}, and proposed continuing the event annually. From the beginning, we recognized that it would be critical to establish deep collaboration between IS researchers and brain scientists. We have done well at that. We have had world class keynote speakers from neuroscience every year, plus specialists providing pre-retreat training courses. This has led to many publications co-authored by IS and neuroscience researchers (e.g.,⁴). Neuroscientists are surprisingly

¹ Dimoka, A., Pavlou, P. A., and Davis, F. D. 2007. Neuro-IS: The Potential of Cognitive Neuroscience for Information Systems Research. *Proceedings of the International Conference on Information Systems*, ICIS 2007.

² Riedl, R., Banker, R. D., Benbasat, I., Davis, F. D., Dennis, A. R., Dimoka, A., Gefen, D., Gupta, A., Ischebeck, A., Kenning, P. H., Müller-Putz, G. R., Pavlou, P. A., Straub, D. W., Vom Brocke, J., and Weber, B. 2010. On the Foundations of NeuroIS: Reflections on the Gmunden Retreat 2009. *Communications of the Association for Information Systems* (27), pp. 243-264.

³ Dimoka, A., Banker, R. D., Benbasat, I., Davis, F. D., Dennis, A. R., Gefen, D., Gupta, A., Ischebeck, A., Kenning, P. H., Pavlou, P. A., Müller-Putz, G. R., Riedl, R., Vom Brocke, J., and Weber, B. 2012. On the Use of Neurophysiological Tools in IS Research: Developing a Research Agenda for NeuroIS. *MIS Quarterly* (36:3), pp. 679-702.

⁴ Riedl, R., Mohr, P., Kenning, P., Davis, F. D., Heekeren, H. 2014. Trusting Humans and Avatars: A Brain Imaging Study Based on Evolution Theory. *Journal of Management Information Systems* (30:4), pp. 83-113.

receptive to collaborating with us; they appreciate being able to explore various real-world applications of fundamental neuroscience knowledge.

We have seen three waves of NeuroIS publications. First, papers about possibilities, research agendas, and the promise of NeuroIS. Second, there was a wave of serious empirical articles, including 3 special issues. In the MIS Quarterly (MISQ) 2010 special issue on trust, both papers were NeuroIS papers. In 2014, special issues on NeuroIS were published in the Journal of the Association for Information Systems (JAIS) and the Journal of Management Information Systems (JMIS). A third wave of journal articles is appearing in these and other top IS journals, including Information Systems Research (ISR) and European Journal of Information Systems (EJIS) as well as top journals outside the IS discipline such as Computers in Human Behavior and PLOS ONE.

This serious traction at high quality journals is establishing credibility and legitimacy for NeuroIS. We applaud the authors of a recent ISR NeuroIS paper that was awarded “Best Published Paper” in 2016⁵ – this paper was originally presented at the 2015 NeuroIS Retreat. Editorial boards of IS journals are increasingly accepting the rigor and legitimacy of neuro paradigms, and a recent NeuroIS book outlines fundamentals of NeuroIS and major applications of neuroscience theories and tools in IS research⁶. For a decade or so, this is impressive progress. The annual NeuroIS Retreat provides an important foundation for this ongoing progress.

”
*Application of neuroscience
in IS design science
research, including the
development of neuro-
adaptive systems, has also
turned out as a major
stream in NeuroIS research.*

”

As the NeuroIS field has emerged, it is possible to identify some topics that have attracted several publications, including Online Trust, IT Security Behaviors, Online Search, Technostress, Emotions in IT Use, IT Addiction, and others. More broadly, the application of neuroscience in IS design science research, including the development of neuro-adaptive systems, has emerged as a major stream in NeuroIS research, one that holds significant future research potential⁷.

In the period 2009-2017 (i.e., before the 10 years anniversary event) a total of 166 different scientists from all continents participated in the NeuroIS Retreats. The blend of IS and neuroscience scholars who presented their work ranges from senior researchers to ambitious students who have realized the enormous potential of neuroscience for IS research. All 166 former conference participants are listed at the end of this book. Thanks to all participants!

A total of 166 scientific papers were presented at the NeuroIS Retreats in the period 2009-2017. Moreover, 14 keynote talks were given, predominantly by neuroscience scholars, and 3 panel discussions were held on major topics in the NeuroIS field. We had live demos of neuroscience tools at several NeuroIS Retreats (e.g., EEG demos). In 2012, we started tutorials which are held as pre-retreat workshops. The main goal of these tutorials is to

⁵ Jenkins, J. L., Anderson, B. B., Vance, A., Kirwan, C. B., and Eargle, D. 2016. More Harm Than Good? How Messages That Interrupt Can Make Us Vulnerable. *Information Systems Research* (27:4), pp. 880-896.

⁶ Riedl, R. and Léger, P.-M.: *Fundamentals of NeuroIS – Information Systems and the Brain*. Springer, 2016.

⁷ vom Brocke, J., Riedl, R., and Léger, P.-M. 2013. Application Strategies for Neuroscience in Information Systems Design Science Research. *Journal of Computer Information Systems* (53:3), pp. 1-13.

provide knowledge on foundations and advances in neuroscience theories, methods, and tools. In 2015 we started to publish the NeuroIS Retreat Proceedings as Springer Lecture Notes, a milestone in the development of the conference.

We highlight the change of the location from Gmunden, a small health and summer resort in Austria situated at Lake Traunsee, to Vienna, one of the world's most beautiful cities. Gmunden offered an inspiring environment which helped to establish and develop the NeuroIS initiative. The "Gmunden Retreat" gained global recognition as a home base for NeuroIS. However, because the participants of the NeuroIS Retreat come from all over the world, reachability became an increasingly important factor over the years, and hence we decided to transfer the NeuroIS Retreat to Vienna. Despite the fact that we are moving from a small city to a metropolis, the Retreat will retain its informal "collaborative workshop" atmosphere with plenty of interaction and networking. Moreover, we welcome research-in-progress, and authors should get feedback at the conference to advance their papers so that the works ultimately get published in high-caliber academic journals. As we open a new chapter in the development of the field, we expect that Vienna will carry on as the symbolic and inspirational "Austrian home base" for NeuroIS.

The growth of NeuroIS is documented by a recent review paper presented at the 2017 International Conference on Information Systems (ICIS) in Seoul⁸; this paper reports on 164 NeuroIS articles published in 55 journals and 11 conference proceedings (not including the NeuroIS Retreat proceedings) by 362 authors from 88 countries spanning all continents. The paper concludes that "NeuroIS has become an established research field in the IS discipline ... the NeuroIS community has definitely reached a critical mass of active researchers who serve in the role of author, reviewer, and editor ... the expectations regarding the potential of NeuroIS to contribute to both IS theory and practice seem to be fairly realistic today" [p. 17]. We firmly believe that the NeuroIS Retreat has significantly contributed to the formation of the NeuroIS community, and we hope in the next decade NeuroIS will continue to make similar progress.

In this book, the reader can find impressions related to the NeuroIS Retreat and to NeuroIS in general. Because Thomas Fischer contributed to the development of this book, we invited him to serve as co-editor. Enjoy this anniversary book.



Fred D. Davis



René Riedl

NeuroIS Retreat Conference Co-Chairs

⁸ Riedl, R., Fischer, T., and Léger, P-M. 2017. A Decade of NeuroIS Research: Status Quo, Challenges, and Future Directions. *Proceedings of the International Conference on Information Systems*, ICIS 2017.

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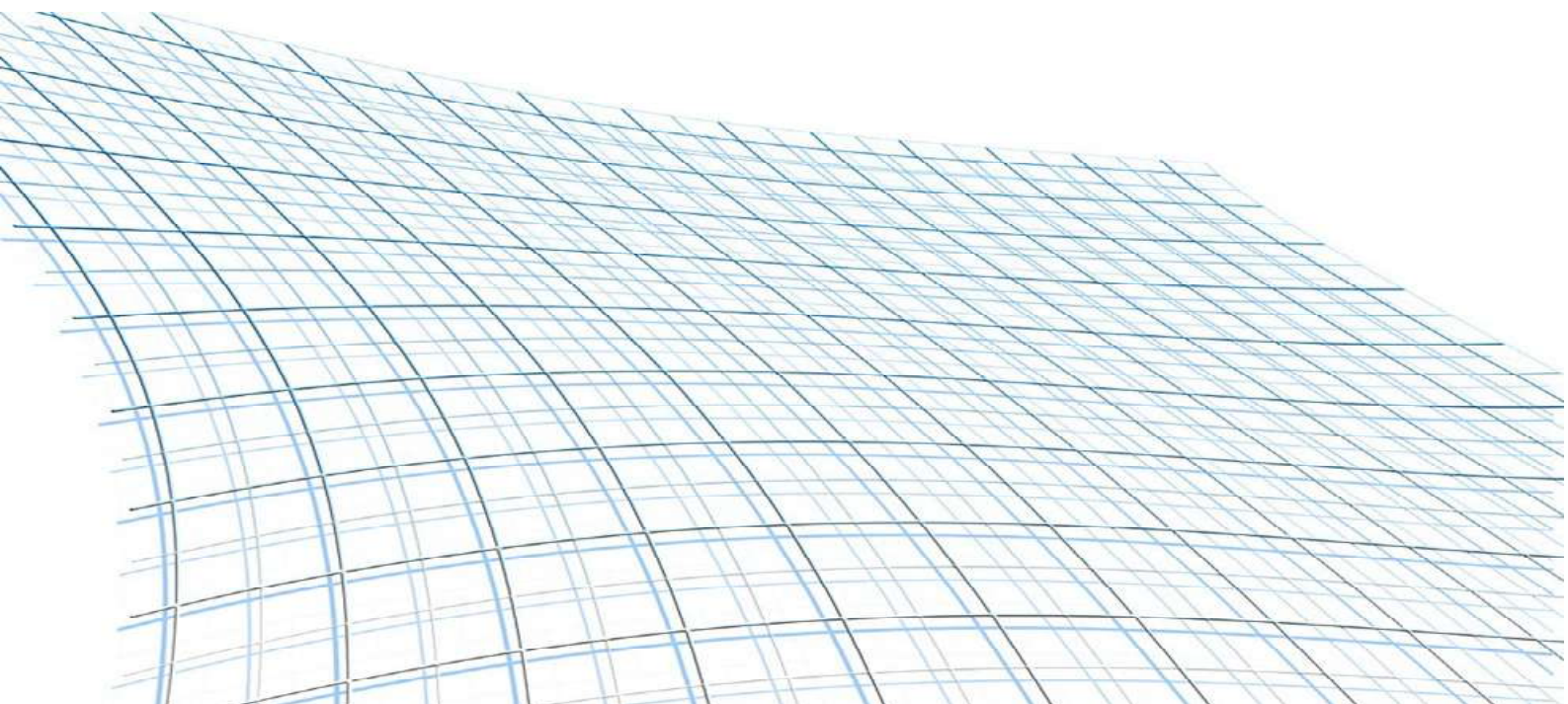
NeuroIS

Due to the increased availability of neuroscience tools and theories, Information Systems (IS) scholars have begun to investigate the potential of neuroscience for IS research. Given the extensive neuroscience literature that has been developed during the last decades, there are many insights that can be drawn from the existing body of knowledge to inform IS research.

The advent of neuroscience tools and theories allows IS research to integrate biological factors, in particular those related to the nervous system, into research on how humans develop and use information and communication technologies. This, in turn, advances our understanding of many IS phenomena (e.g., information processing, technology acceptance, or user well-being), and better theories positively affect the design and development of better systems. Against this background, we consider neuroscience approaches as valuable complements to existing IS methods and knowledge.

Neuro-Information-Systems (NeuroIS) is a scientific field that relies on neuroscience and neurophysiological theories and tools to better understand the development, use, and impact of information and communication technologies. NeuroIS seeks to contribute to (i) the development of new and advanced theories that make possible accurate predictions of IS-related behaviors, and (ii) the design of systems that positively affect economic and societal outcomes (e.g., productivity, well-being).

NeuroIS examines topics lying at the intersection of IS research and neurophysiology and the brain sciences. Specifically, 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 neurophysiological tools, spanning techniques such as electroencephalography (EEG), functional magnetic resonance imaging (fMRI), hormone assessments, skin conductance and heart rate measurement, facial electromyography, and eye-tracking, among others. Moreover, it is already foreseeable that quantitative and molecular genetics will play a role in future NeuroIS research.

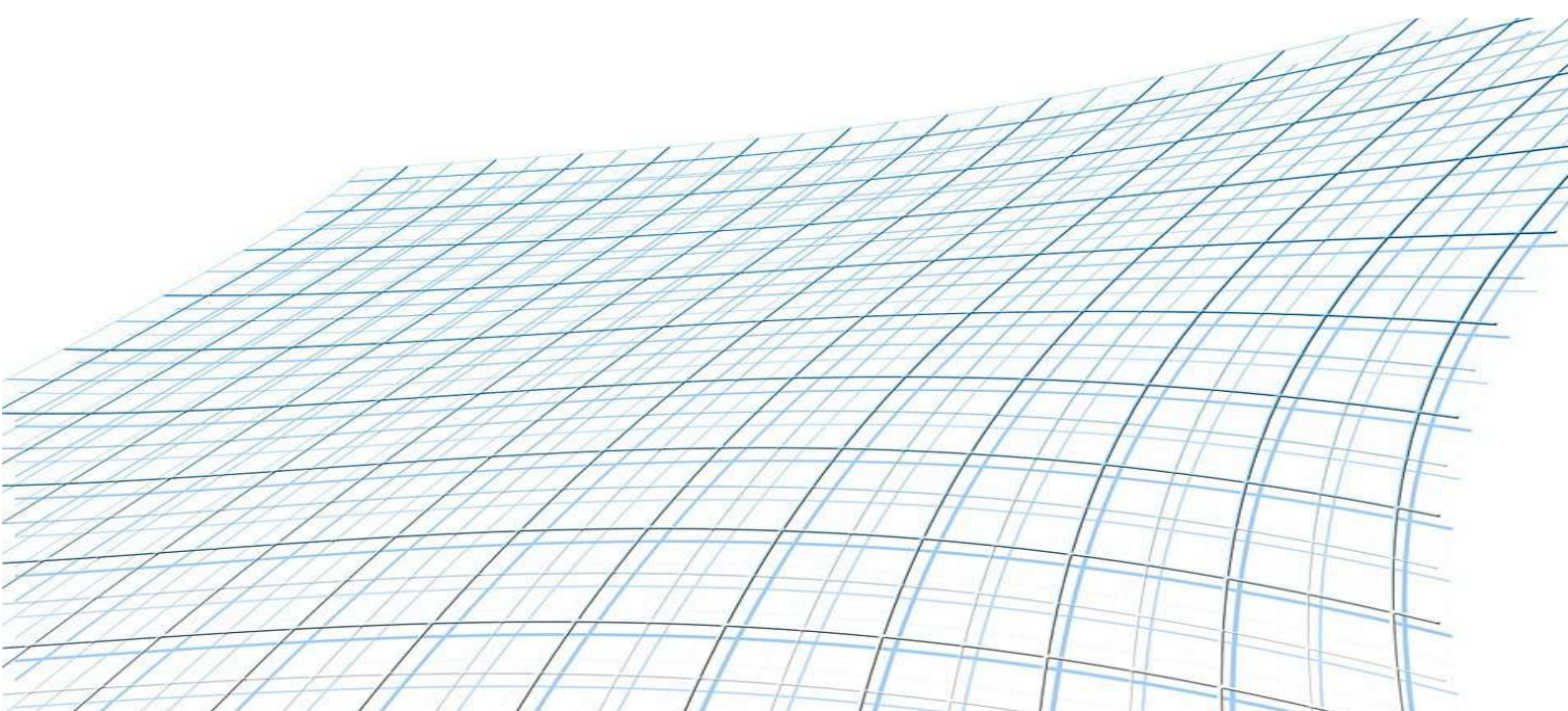


Genesis

Since its genesis in the 1960s, IS research has drawn extensively upon knowledge from multiple scientific disciplines (e.g., psychology, sociology, economics, management, and computer science), which has contributed to its interdisciplinary nature. Concepts and theories, as well as methods and tools, from various reference disciplines have positively affected both the development and current structure of the IS discipline, as well as its publications.

Despite the fact that a very limited number of publications on information and communication technologies and neuroscience research have been available since the 1990s, the idea of applying cognitive neuroscience approaches in IS research appeared in the context of the 2007 International Conference on Information Systems (ICIS) in Montréal. Since that time, the field has been developing at a rapid pace.

