A Decade of NeuroIS Research: Status Quo, Challenges, and Future Directions

René Riedl, Thomas Fischer, Pierre-Majorique Léger
NeuroIS

NeuroIS is a field in Information Systems (IS) that makes use of neuroscience (e.g., fMRI or EEG) and neurophysiological (e.g., EDA or HR) tools and knowledge to better understand the development, adoption, and impact of information and communication technologies.

Riedl et al. (2010), CAIS
Genesis of NeuroIS

ICIS 2007 in Montréal
(4 independent presentations)

- Fred Davis
- Angelika Dimoka
- Adriane Randolph
- René Riedl
Development of the NeuroIS Field

- Papers in the most prestigious journals of the field, *MISQ* and *ISR*
- 2 NeuroIS special issues in top journals, *JMIS* and *JAIS*
- Many papers in the ICIS proceedings
Development of the NeuroIS Field

- a specialized conference was started in 2009: **NeuroIS Retreat** (starting with the 10 years anniversary in 2018, this event will be held in **Vienna** – formerly held in Gmunden, Austria)

- Organizing Committee: F. D. Davis / R. Riedl / J. vom Brocke / P.-M. Léger / A. Randolph

www.NeurolIS.org
To scientifically assess the status of the NeuroIS field, a detailed look into the published literature is necessary.
Research Questions

■ **Who** published NeuroIS research?

■