In 2009, an academic event took place in Austria to develop a research agenda for NeuroIS that would bring together IS researchers with experience and/or interest in NeuroIS with academics from neuroscience. The Retreat has developed into an annual scientific conference for presenting research and development projects at the nexus of IS and neurobiology, the NeuroIS Retreat (www.NeuroIS.org). This event has the objective to promote the successful development of the NeuroIS field. Importantly, it is best characterized by its “workshop atmosphere”, and this format promotes inspired reflection on recent developments in neuroscience and the potential of the brain sciences and neurobiology for IS research. This year, 2018, the NeuroIS Retreat celebrates the 10 years anniversary. This is a great success, and it is the result of hard work of an enthusiastic scientific community, the NeuroIS community.



NeuroIS Retreat 2009



September 22-24
Schlosshotel Freisitz-Roith

The primary objectives of the 2009 NeuroIS Retreat were to explore the following questions:

- >> Which cognitive neuroscience methods and theories are relevant for IS research?
- >> What are IS research topics that are appropriate for investigation by means of neuroscience methods?
- >> What should be the normative standards for NeuroIS research?
- >> What are promising approaches to establish NeuroIS as a new subfield within the IS discipline?
- >> What core cognitive neuroscience knowledge would IS researchers need to be NeuroIS researchers?
- >> What degree of collaboration will be needed between IS researchers and brain researchers, at least initially?
- >> How receptive will leading IS journals be to NeuroIS research?



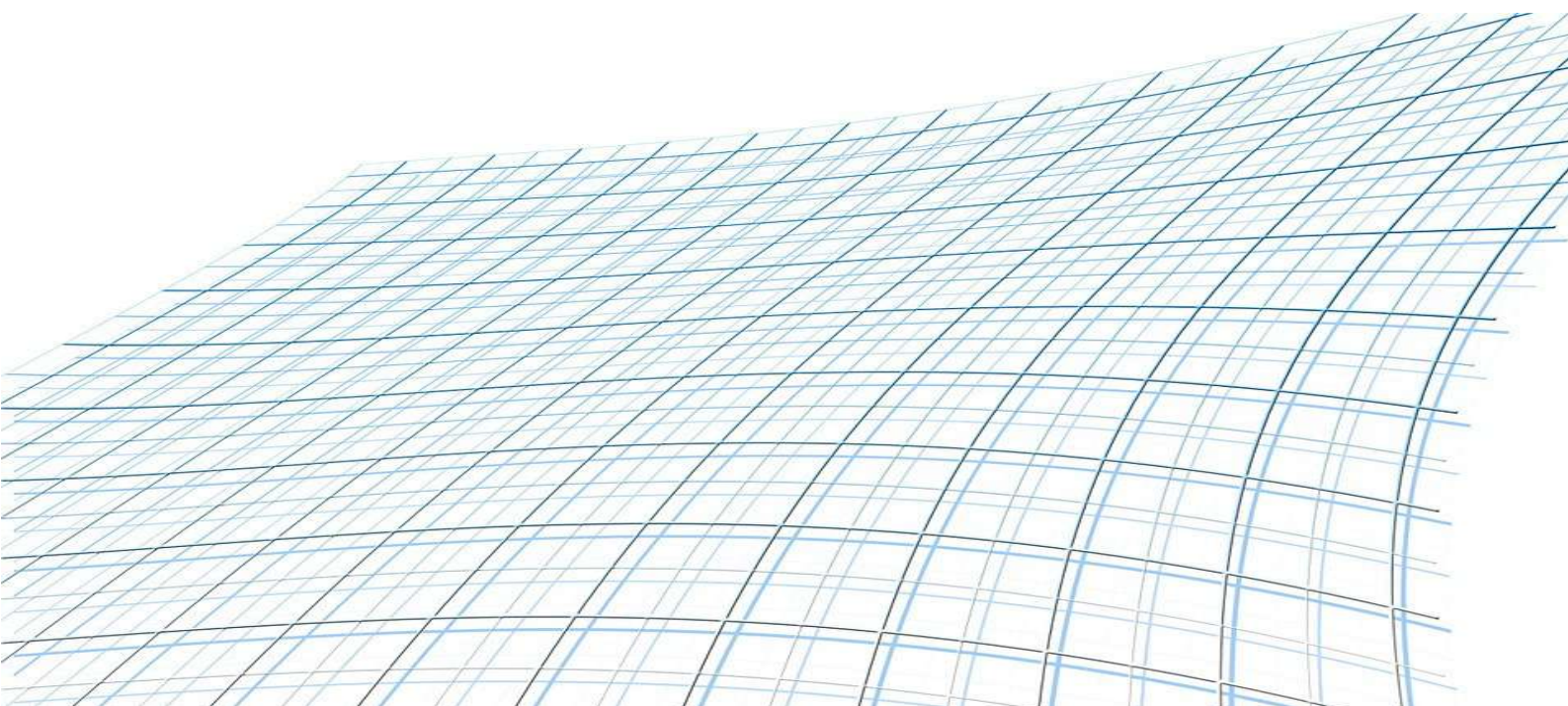
Bernd Weber, René Riedl, Angelika Dimoka,
Fred D. Davis, and Heinz Köppl

Keynote by Bernd Weber

Neuroeconomics: On the biological basis of human decision making

In the keynote speech in 2009 Bernd Weber talked about neuroeconomics and the biological basis of human decision making. He provided insights into methods used in neuroeconomics, coming from psychology, experimental economics and neuroscience, to better understand mechanisms and neural computations underlying human behavior. He especially focused on social interactions and monetary choices, showing how humans integrate social context into the valuation of rewards.





Conference dinner



Izak Benbasat and Paul Pavlou



Alok Gupta



Rajiv Banker

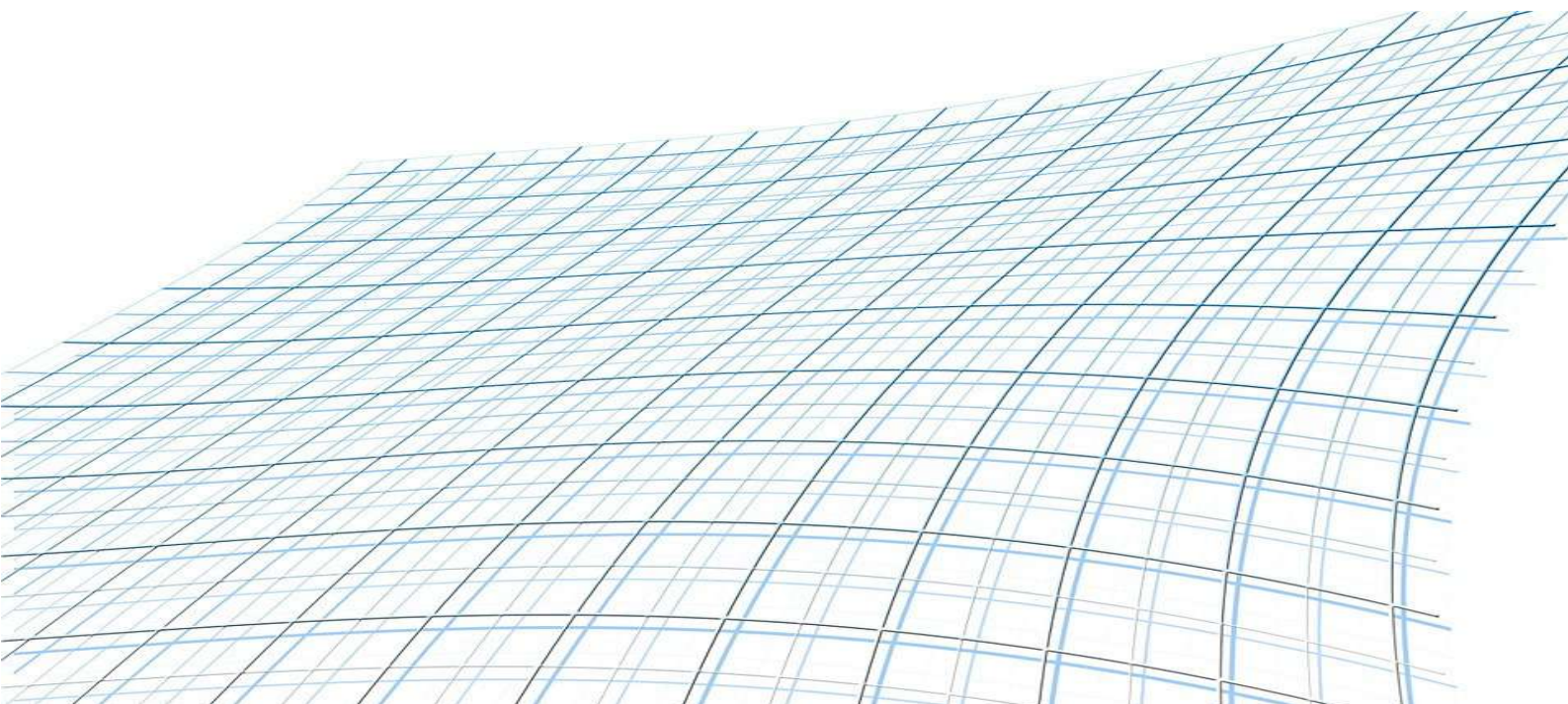


Fred D. Davis, Izak Benbasat, and David Gefen

NeuroIS Retreat 2010



June 28-30
Schlosshotel Freisitz-Roith



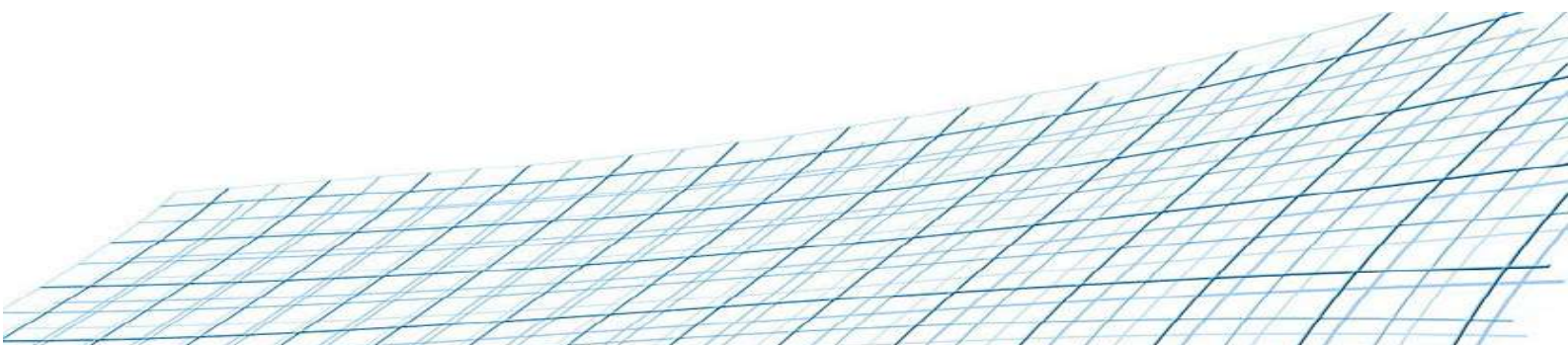
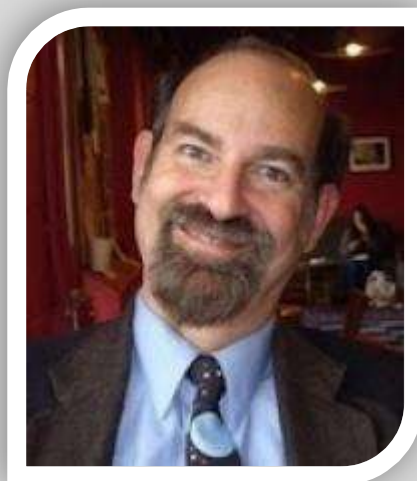


Brain-Computer Interaction demonstration
by Alex Kreiling and Christa Neuper



Heinz Köppl, René Riedl, Christa Neuper, Fred D. Davis,
Robert Savoy, Peter Kenning, Andreas Murray

Keynote by Robert Savoy
**The interaction and complementarity of
behavioral research with functional MRI**



Keynote by Christa Neuper
Brain-computer interaction (BCI)





Pierre-Majorique Léger



Group discussion



Jan vom Brocke



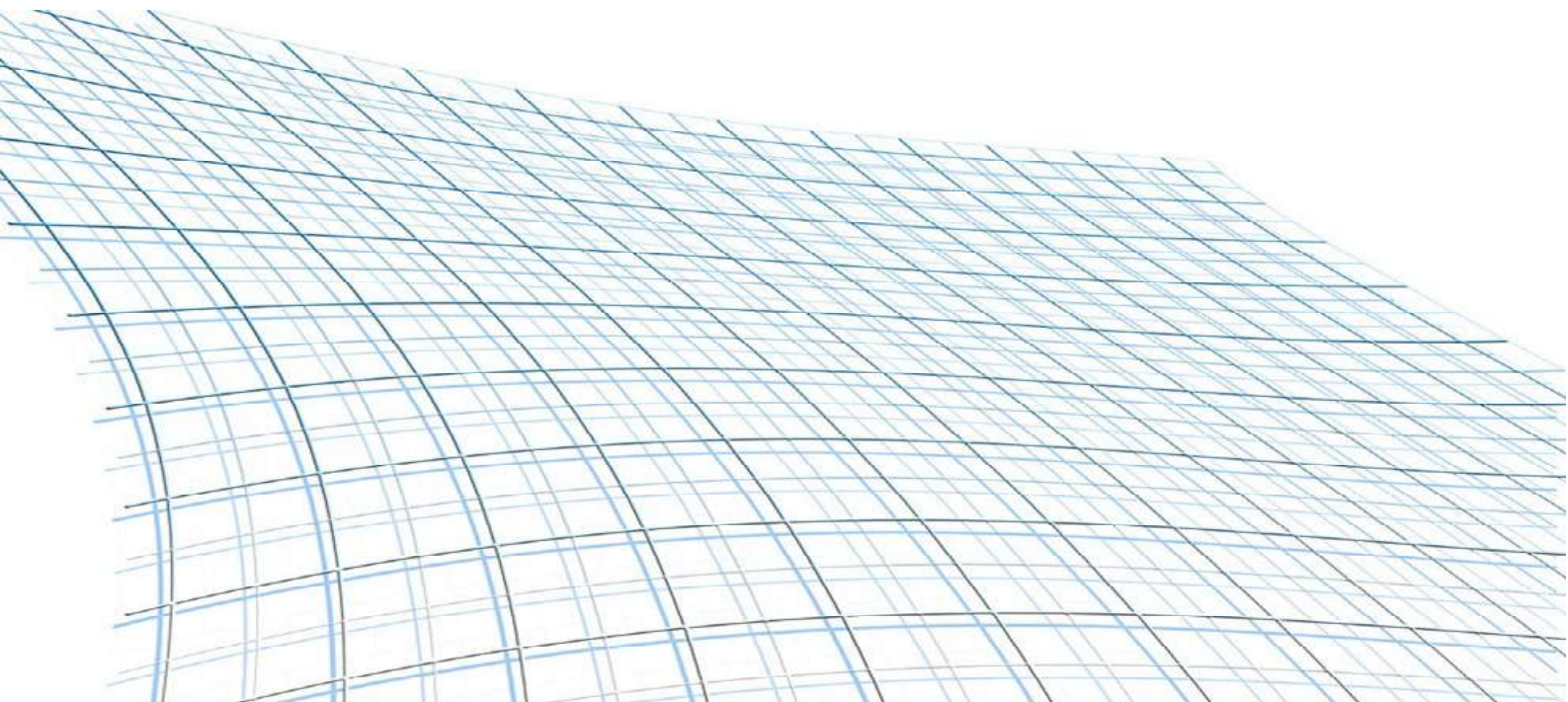
Group discussion

NeuroIS Retreat 2011



June 26-28
Schlosshotel Freisitz-Roith

**Special guest: Barbara Prammer (first row, center),
former President of the National Council of Austria**



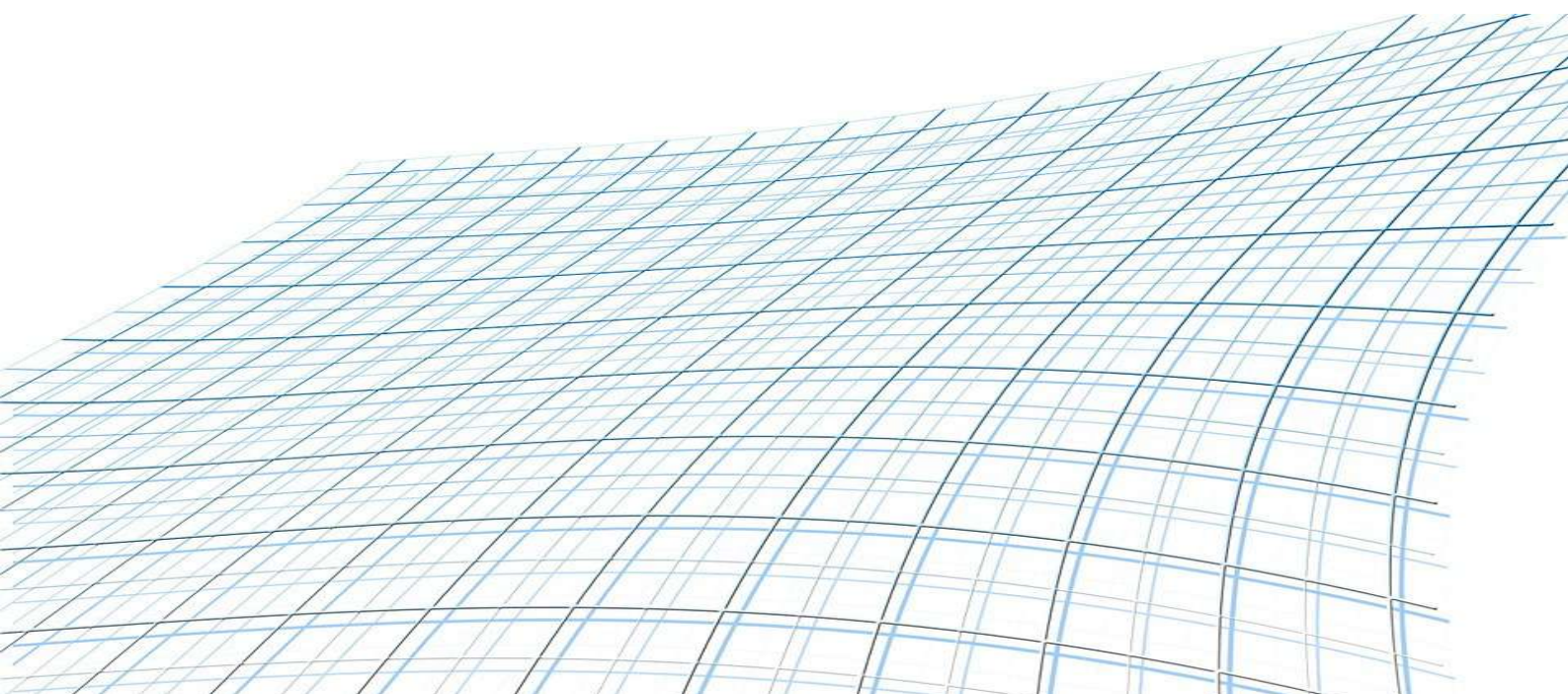
Keynote by Martin Reuter

Genetic approaches to the field of NeuroIS



NeuroIS is interested in the role of the brain for human decision-making and information processing. The predominant techniques used are magnetic resonance imaging (MRI) and electroencephalography (EEG) relating brain activity and structural differences in brain anatomy to behavior. However, the use of MRI and EEG is often limited to laboratory settings, whereas genetic studies that are used very seldom until now are not. Thus, the ecological validity of genetic studies is high, a factor that could promote the application of genetic approaches in the IS discipline, similarly to recent developments in neuroeconomics and social neuroscience. The

talk gave an introduction into the field of behavioral genetics addressing fundamental questions like “Is a certain phenotype heritable and how can I prove this?”, “How can I quantify heritability?”, and “Which genes are related to a certain phenotype and how can I genotype?”. Moreover, empirical studies were presented that demonstrate how gene variations can influence human decision-making. The focus was on molecular genetic studies investigating human trust and altruism. Further research directions were outlined that combine genetic and MRI data or prove the functionality of candidate genes.



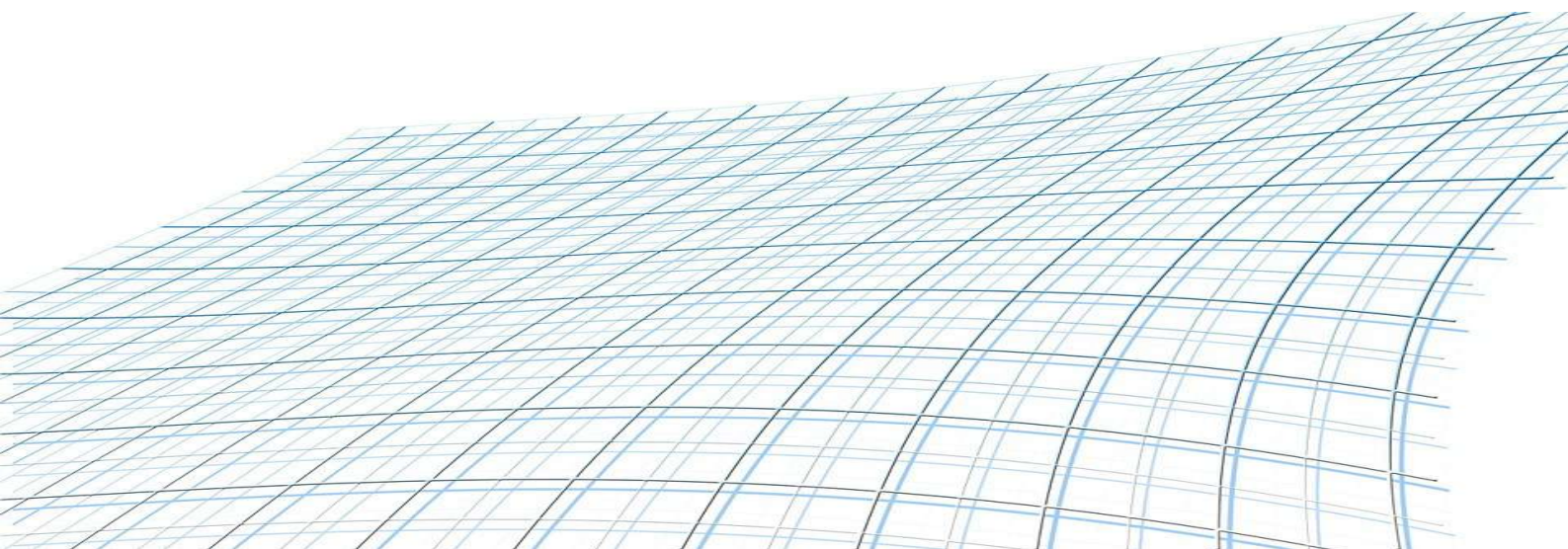
Keynote by Alan Hevner

NeuroDesign research in Information Systems: A proposal



The use of neuroscience to investigate research questions in the Information Systems (IS) field has grown rapidly with the availability of methods and tools adapted to IS research and application environments. Design science research in IS centers on the activities of Build and Evaluate performed in design cycles followed by more extensive evaluations in a field setting. The majority of current NeuroIS work focuses on the Evaluate activity while little has been studied on the Build activity. In this keynote, Alan Hevner proposed a framework for bringing neuroscience to bear on the activities of building IS design artifacts.

Drawing from the development of software-intensive systems, a set of key design principles were identified and examined (creativity, complexity, control, composition, collaboration, and communication). NeuroDesign research questions were posed for the study of how each impacts the Build activity in design science research. The goal was to expand the influence and impact of NeuroIS research to important questions of how to discover (e.g. build) the best design artifacts for innovative IS solutions.

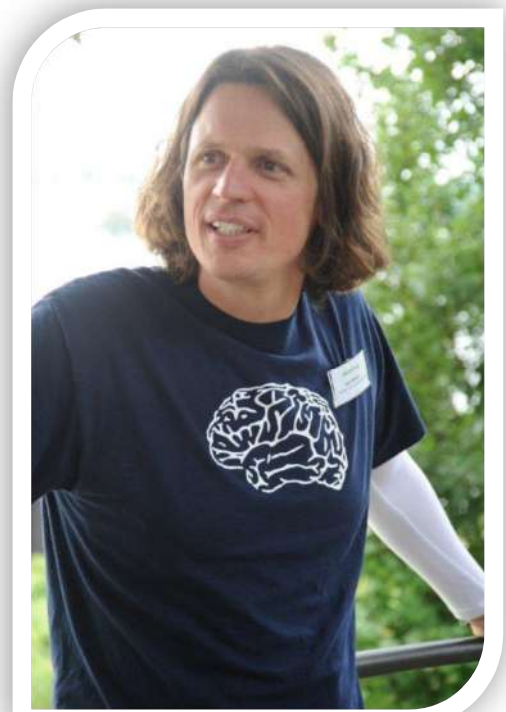




Conference dinner



Glenn Browne and Alan Hevner



Eric Walden

NeuroIS Retreat 2012



June 3-6
Schlosshotel Freisitz-Roith



Adriane Randolph



Marc Adam

Keynote by Anja Ischebeck
The search for information



Keynote by Anja Ischebeck
 and group discussion

Processing information effectively determines our success in life. While we are confronted with an overwhelming amount of information, we have to quickly select the potentially relevant bits. Humans tend to search for information that is consistent with their beliefs and to downplay information that is not. This tendency could be driven by the emotional need to reduce an informational conflict (cognitive dissonance) or reflect a cognitive deficit to process information contrary to one's own beliefs. Imaging studies showed that both, cognition and emotion, play a role in the search for information after decisions. Information about the self is particularly relevant and is processed differently from information about other people. Humans show a tendency to confirm positive information and to reject potentially bad information about themselves. It could be shown that this tendency becomes stronger under a threat of self value. Studies using fMRI elucidated the brain areas involved in the processing of information about the self. These brain areas are different from those responding under threat possibly indicating that information about the self is processed differently from its emotional content. The results so far show that neuroscience can greatly inform social psychology and applied psychology.

Keynote by Gernot Müller-Putz

Hybrid brain-computer interfacing: Principles and applications



This keynote speech included a live demonstration of a hybrid brain-computer interface implementation platform, the live demo was assisted by Christian Breitwieser.

Panel: Senior Scholars' Perspectives on NeuroIS



Shirley Gregor, David Gefen, Ting-Peng Liang, Christof Weinhardt, René Riedl



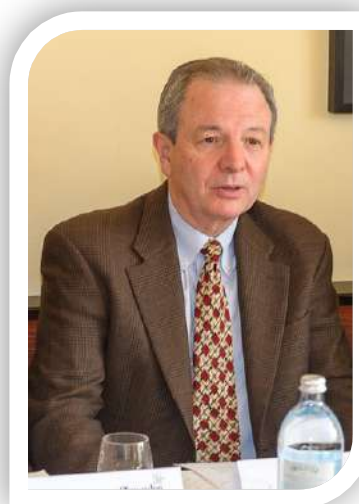
Alan Dennis



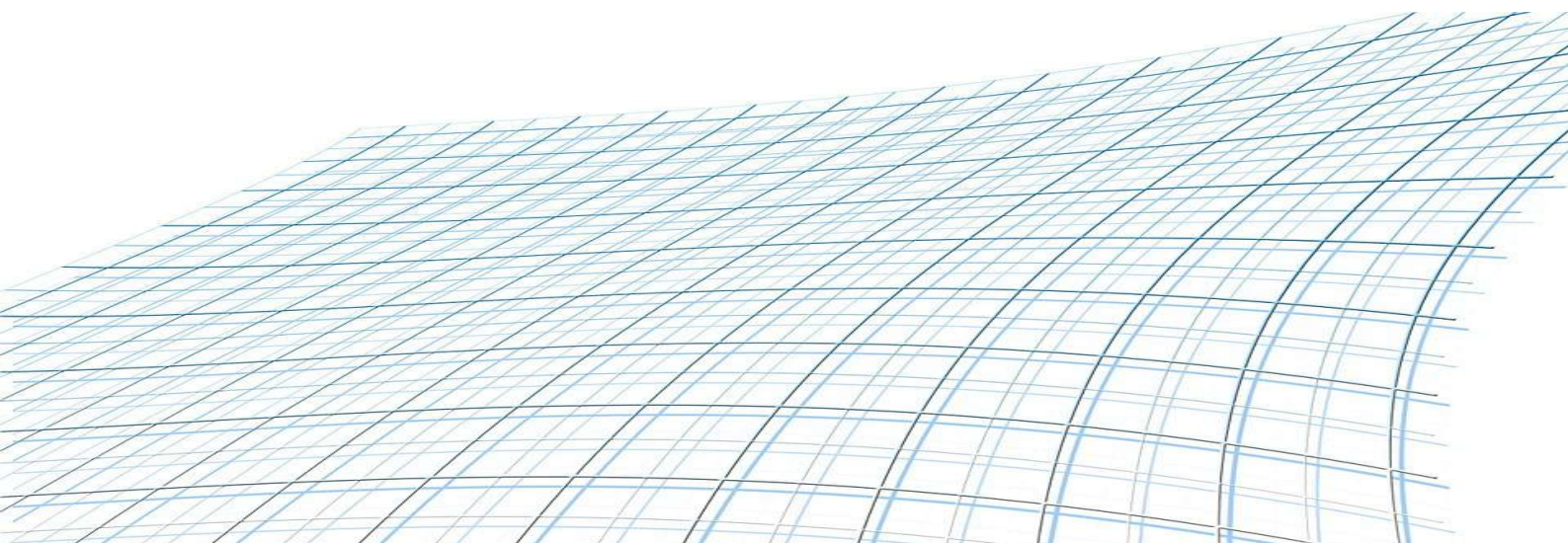
Shirley Gregor



Lars Taxén



Detmar Straub



NeuroIS Retreat 2013



June 1-4
Schloss Orth



Paper presentation in the historic hall of Schloss Orth

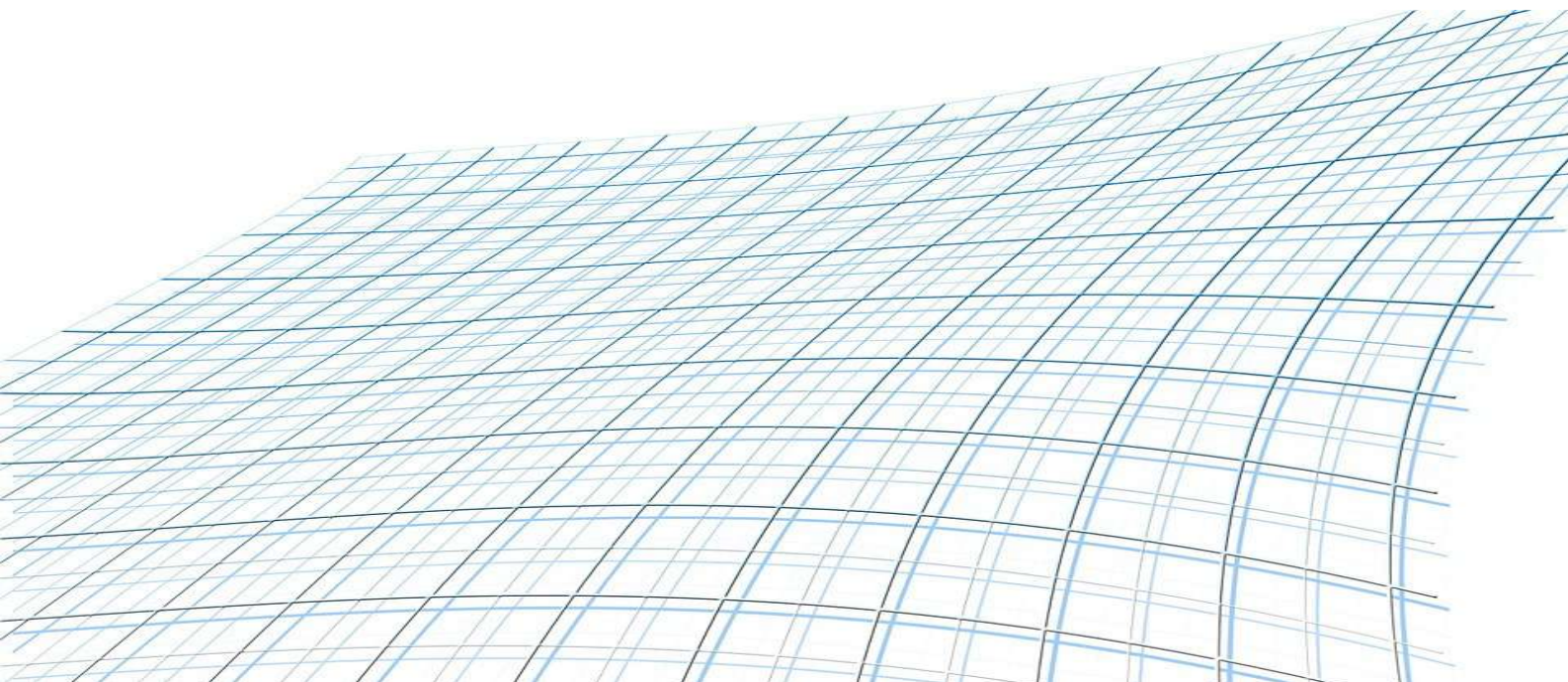
Keynote by Martin Reuter

New developments in NeuroIS: The power of the genes



The new scientific discipline of NeuroIS enriches classical IS research by a neurobiological perspective. Frequently used imaging techniques (e.g., fMRI) are limited to experimental conditions that lack ecological validity, a shortcoming that is to a lesser extent also true for physiological measures such as GSR or ECG. The use of a genetic approach in NeuroIS research does hardly exist, although this technique allows conducting IS research in realistic environments. Moreover, genetic information disentangles environmental from hereditary influences and even provides information on central nervous mechanisms. Besides a brief introduction into the molecular genetic approach, examples

from empirical genetic NeuroIS research were presented. The studies deal with technostress (i.e., stress induced by disturbed human-computer interaction), the prediction of technology acceptance by genetic markers, and the biological basis of Internet addiction. An outlook was given on the possibilities and limitations of using the genetic approach in the context of NeuroIS research.

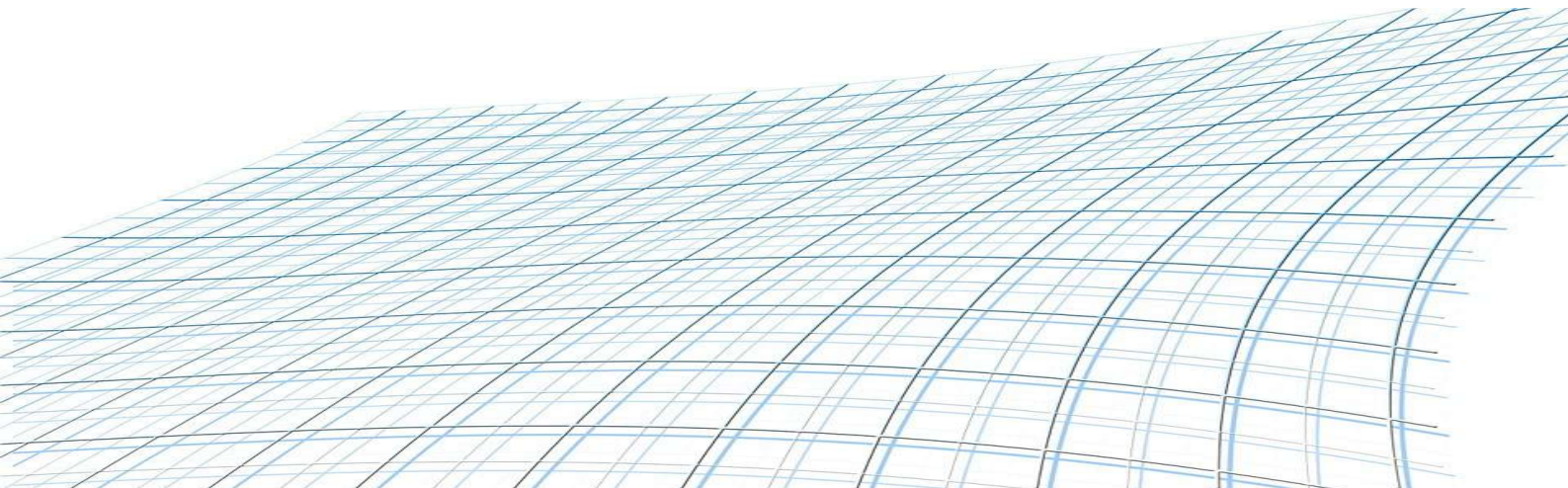




Jan vom Brocke and
Marc Adam



Javed Mostafa



Sylvain Sénécal,
Stefan Tams,
and Marc Fredette



Conference dinner



Water in the courtyard of Schloss Orth due to a historic flood in Central Europe. The venue had to be changed during the event and was transferred to a hotel on a hill. Thanks to all people who helped to make this transfer possible and hence secured the success of the event!

NeuroIS Retreat 2014



June 5-7
Schloss Orth



Marc Adam, Jan vom Brocke,
Andrija Javor



Élise Labonté-LeMoyne

Keynote by Robert Savoy
**Studying connectivity in the brain
via MRI: concepts and methods**



Mobile eye-tracking demo by Werner Wetzlinger and Jella Pfeiffer



Boat on the pier in Gmunden



Sylvain Sénécal and Adriane Randolph



Sven Laumer and Christian Maier



Boat trip on Lake Traunsee with conference dinner



Pankush Kalgotra and
René Riedl



Rudy Hirschheim



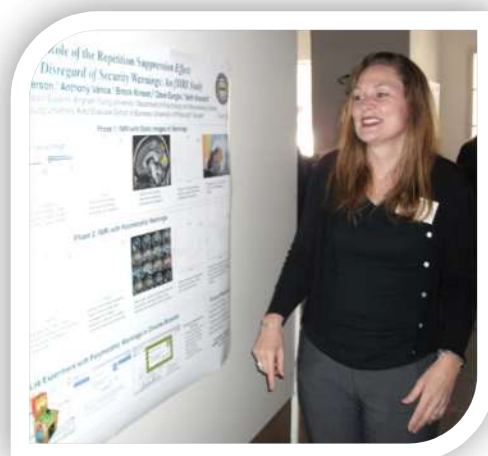
Markus Weinmann



Ricardo Buettner



Christoph Schneider



Bonnie Anderson

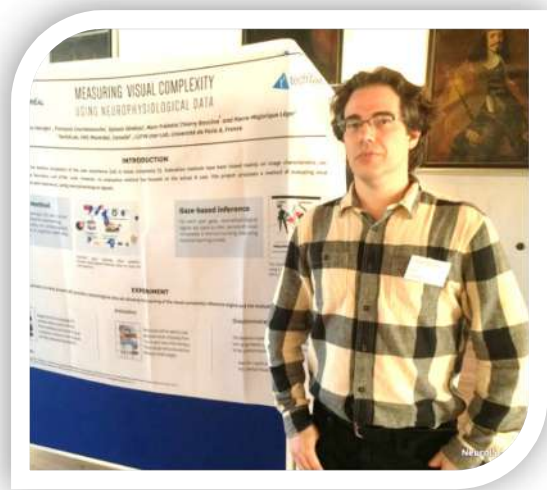
NeuroIS Retreat 2015



June 1-3
Schloss Orth



Tony Vance



Marc Fredette

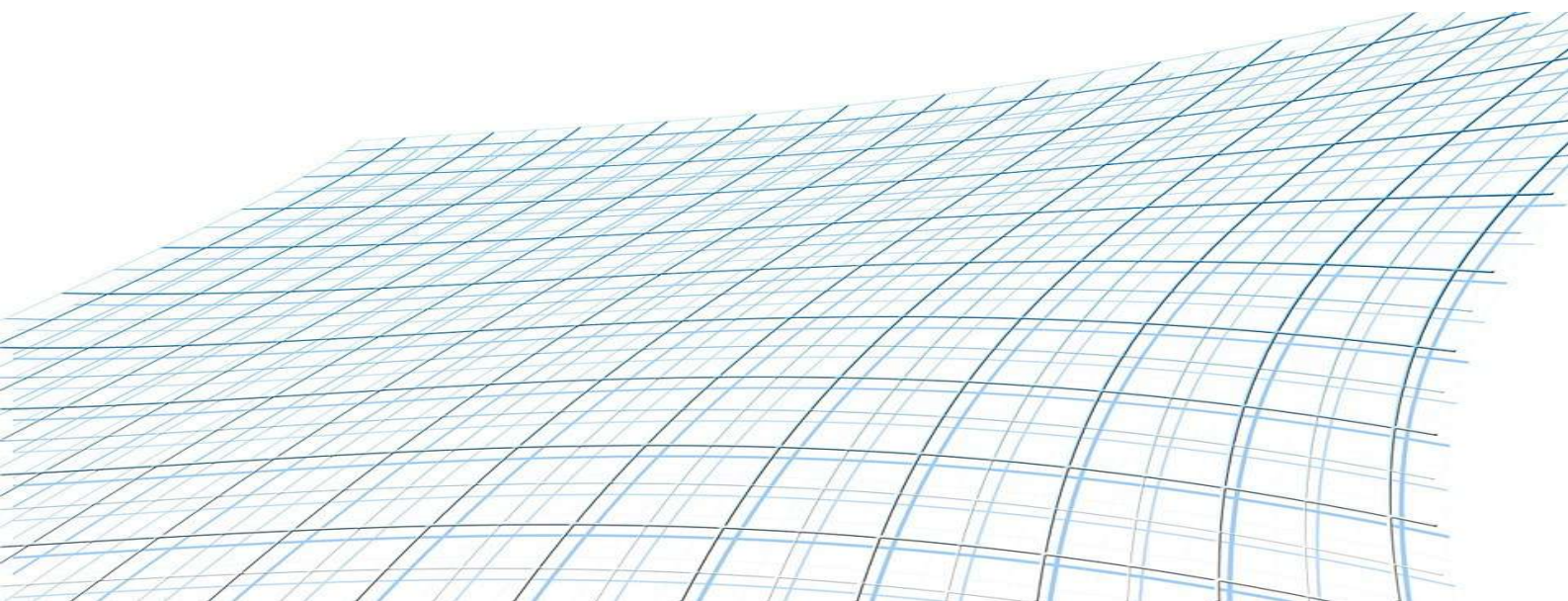
Keynote by Christian Montag

Towards a new research discipline called Psycho(neuro)informatics: Empirical evidence from the investigation of the psychobiological basis of Internet addiction



More and more users around the world overuse the Internet with negative long-term consequences for their well-being. With the advent of the smartphone, the Internet can be accessed from nearly everywhere. This technological innovation may lead to overuse of both the Internet and smartphone, and is likely to rise to a completely new level in the future. The talk presented data on more than 2000 participants whose smartphones were tracked for several weeks to obtain insights into how the smartphone

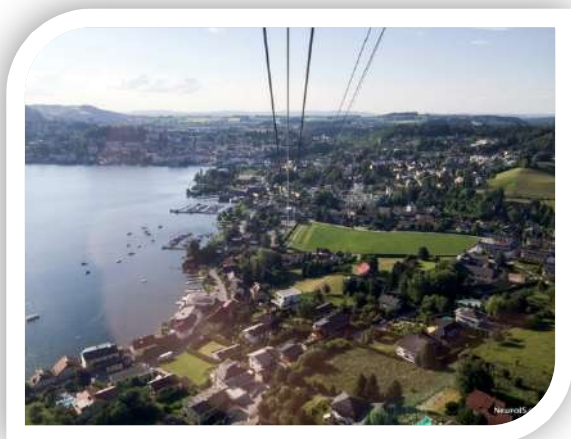
dominates our daily life. This study also demonstrated how methods from computer science can be used in psychology to predict psychological variables from human-machine interaction. Finally, in this talk Christian Montag argued why it is meaningful to combine real life variables recorded from human-machine-interaction with genetics and brain imaging. This new approach gives way to Psychoneuroinformatics.



Cable car ride to Grünberg mountain with conference dinner



Cable car to Grünberg mountain in Gmunden



View from the cable car



Participants at the conference dinner



Participants in front of Schloss Orth in Gmunden



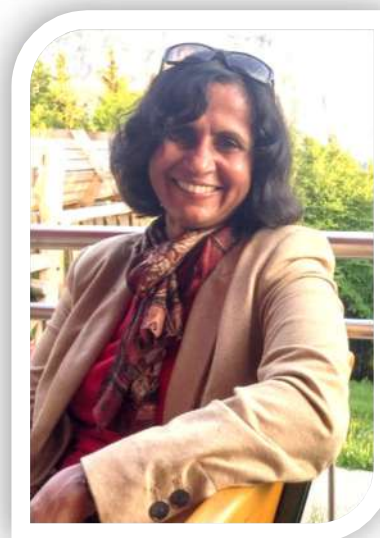
Lisa Falschlunger



James Rodger



Javed Mostafa



Radhika Santhanam



Roozmehr Safi



Harald Kindermann

NeuroIS Retreat 2016



June 6-8
Schloss Orth



Andreas Auinger
and Rob Gleasure



Selina Wriessnegger

Keynote by Hauke Heekeren
Social media and the brain



Social media use is a global phenomenon, with almost two billion people worldwide regularly using these websites. As Internet access around the world increases, so will the number of social media users. Neuroscientists can capitalize on the ubiquity of social media use to gain novel insights about social cognitive processes and the neural systems that support them. This talk outlined social motives that drive people to use social media, proposed neural systems supporting social media use, and described approaches neuroscientists can use to conduct research with social media.



NeuroIS Retreat participants listening to the keynote by Hauke Heekeren



Camille Grange,
Selina Wriessnegger,
Barbara Weber,
Élise Labonté-LeMoyne



The NeuroIS Retreat
Organizing Team

Adriane Randolph,
Pierre-Majorique Léger,
Fred D. Davis,
René Riedl,
Jan vom Brocke



Boat trip on Lake Traunsee with conference dinner



Manuela Macedonia



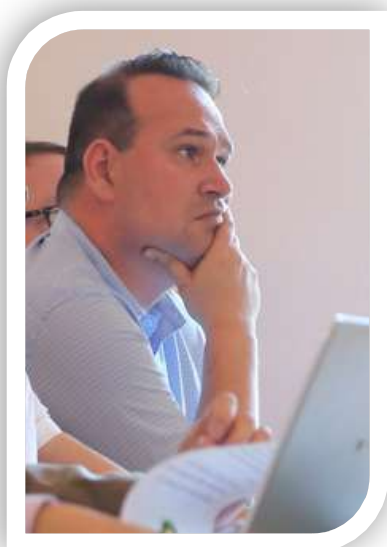
Peter Walla



Verena Dorner



Thomas Meservy



Ofir Turel



Seyedmohammadmahdi Mirhoseini

NeuroIS Retreat 2017



June 12-14
Schloss Orth



Presentation of NeuroIS research idea by Colin Conrad

It is a major goal of the NeuroIS Retreat to provide feedback on research ideas, so that researchers, in particular those with relatively little experience, can advance their studies.

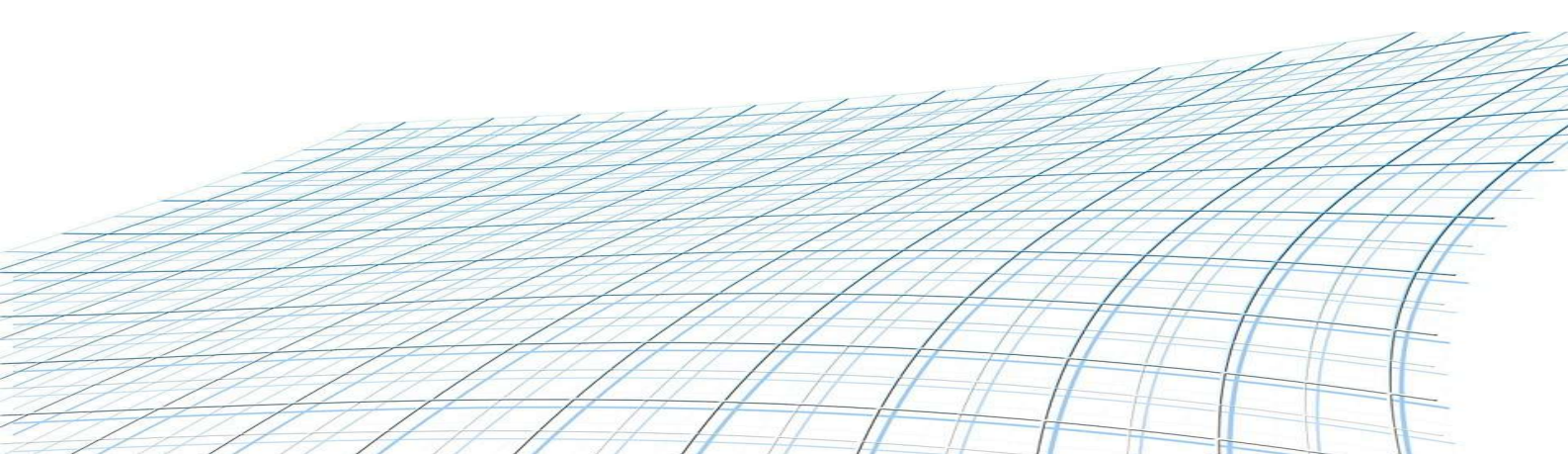
Keynote by Tobias Kalenscher

Why do we need animals to understand the neurobiology of economic decision-making?



Despite the still frequently made assumption that humans are rational, consistent, sophisticated and selfish decision-makers, decades of research in the behavioral sciences suggest that individuals are often much less rational and egoistic than originally assumed. Yet, what causes these systematic deviations from the rational choice ideal still remains a mystery. Interestingly, not only human decision-makers, but also non-human animals often act in a way which is seemingly inconsistent with their revealed preferences, e.g., when foraging for food. Humans and animals often make similar, maybe even identical decision “errors”. These intriguing parallels in human and animal choice patterns support the premise that they may share evolutionary roots. In his talk, Tobias

Kalenscher argued in favour of the idea that the reality of decision-making with all its facets, including action against one’s own preferences, has to be understood in light of the nature, constraint and evolution of the neural apparatus supporting its function. He proposed that the neural architecture of choice has evolved to its current state because it provided decision-makers with an adaptive advantage. This means that, even though there might exist a many-to-one mapping of neural implementations to choice processes, careful comparisons across species can complement human microeconomics research by supplying possible answers to the question why we make decisions as we do. Or, in other words, “a theory that works well across species has a greater likelihood of being valid than one that works well with only one, or a limited set of, species.” (Kagel et al., 1995, p. 4⁹).

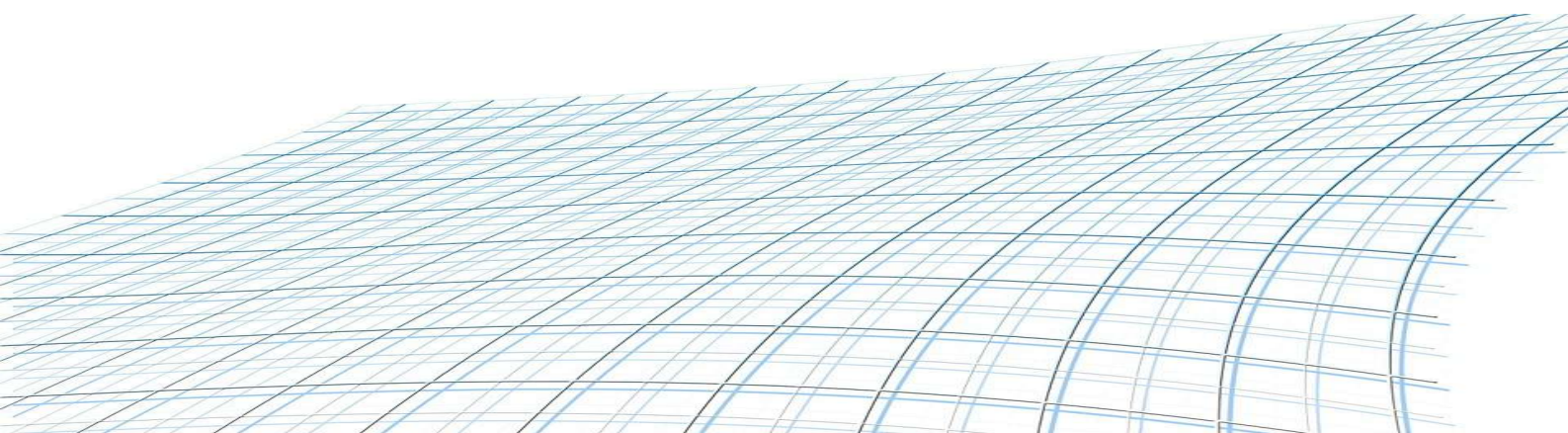


⁹ Kagel, J. H., Battalio, R. C. and Green, L. 1995. Economic Choice Theory: An Experimental Analysis of Animal Behavior, Cambridge: Cambridge University Press.

The Power of EEG: From single channel to high resolution derivations

Hot Topic Talk by Gernot Müller-Putz

The talk briefly described the neurophysiological foundation of EEG, recording methods, artifacts, type of electrodes and amplifiers. The main part contained the discussion of using EEG depending on the number of derivations used and type of application as there are (i) single channel EEG and neuro-feedback, (ii) medium number of channels to differentiate between brain states and (iii) high resolution EEG for functional brain imaging. A brief outlook to future applications of EEG concluded this talk.



Panel: NeuroIS 2007 – 2017: Hot Topics and the future of NeuroIS



Moderator Jan vom Brocke and the panelists (Peter Walla, Pierre-Majorique Léger, Alan Hevner, Fred D. Davis)



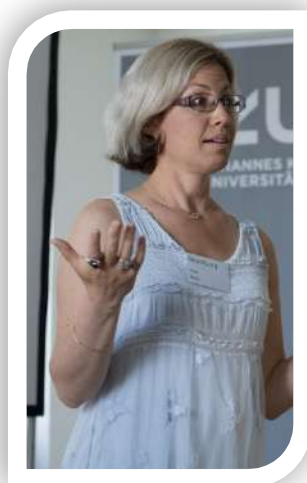
Harald Kindermann



Anna-Maria Seeger and Armin Heinzl



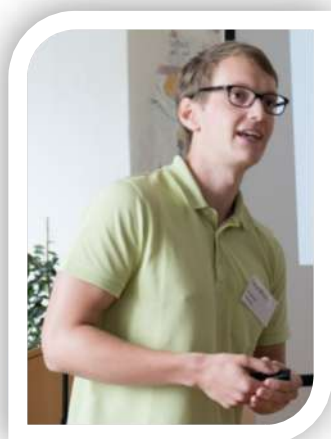
Jeffrey Jenkins



Yael Benn



Ofer Bergman



Thomas Fischer



Caspar Krampe and Nadine Gier

From Gmunden to Vienna

Through the years, the NeuroIS Retreat has been held in Gmunden. It started in *Schlosshotel Freisitz-Roith* (Gmunden) in 2009 and moved to *Schloss Orth* (Gmunden) in 2013. Starting with the 10 years anniversary, the NeuroIS Retreat is held in Vienna.



Schlosshotel Freisitz-Roith (Gmunden)



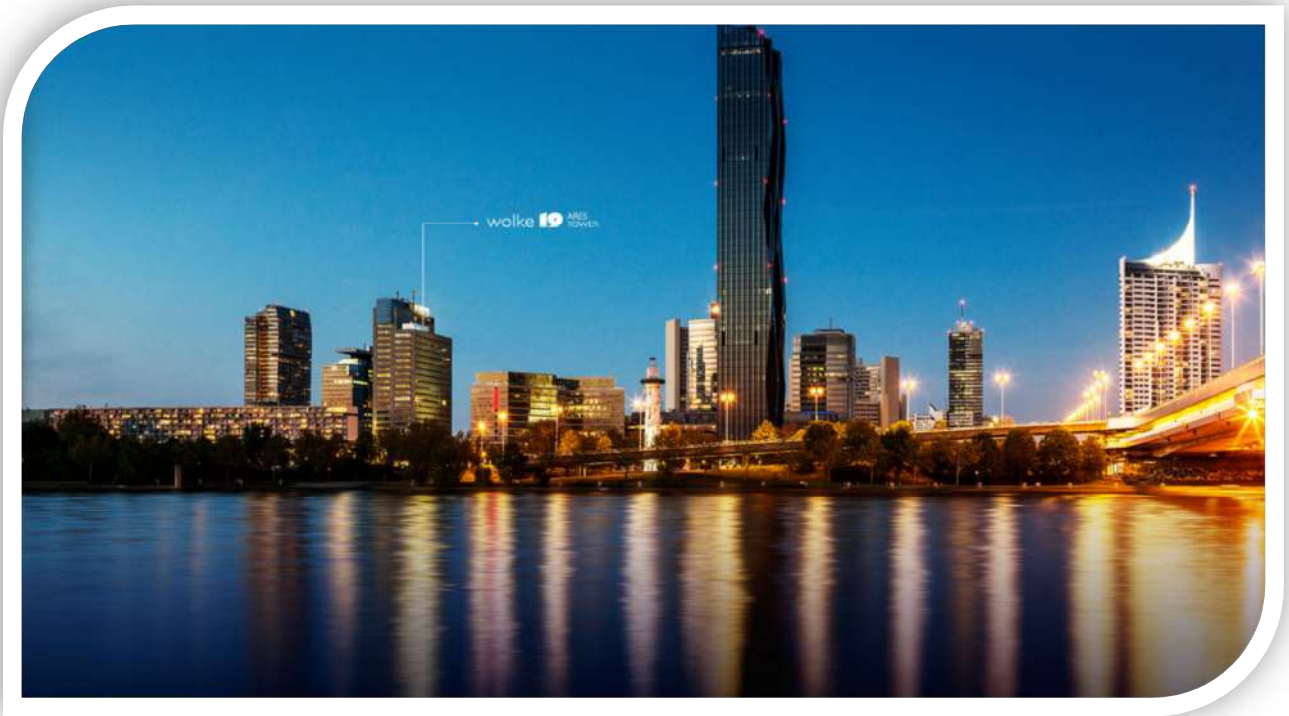
Schloss Orth (Gmunden)



View from Wolke 19 in the Ares Tower over Vienna and the Danube River

NeuroIS Retreat 2018

In 2018, the 10 years anniversary NeuroIS Retreat took place in the Ares Tower, Wolke 19, in Vienna. The NeuroIS community met for the first time in Austria's capital, one of the world's most beautiful cities. The NeuroIS Retreat took place from June 19-21.

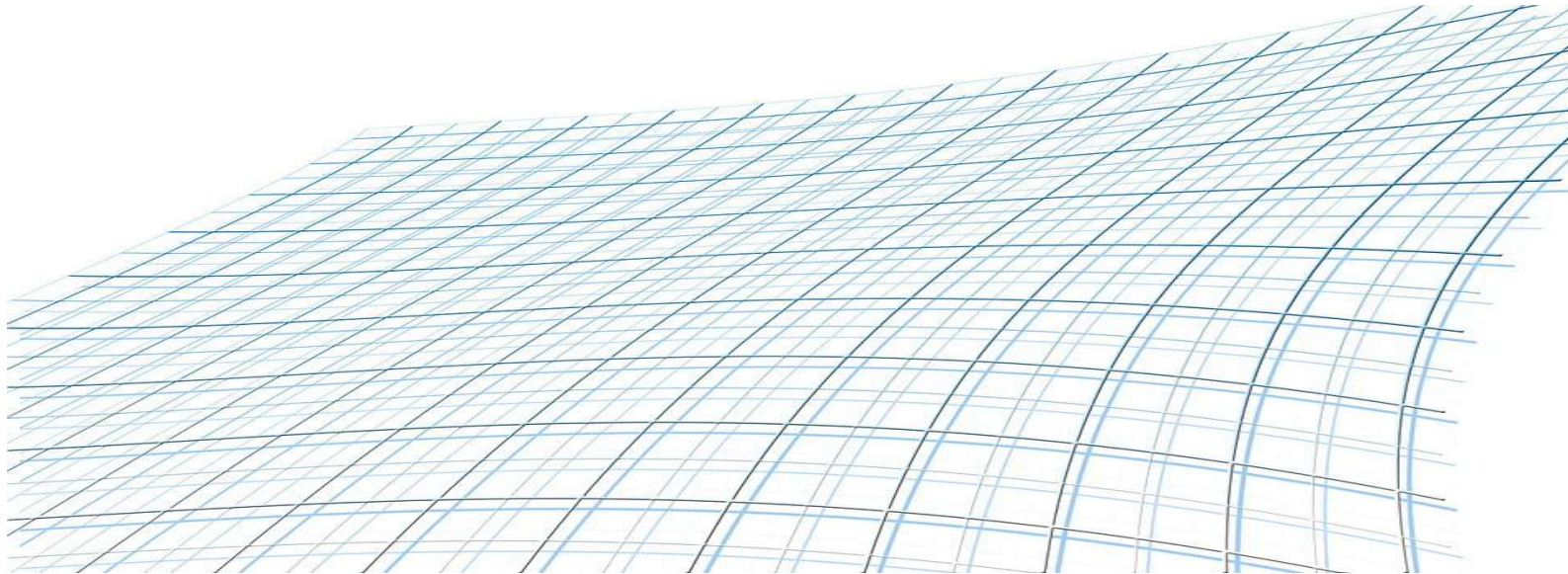


Wolke 19 in the Ares Tower at the Danube River

Organizing Committee

- >> Conference Co-Chairs: Fred D. Davis, René Riedl
- >> Programme Co-Chairs: Jan vom Brocke, Pierre-Majorique Léger, Adriane Randolph
- >> Programme Committee: Marc Adam, Bonnie Anderson, Patrick Chau, Alan Dennis, Ana de Guinea Ortiz, Robert Gleasure, Jacek Gwizdka, Armin Heinzl, Alan Hevner, Marco Hubert, Peter Kenning, Brock Kirwan, Sven Laumer, Ting-Peng Liang, Aleck Lin, Gernot Müller-Putz, Fiona Nah, Sylvain Sénécal, Stefan Tams, Lars Taxén, Ofir Turel, Anthony Vance, Eric Walden, Selina Wriessnegger
- >> Organisation Support: Thomas Fischer

Pictures – 10 Years Anniversary venue



Dr. Hermann Zemlicka Award



The NeuroIS community is indebted to a visionary thinker, Dr. Hermann Zemlicka, a highly respected Austrian politician, member of the Gmunden City Council, and entrepreneur, who passed away at age 55 in June 2012. On behalf of the Town of Gmunden, Hermann proactively invited René Riedl and Fred D. Davis to host the Retreat in Gmunden. He significantly contributed in many ways to the establishment of the NeuroIS Retreat. Without his visionary support, it would not have been possible to bring this conference into being.

In memoriam of this outstanding person, the Dr. Hermann Zemlicka Award is given to “the most visionary paper” by the conference committee each year. In the period 2009-2017, when the Retreat was held in Gmunden, the winners received – in addition to a certificate – a Gmundner Ceramic plate.

2013 Winner

Looking for information relevance in the brain
by *Jacek Gwizdka*

Relevance is a fundamental concept in human-information interaction, yet very little is known about cognitive processes involved in judgments of relevant vis-a-vis irrelevant information. I investigated differences in brain activations and eye-movement associated with judging relevant, topical and irrelevant information on target-word search (WS) and question-answering (QA) tasks. A mixed-design, event-based experiment (N=18) was conducted in a lab equipped with fMRI and eye-tracker system. For QA task, brain activations in parietal and occipital lobes were found to be different between processing relevant and topical documents, while activations in frontal, temporal and parietal lobe were found to be different between processing relevant and irrelevant documents. My work contributes to better understanding of the nature of information relevance.



2014 Winner

Designing web pages for increased content familiarity: A strategy 1 study
by *Rob Gleasure*

There are numerous motivations for small-to-medium businesses to engage in ecommerce. Yet in order for these businesses to generate value from their ecommerce activities, it is important that they can foster a sense of familiarity among users with the content of their websites. The design hypothesis proposed in this study was that webpages should include novel low-arousal images of positive valence to increase users'

familiarity with the content of that webpage. The direct implications concern the use of novel low-arousal imagery as a means of increasing content familiarity. The findings also suggest that websites should encourage browsing behavior in users where possible, rather than encouraging visits where users are looking for some pre-determined items.



2015 Winner

Neurophysiological analysis of visual syntax in design
by *Christopher Davis* and *Alan Hevner*

Creative design activities in the development of software-intensive systems involve the wide use of visual tools, such as flowcharts and UML diagrams. In this research-in-progress paper, we explore the potential of eye fixation related potential (EFRP) as a method to assess the efficacy of visual notations used to build and evaluate IT artifacts. Drawing on past work in the areas of visual syntax and semantics, we ask whether selection of visual forms is a significant predictor of design artifact quality and utility. In particular, we propose a study that combines the use of EEG and EFRP methods to analyze the neurophysiological correlates of how designers employ visual syntax in the development of IT artifacts for software intensive systems. Implications for both research and practice are discussed.



2016 Winner

A refined examination of worker age and stress: Explaining how, and why, older workers are especially techno-stressed in the Interruption Age
by *Stefan Tams*

The workforce is aging rapidly, with the number of older workers increasing sharply (older being defined as 60 and over). At the same time, interruptions mediated by modern information technologies are proliferating in organizations. These interruptions include email notifications and instant messages, amongst others, which have been shown to have hazardous consequences for employees in terms of stress.

Older workers might be especially affected by these interruptions, implying major problems for this fast-growing user group with regard to their well-being and work performance. The present study tests a research model suggesting that older workers experience more interruption-based technostress than their younger counterparts because of differences in inhibitory control between older and younger adults. In doing so, this study answers recent calls for examining age as a substantive variable in IS research, and it contributes to the literature on technostress by showing how technostress affects different user groups to different extents.



2017 Winner

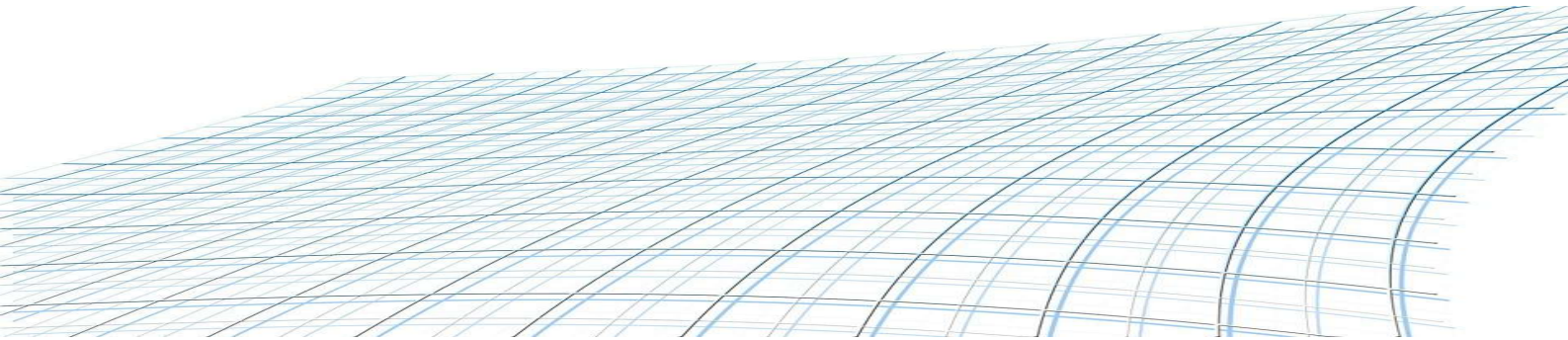
Using EEG signal to analyze decision making Cognitive processes
by *Nabila Salma, Bin Mai, Kamesh Namuduri, Rasel Mamun, Yassir Hashem, and Hassan Takabi*

We demonstrate how EEG signals can be used to analyze people's mental states while engaging in cognitive processes during IS decision-making. We design an experiment in which participants are required to complete several cognitive tasks with various cognitive demands and under various stress levels. We collect their EEG signals as they perform the tasks and analyze those signals to infer their mental state (e.g., relaxation level and stress level) based on their EEG signal power.



Statements on NeuroIS

In this section of the book, we present the statements that we have received from scholars. We invited both younger scientists and highly distinguished academics. Moreover, it was our goal to receive statements from IS scholars and academics from other scientific disciplines, such as neuroscience, psychology, and brain-computer interaction. Almost all scholars who were invited to provide a statement accepted our invitation. We thank all contributors for their valued reflection on the NeuroIS field and the NeuroIS Retreat.



Statements by Information Systems Scholars

Ting-Peng Liang

President, Association for Information Systems (AIS)
National Sun Yat-Sen University, Taiwan

“NeuroIS is an exciting area for enhancing the scientific foundation of IS research through providing objective evidence of decision making associated with information technologies. I really enjoyed attending the Retreat to get in touch with many friends with interests in this new area. In recent years, I have been conducting fMRI projects about online purchasing behavior and escalation of commitment. Some interesting theoretical insights that would not be covered otherwise, have been explored. Although ten years are not long and we are still in the early stage of NeuroIS, I believe the neuroscientific methodology will become an essential methodology for IS research in the near future.”



NeuroIS as an established subfield of the Information Systems discipline

by **Vladimir Zwass**, Editor-in-Chief of the *Journal of Management Information Systems (JMIS)*, Gregory Olsen Endowed Chair and University Distinguished Professor of Computer Science and MIS, Fairleigh Dickinson University, USA



“Within the recent decade, NeuroIS has been established by a highly dedicated group of researchers as a subfield of the Information Systems (IS) discipline, with the tools, methodologies, and the emerging identity of its own. The present volume is certainly a convincing evidence of this. Here, I will offer a few remarks as the Editor-in-Chief of the top-tier journal that has published by far the largest number of these scholars’ papers.

With the approaches of neuroscience and the use of neurophysiological tools, the NeuroIS field has brought the direct measurement of bodily reactions into the orbit of the IS scholarship. The IS discipline seeks to understand how systems can be organized effectively to manage information and knowledge toward specific outcomes, in order to support individuals, organizations, marketplaces, and products. NeuroIS provides access to direct reactions of individuals to stimuli with such techniques as functional magnetic resonance (fMRI) imaging, positron emission tomography (PET), electroencephalography (EEG), oculometry, and a number of others. The progress of NeuroIS will help us to understand more deeply the cognitive, emotional, decision-making, and – we hope – social processes that lead to the desired (or undesirable) outcomes. Technostress, effectiveness of IS training, reactions to the many and various online advertising modalities, alternative online auction designs, gaming and gamification, effectiveness of crowdsourcing motivations, design theories for the IS user experience – these are only a few subjects that are already benefitting from the NeuroIS approaches. The notion of technology fit will acquire a deeper meaning as we directly gauge the physical reactions at the expense of some of the survey studies.

NeuroIS has joined the subfields of other mother disciplines, such as economics and marketing, which deploy the neurophysiological and related tools to study directly the reactions of the human body, and primarily on the neural system, in the context of the reference field. In its horizontal cut through a number of disciplines, the Neuro-approach resembles the application of the computational research methods in multiple disciplines to handle problems that are often either intractable or tractable only in part by the prior empirical techniques. Both of these “horizontal” subfields are underwritten by the Moore’s Law-driven developments that have entered the “second half of the chessboard,” with the progressive doubling of computer capabilities on the extremely large base and at a contained cost leading to the spectacularly new research possibilities.

A milestone special issue devoted to NeuroIS has been published in the *Journal of Management Information Systems (JMIS)* [Liang and vom Brocke, 2014¹⁰]. Scholarly journals, particularly the leading ones, play the filtering role. Equally important, they play a

¹⁰ Liang, T.-P. and vom Brocke, J., Guest Editors, 2014. “Special Issue: Neuroscience in Information Systems Research,” *Journal of Management Information Systems*, 30(4), pp. 7-233.

fostering role, guiding the development of the discipline towards salience, towards the methods that combine new insights with the new rigor that give a discipline its vibrancy. Special issues and sections are a major means towards that goal. Since its inception 35 years ago, JMIS has been committed to a broad interpretation of our discipline and to furthering all scholarly methodologies that can contribute to our understanding and to the development of information systems. The guest editors of this Special Issue on NeuroIS, Ting-Peng Liang and Jan vom Brocke, have made a signal contribution by attracting and guiding a landmark set of works to publication. This openness of JMIS to the emerging approaches to scholarship explains - in part - why we have published several outstanding NeuroIS papers. Of course, we have been fortunate to receive the submissions that led, after the efforts of the reviewers drawn from the successful scholarly community that has been formed in the subfield, to these publications.

NeuroIS owes its identity in a large part to its reliance on the neurophysiological tools. But this is not only so. There are several aspects to the identity of a scholarly field or discipline [Teo and Srivastava, 2007¹¹]. The disciplinary practices of NeuroIS are relatively well established. The areas of concern are well circumscribed at this time at the individual level of analysis. A cohesive research community has emerged. Integrative papers are being published. Notably, Gregor and her colleagues have provided the nomological network for the understanding of emotions in IS research. A comprehensive set of guidelines for the research in the subfield has been offered [vom Brocke and Liang, 2014¹²; Riedl and Léger, 2016¹³]. The recent bibliometric analysis comprises 164 papers published in the field between 2008 and 2016 [Riedl et al, 2017¹⁴].

”
*The disciplinary
practices of NeuroIS
are relatively well
established.*
”

It is to be noted that both disciplines of IS and cognitive neuroscience have developed over the recent half-century and have been propelled by the development of computer technology and the thinking modes this technology has given rise to. Considering the current technological trends and the concomitant evolution of research thought, we can forecast a very bright future for this line of IS study. There are several reasons for this optimism. The first of them is the coherent scholarly community whose volume comprises this article. Equally important, the tools on which NeuroIS relies will be transformed in the present second machine age, driven by computerization and digitization, as the innovations compound rapidly [Brynjolfsson and McAfee, 2014¹⁵]. Their capabilities and power may be fully expected to expand in many directions. If we seek an analogy in the tools developed four centuries ago, the microscope and the telescope, we can trace the development of the

¹¹ Teo, T.S.H. and Srivastava, S.C. 2007. “Information Systems (IS) Discipline Identity: A Review and Framework,” *Communications of the AIS*, 20, Article 13.

¹² Vom Brocke, J. and Liang T.-P. 2014. “Guidance for Neuroscience Studies in Information Systems Research,” *Journal of Management Information Systems*, 30(4), pp. 211-233.

¹³ Riedl, R. and Léger, P.-M. 2016. *Fundamentals of NeuroIS: Information Systems and the Brain*, Berlin, Heidelberg: Springer.

¹⁴ Riedl, R., Fischer, T. and Léger, P.-M. 2017. “A Decade of NeuroIS Research: Status Quo, Challenges, and Future Directions,” *Proceedings of the 38th International Conference on Information Systems*, Seoul, South Korea.

¹⁵ Brynjolfsson, E. and McAfee, A. 2014. *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*, New York: W.W. Norton.

scientific disciplines by relying on them and their descendants. Indeed, the 2017 Nobel Prize in Chemistry was awarded to a team that, based on the electron microscopy, developed the methods of cryo-electron microscopy that produces 3D images of biomolecules at atomic resolution – and that can enhance our understanding of drug targets and biological processes. Over the course of the expansion of the scientific enterprise, “[n]ew tools helped change the minds of the intellectuals under their influence,” in the words of a leading historian of technological progress [Mokyr, 2016, p. 56¹⁶].

The scholarly analysis is a principal aspect of IS. However, we should always foster design-science approaches as well. Thus, we may expect that NeuroIS will contribute not only to the analysis but also to the synthesis of systems. One can foresee, for example, the development of a design science for what we may call virtual exoskeletons that would enable less qualified workers to maintain their position in the workforce. An example is the assistive system that the Japanese equipment manufacturer Komatsu provides in their excavators to assist inexperienced operators by computing correct digging angles (cited in [Zysman and Kenney, 2018¹⁷]). This idea is capable of generalization as well as specialization. The early and compelling vision of information technology as a human symbiont may still serve a guiding light [Licklider, 1960¹⁸]. This direction of research can contribute to the weighty issues emerging from the job shrinkage owing to the emerging technologies.

”
*We may expect that
 NeuroIS will contribute
 not only to the analysis
 but also to the synthesis
 of systems.*
 ”

Words of caution here will not go amiss. NeuroIS is demanding. Our IS-trained researchers enter a subfield whose tools are used by radiologists and other professionals specializing in the interpretation of the images and other outputs provided by the increasingly sophisticated tools, who undergo many years of training and whose expertise calls for further years of experience. This tells us that the success of many research projects in the area will depend on the habitus of collaboration with the relevant experts for the cross-disciplinary approach to research. It also calls for access to research-ready and well-calibrated devices, be they fMRI, EEG, PET scanners, or eye trackers.

I will not be divulging secrets by mentioning that JMIS has not promoted more submitted papers to publication in the domain than it has published.

The dedicated research community that has created and is developing the NeuroIS subfield centers to a large extent on the Retreat symposia of which the present one is the anniversary event. The support of the Gmunden community in Austria was instrumental and is appreciated by the entire IS college of scholars. The anniversary meeting brings the NeuroIS Retreat to Vienna, a favorite city of mine. Many years ago, I was a member of the Professional Staff of the International Atomic Energy Agency located in this wonderful European capital, working on the International Intercomparison of the Status of Radiation Therapy. While not exactly dealing then with the current NeuroIS tools, I am happy to revisit the domain.”

¹⁶ Mokyr, J. 2016. *Culture of Growth: The Origins of Modern Economy*. Princeton: Princeton University Press.

¹⁷ Zysman, J. and Kenney, M. 2018. “The Next Phase in the Digital Revolution: Intelligent Tools, Platforms, Growth, Employment,” *Communications of the ACM*, 61(2), pp. 54-63.

¹⁸ Licklider, J.C. R. 1960. “Man-Computer Symbiosis” *IRE Transactions on Human Factors in Electronics*, HFE-1, pp. 4-11.

“Great to have researchers with this shared interest coming together to discuss their research.”

David Gefen
Provost Distinguished Research Professor
Drexel University, USA



“Transformatory!”

Armin Heinzl
Chair of General Management
and Information Systems
University of Mannheim, Germany

“Happy to see the evolution of the field of NeuroIS, and glad to be part of the inaugural group who helped to develop the field!”

Paul Pavlou
Senior Associate Dean & Milton F. Stauffer Professor
Temple University, USA





“NeuroIS is unique among ‘neuro’ fields, as the triggers we study are technological, therefore open to design and dynamic reconfiguration. NeuroIS researchers must therefore balance social science with biology, explanation with design, and what is possible with what is responsible. Luckily, we have the NeuroIS Retreat. This event has three vitally important qualities. First, participants have access to an extra-ordinary breadth and depth of theoretical and methodological knowledge. Second, participants can present and discuss work at all levels of maturity in an atmosphere that is unfailingly constructive. Third, participants enjoy beautiful natural and cultural settings that help them to feel inspired and refreshed about their research. These qualities make the Retreat a true asset for anyone with a passion for the field.”

Rob Gleasure
University College Cork, Ireland

“I have been joining the NeuroIS Retreat for five consecutive years now, and I must say that I am impressed with the development I have seen over the years. The research questions and methods have become a lot more sophisticated, and I have noticed more convergence on what constitutes good NeuroIS research. Additionally, more and more NeuroIS research has been published in premium journals. So, I am optimistic about the field’s future, and I am excited to be a part of it.”



Stefan Tams
Associate Professor, Department of Information Technologies
HEC Montréal, Canada



“I am really proud of what we have accomplished over the last decade. I am truly amazed by the speed at which we have been able to master the use of neuroscience tools in our field, and also at the methodological contributions achieved during this period. I like to think that is due to the “Gmunden” spirit. At the NeuroIS Retreat, we have tried to create a constructive and collegial atmosphere to help IS researchers appropriate neuroscience tools and theories, but also to provide early guidance in research projects to enable newcomers to successfully execute NeuroIS projects. We still have many challenges to overcome. Access to neuroscience instruments and labs are still at infancy stages. PhD programs need to start training IS researchers in this new reference discipline to become active contributors to the field. But I believe the most interesting outcome of this first decade is the level of interest and attention we are receiving

from industry with regards to the use of these methods in a design science context. Several multinationals are already using methods and tools developed by our community in their practice and this, I believe, is the ultimate testament for our relevance.”

Pierre-Majorique Léger

Professor, Department of Information Technologies
Co-Director, Tech3Lab
HEC Montréal, Canada

“NeuroIS is a highly fascinating field. For the first time in history, it is possible to provide information processing capacities that are actually sensitive to the cognitive and the affective state of people. While there is a plethora of opportunities to advance information systems research through neuroscience tools, methods and theories, I personally think that neuro-adaptive systems as in “emotion-sensing services” are the most pre-eminent example of what NeuroIS can do. Not only can these systems help to support decision making in business, but – more importantly – such emotion-sensing service will help people to live a more healthy and enjoyable life. I feel very privileged to be part of a community that can make such important contributions.”



Jan vom Brocke

Head of the Institute of Information Systems
Hilti Chair of Business Process Management
University of Liechtenstein, Liechtenstein

“My experiences at the Gmunden NeuroIS Retreats have been highly rewarding by extending my design science research thinking in new neuroscience directions. The ability to network with leading NeuroIS thinkers in a beautiful venue conducive to collaboration has been amazing.”

Alan Hevner

Professor and Eminent Scholar
Muma College of Business
University of South Florida, USA



“I began using neuro-physiological measures to allow communication by people with locked-in syndrome over fifteen years ago as brain-computer interfaces (BCIs). This work is one of the first dissertations completed under what is now deemed NeuroIS, and has presented a new horizon for human-computer interaction. It was first introduced to the core IS community as an AMCIS proceeding in 2004 by focusing on the underlying user profiles used for BCI design. It then met with a critical event of several like-minded yet independent researchers converging on ICIS in 2006 and presenting related work. Several more conversations and conference presentations soon followed, along with the adoption of a catchy name, and “NeuroIS” was born! The years to follow were not without challenge but made easier by the community fostered at the NeuroIS Retreats. Those of us working early in the area were often asked, “How is this work ‘IS’?” This was such a difficult

question to answer without defensiveness when we saw the connection so clearly: neurophysiological tools offered such promise in helping unlock people to improve their quality of life and to understand their complex interactions with systems. Our passion has since taken hold, and the IS field has joined us in recognizing NeuroIS as a viable sub-field.”

Adriane Randolph

Associate Professor
Executive Director, Brain Lab
Kennesaw State University, USA



“The emergence of the field NeuroIS has provided new impetus, direction and opportunity for my research. The cognitive processes undergirding the design of information systems present a substantial challenge. Access to methods, tools and colleagues that enable us to enrich our repertoire to explore the neurophysiological aspects of design has been both stimulating and rewarding. The collaborative emphasis of the Retreat is responsible for seeding fruitful collaborations and experiments, allowing us to build upon and add momentum to established research streams. The particular contribution we anticipate - to improve modeling notations and international standards to accommodate new forms of information systems and architectures - has been significantly advanced through the NeuroIS initiative.”

Christopher Davis

Professor, Information Systems & Decision Sciences
University of South Florida, USA

“I am of the opinion that IS research has grown to a point where the human element should become much more of a focal point of research. The human behaviors, especially the human decision making processes, during their interactions with IS/IT have long been critical elements in IS research, and the emergence of NeuroIS provides a much needed nascent research paradigm that has enabled a new approach to obtaining novel and significant insights into this fascinating IS phenomenon. NeuroIS inserts a distinctive dimension into the extant IS research, and provides a promising prospect of research impacts. I am glad that I had



been able to participate in this community since 2014. The NeuroIS Retreat, as the world’s premiere NeuroIS research forum and repository, has been instrumental in helping me understanding what NeuroIS is about and how to conduct NeuroIS research. It also provides me with an invaluable platform for idea exchange with the world’s top NeuroIS researchers. I strongly believe that NeuroIS as a research field, and NeuroIS.org as an organization, would continue to grow their global reach and impact. I also endeavor to continuously contribute to its growth and be an integral part of its long-term success.”

Bin Mai

Assistant Professor, Department of Information Technology & Decision Sciences
University of North Texas, USA

Statements by Brain Researchers

Christa Neuper

Rector
University of Graz, Austria

“We are coming from the Neuroscience field, being more clear, from neuropsychology and brain-computer interfacing, respectively. Both fields contribute to NeuroIS: on the one hand neuroscientific and psychological knowledge which is necessary to develop experiments and to understand results. On the other hand, technological background in methods, analysis even in real-time brain analysis. We are happy that we were part of the NeuroIS Retreat from the beginning learning from IS scholars and contributing our expertise in form of keynotes, demos, workshops and many fruitful and interesting discussions.”



Gernot Müller-Putz

Head of the Institute for Neural Engineering
Graz University of Technology, Austria



“My first experience with NeuroIS as well as the Retreat took place a while ago in Gmunden. It has been a very positive experience during which I found many very open minded people with a strong focus on research and its application. This was certainly additionally supported by the perfect location which enabled interesting and fruitful exchange. My expectations would be for the future that this interdisciplinary cooperation grows further leading to important and applied insights.”

Bernd Weber

Co-Director, Center for Economics and Neuroscience
University of Bonn, Germany

“I was fortunate to be invited twice to speak at the annual NeuroIS meeting—once in 2010 and once in 2014; both times in Gmunden, Austria. The first presentation focused on experimental task design for fMRI; the second presentation focused on the roles that MRI was playing in the study of the brain's connectivity, both structurally (using diffusion-weighted imaging) and functionally (using the same acquisition protocol as for conventional task-based fMRI experiments, but applied while the subject was at rest and not performing any particular task). Attending and participating in those meetings, especially the first one in 2010 where I had more time to interact with participants, was enjoyable and engaging. While it was clear that many other approaches to NeuroIS questions were being discussed, the ones that relied on fMRI-based experiments seemed promising to some participants. And, on a personal note, the trip to Gmunden in 2010 with my wife included my first visit to Vienna and the Alps. We subsequently returned in 2014 to both Vienna and Gmunden. And Vienna has become one of our two favorite European cities, as well as the site of the 2018 NeuroIS meeting. (Sorry. Paris is still our number one.)”



Robert Savoy

The Athinoula A. Martinos Center for Biomedical Imaging
at Massachusetts General Hospital, USA

“I attended the NeuroIS meeting 2017 in Gmunden as an invited speaker. My expectations were mixed, but I was very positively surprised about the combination of expertise, curiosity and open-mindedness of the protagonists in this field. Neuroscience is, historically, a fundamental science, and most generated knowledge is of very basic nature. Yet, neuroscience can do much more; it has, for instance, indisputable translational value for clinical applications, but its application potential goes way beyond that. Thus, it is very elating to see that NeuroIS attempts to search, generate and apply intellectual synergies between the neurosciences and information system sciences. The scientifically sound and, at the same time, very promising approach explores new avenues to apply neuroscientific insights to better understand, improve and use information and communication technologies. I strongly welcome the rigorous, progressive thinking in the NeuroIS field. The reliance on neuroscience and neurophysiological knowledge to improve information systems is the way to move forward!”



Tobias Kalenscher

Head of the Department of Comparative Psychology
University of Düsseldorf, Germany



Christian Montag

Head of the Department of
Molecular Psychology
University of Ulm, Germany

"I initially became familiar with NeuroIS through my contact with Prof. Dr. René Riedl, who together with Prof. Dr. Pierre-Majorique Léger published the important work *Fundamentals of NeuroIS – Information Systems and the Brain* (Riedl & Léger, 2016¹⁹) in the international Springer book series *Studies in Neuroscience, Psychology and Behavioral Economics* (Reuter & Montag²⁰). Given the large overlap between Prof. Riedl's and my own research at the intersection of psychology, digital technology use and neuroscience, I very happily accepted an invitation to give a keynote presentation titled *Towards a new research discipline called "PsychoNeuroInformatics"* at the NeuroIS Retreat 2015. In my presentation, I argued for the importance of using smartphone technologies to observe and understand human behavior because this research can be

done on a longitudinal basis, with unprecedented access to large samples and at comparably low costs. I also outlined the potential dark sides of technology overuse, such as the development of addictive patterns of behavior in relation to the consumption of a large array of digital content. Finally, I presented some initial examples of how to combine human behavior recorded via smartphone applications with neuroscientific data, such as data collected from human brain imaging; see, for example, Montag et al. (2016²¹, 2017²²).

I am convinced that interdisciplinary research will be the key to most of the major advances in science that will be accomplished in the 21st century. These advances will also be driven by the increasingly fine-grained knowledge scientists will need to acquire within their respective disciplines to make the necessary advances in their own home disciplines. This also means that a single researcher alone will usually not have the capacity to follow all developments in the many interesting research fields arising from the various disciplines. For example, consider each of the complex disciplines of psychology, neuroscience and information systems that are merging to form NeuroIS. As part of this development, the NeuroIS Retreat has been offering fantastic

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The NeuroIS Retreat has been offering fantastic opportunities to discuss new developments in the interdisciplinary field of NeuroIS and to come into contact with the latest achievements in the field.
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¹⁹ Riedl, R. and Léger, P.-M. 2016. *Fundamentals of NeuroIS: Information Systems and the Brain*, Berlin, Heidelberg: Springer.

²⁰ Reuter, M., and Montag C. *Studies in Neuroscience, Psychology and Behavioral Economics*. Springer.

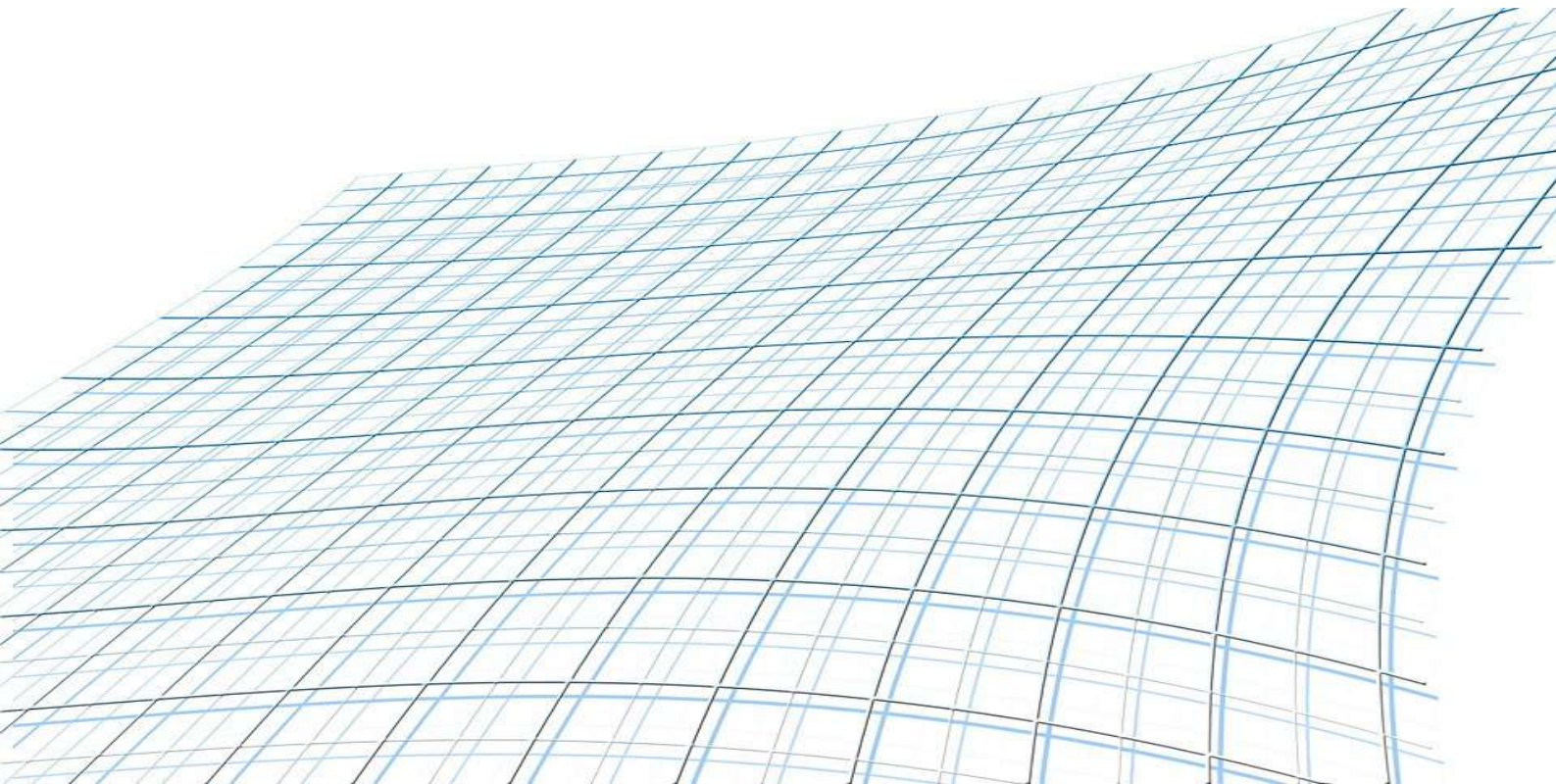
²¹ Montag, C., Duke, É. and Markowetz A. 2016. "Toward Psychoinformatics: Computer Science Meets Psychology," *Computational and Mathematical Methods in Medicine*, Article ID 2983685.

²² Montag, C., Markowetz, A., Blaszkiewicz, K., Andone, I., Lachmann, B., Sariyska, R., ... and Weber B. 2017. "Facebook Usage on Smartphones and Gray Matter Volume of the Nucleus Accumbens," *Behavioural Brain Research*, 329, 221-228.

opportunities to discuss new developments in the interdisciplinary field of NeuroIS and to come into contact with the latest achievements in the field. When I think of my visit to the NeuroIS Retreat in 2015, I can still see in my mind the beautiful location of Schloss Orth located in lake Traunsee in Gmunden. The conference offers a very warm and intimate atmosphere, which is unusual for most of the international meetings that I have been involved with. The unique private setting of the NeuroIS Retreat makes it possible to easily establish and develop links with many scientists from all over the world. To give an example: I was able to make concrete plans for a scientific collaboration with a colleague attending the conference in 2015, which resulted in a peer-reviewed paper published only half a year after the conference.

”
*I am sure that
NeuroIS in Vienna
will be as warm and
intimate as in
Gmunden.*
”

Congratulations on the 10th anniversary of NeuroIS! I am absolutely delighted to attend the conference this year in Vienna, which without doubt will be another success. I wish the organizers and regular attendees of the NeuroIS Retreat every success for the years ahead. I very much hope that the relocation of the conference from Gmunden to Austria's wonderful capital Vienna will attract even more international attendees presenting their high impact research. I am sure that NeuroIS in Vienna will be as warm and intimate as in Gmunden, and I am thoroughly looking forward to this year's vibrant and engaging scientific discussions.”



Distinction for Fred D. Davis

by René Riedl

In 2015, Fred D. Davis was honored by the former governor of the state Upper Austria, Dr. Josef Pühringer, for his academic services. During his laudation in the context of the NeuroIS Retreat, the governor stressed that it is an honor for the state Upper Austria, but also for Austria in general, that Professor Davis significantly contributed to the development and establishment of this scientific conference in Austria. The NeuroIS community is proud of Professor Fred D. Davis!



Laudation by
Josef Pühringer



Josef Pühringer honors
Fred D. Davis



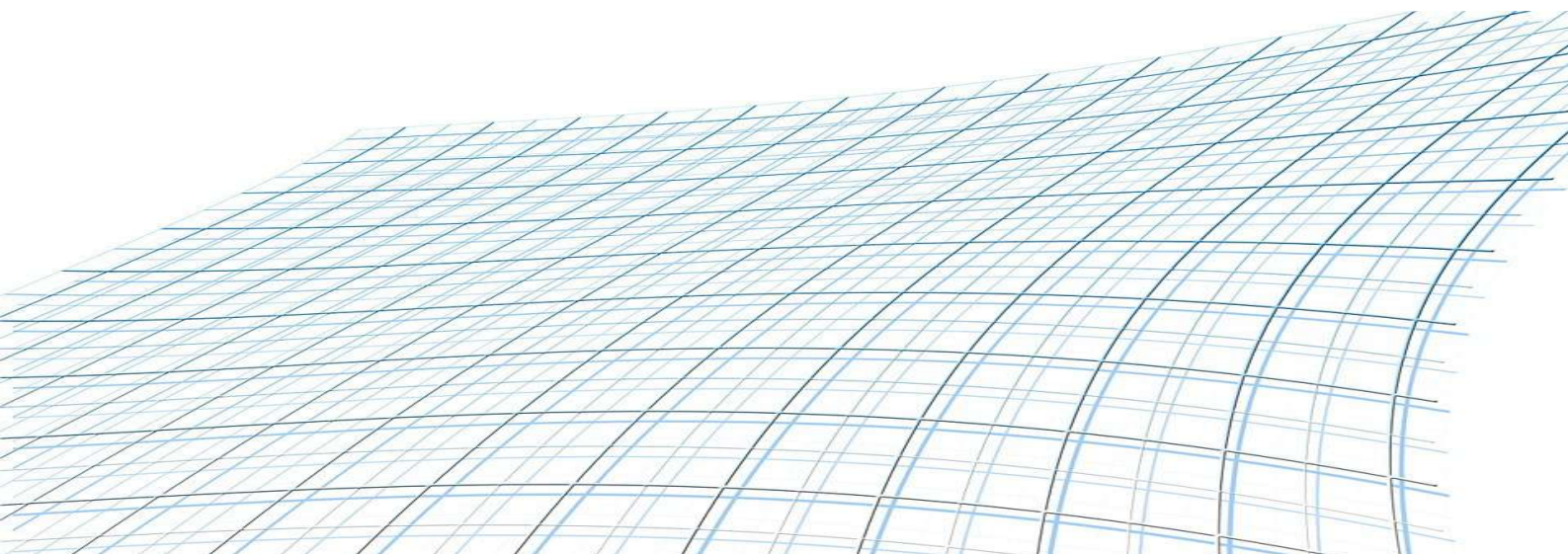
Stefan Krapf (mayor of
Gmunden), René Riedl, Fred D.
Davis, Josef Pühringer (former
governor of the state Upper
Austria), Andreas Murray
(tourism director of the Traunsee
region)

Message from Springer

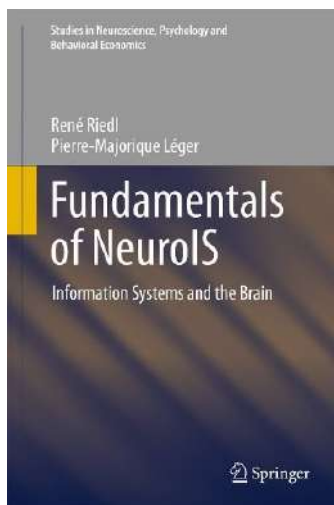


“When we started our collaboration with the Gmunden Retreat on NeuroIS back in 2014 and eventually published the first volume of proceedings for the 2015 edition of the conference in our Lecture Notes on Information Systems and Organisation, it was an experiment. Normally we would look at larger events and more established streams of research for a successful publication. On the other hand we had all our trust in the foresight, thought leadership and professional intuition of the major stakeholders within the Retreats committee. We have not been disappointed at all. Quite to the contrary, both the NeuroIS Retreat and the number of books and proceedings emerged out of Gmunden were better received by the scientific community – our readers – better, than ever anticipated, showcasing the impact of Neuroscience research on IS research and demonstrating the outreach of this particular group of researchers. At Springer we are extremely proud to be your partners and we cheerfully congratulate you on your tenth anniversary.”

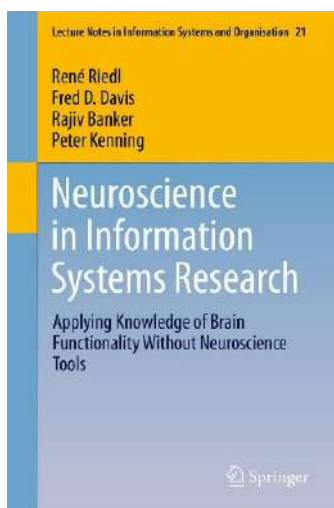
Christian Rauscher
Executive Editor Business/OR/MIS
Springer



NeuroIS literature published by Springer

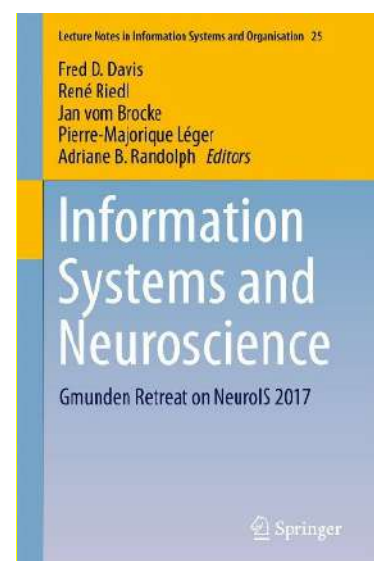
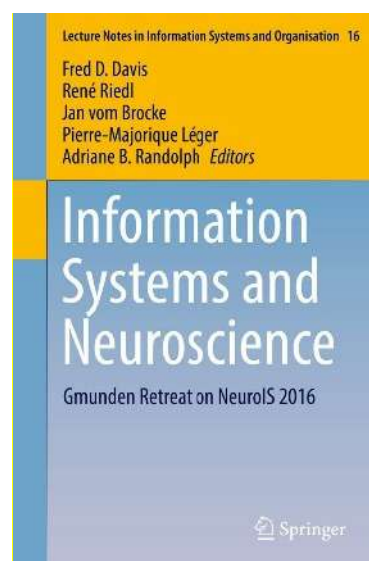
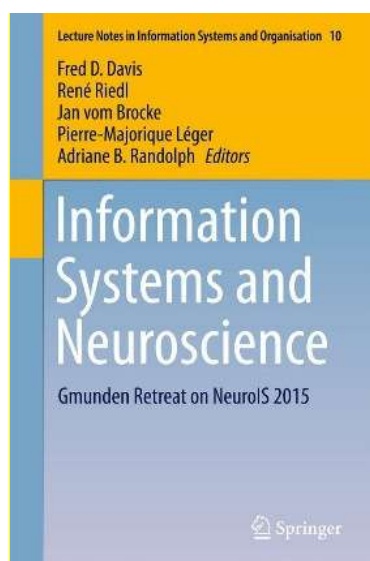


Riedl, R. and Léger, P.-M. 2016. Fundamentals of NeuroIS: Information Systems and the Brain, Berlin, Heidelberg: Springer.



Riedl, R., Davis, F. D., Banker, R. and Kenning, P. 2017. Neuroscience in Information Systems Research: Applying Knowledge of Brain Functionality without Neuroscience Tools, Berlin, Heidelberg: Springer.

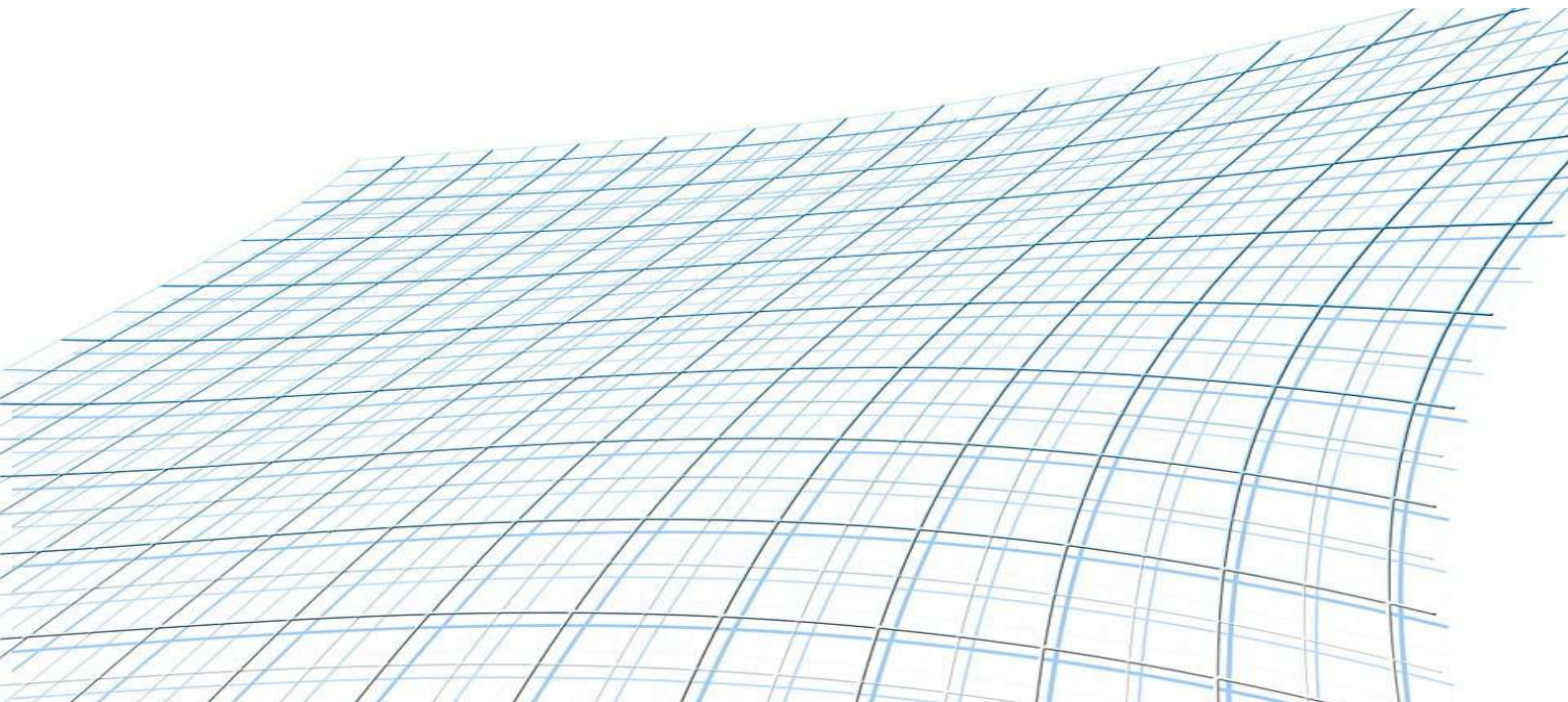
Publication of the Springer Proceedings of the NeuroIS Retreat started in 2015.



Selected NeuroIS Publications

Based on the following QR code and at www.NeuroIS.org, you can find the 164 publications included in a recent review paper that has analyzed the NeuroIS literature:

Riedl, René, Fischer, Thomas and Léger, Pierre-Majorique (2017). A Decade of NeuroIS Research: Status Quo, Challenges, and Future Directions. Proceedings of the 38th International Conference on Information Systems (ICIS), Seoul, South Korea.



Previous NeuroIS Retreat Participants

Marc Adam	Kevin Hill	Jella Pfeiffer
Bonnie Anderson	Rudy Hirschheim	Jakob Pinggera
Andreas Auinger	Elizabeth Howlett	Luisa Pinto
Rajiv Banker	Yu-feng Huang	Anna Katharina Pracht
Henri Barki	Marco Hubert	Naveen Quazilbash
Izak Benbasat	Hamzah Ibrahim	Isabel Ramos
Yael Benn	Anja Ischebeck	Adriane Randolph
Ofer Bergman	Andrija Javor	Gerhard Ransmayr
Sabine Bergner	Jeffrey Jenkins	Jan Recker
Edward Bernroider	Dominik Jung	Martin Reuter
Gustav Bernroider	Tobias Kalenscher	Amir Riaz
Upasna Bhandari	Pankush Kalgotra	René Riedl
Christian Breitwieser	Melih Kandemir	James Rodger
Walter Brenner	Peter Kenning	Laurens Rook
Michael Breward	William Kettinger	Roosmehr Safi
Katherine Breward	Harald Kindermann	Radhika Santhanam
Glenn Browne	Brock Kirwan	Robert Savoy
Ricardo Buettner	Michael Knierim	Christoph Schneider
Ann Frances Cameron	Jan Krämer	Melanie Schreiner
Emma Campbell	Caspar Krampe	Isabella Seeber
Vincent Carrasco	Helmut Krcmar	Anna-Maria Seeger
Christy Cheung	Alex Kreiling	Sylvain Sénécal
Colin Conrad	Élise Labonte-LeMoine	Hong Sheng
Paul Cronan	Sven Laumer	Maria Shitkova
Fred D. Davis	Pierre-Majorique Léger	Keng Siau
Christopher Davis	Othmar Lehner	Sarah Spiekermann
Alan Dennis	Mengxiang Li	Detmar Straub
Jens Dibbern	Ting-Peng Liang	Tina Strombach
Angelika Dimoka	Aleck Lin	Walter Struhal
Verena Dorner	Nicholas Lockwood	Stefan Tams
David Douglas	Peter Loos	Lars Taxén
Nour El Shamy	Ewa Lux	Vasileios Terzis
Kelly Fadel	Manuela Macedonia	Timm Teubner
Lisa Falschlunger	Bin Mai	Ofir Turel
Thomas Fischer	Christian Maier	Aleksander Valjamae
Marc Fredette	Roger McHaney	Anthony Vance
Celina Friemel	Thomas Meservy	Srini Venkatraman
David Gefen	Nash Milic	Jan vom Brocke
Christian Gibas	Mahdi Mirhoseini	Aliona von der Trenck
Nadine Gier	Peter Mohr	Eric Walden
Robert Gleasure	Christian Montag	Peter Walla
Camille Grange	Christos Moridis	Bernd Weber
Shirley Gregor	Javed Mostafa	Barbara Weber
Alok Gupta	Marius Müller	Anne-Katharina Weilenmann
Jacek Gwizdka	Gernot Müller-Putz	Christoph Weinert
Richard Hall	Fiona Fui-Hoon Nah	Christof Weinhardt
Bryan Hammer	Tillmann Neben	Markus Weinmann
Allan Hanbury	Christa Neuper	Werner Wetzlinger
Anuja Hariharan	Manuel Neurauter	Eoin Whelan
Khaled Hassanein	Nurten Öksüz	Selina Wriessnegger
Florian Hawlitschek	Anssi Öörni	Bo-Sophia Xiao
Milena Head	Ana Ortiz de Guinea	Qing Xu
Hauke Heekeren	Paul Pavlou	Markus Zanker
Armin Heinzl	Jakob Perktold	Chen Zhang
Erik Hemmer	Julien Perret	
Alan Hevner	Thies Pfeiffer	

In addition to Fred D. Davis and René Riedl, the conference co-chairs, so far one person participated at all NeuroIS Retreats (2009-2017): Jan vom Brocke. Congratulations Jan – we thank you for your ongoing support! Other scholars who participated at 1/3 of the NeuroIS Retreats at least are: 7× Pierre-Majorique Léger; 6× Harald Kindermann; 5× Jacek Gwizdka, Armin Heinzl, Gernot Müller-Putz, Adriane Randolph, Stefan Tams, and Lars Taxén; 4× Marc Adam, Ricardo Buettner, Rob Gleasure, Alan Hevner, Peter Kenning, Aleck Lin, Anthony Vance, and Peter Walla; and 3× Bonnie Anderson, Andreas Auinger, Christopher Davis, Thomas Fischer, Andrija Javor, Manuela Macedonia, Javed Mostafa, Tillmann Neben, Detmar Straub, Eric Walden, Barbara Weber, and Selina Wriessnegger. Thanks to these scholars and all other former participants!

Video summaries of the previous NeuroIS Retreats can be found based on the following QR codes:



2009



2010



2011



2012



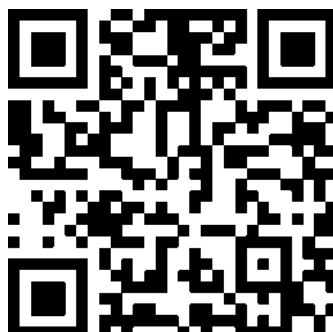
2013



2014



2015



2016



2017

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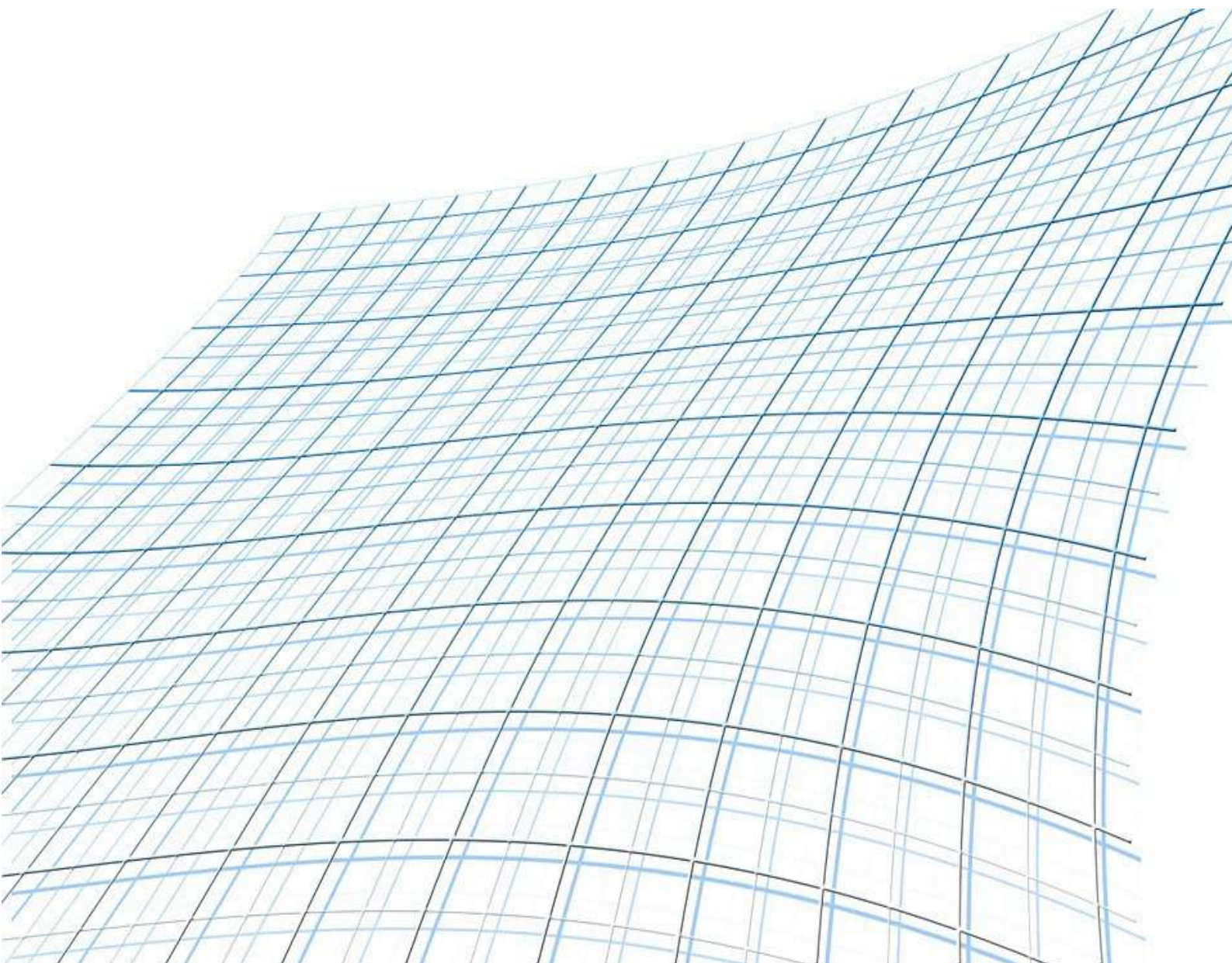
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You can also find this anniversary book online on our website.

www.NeuroIS.org

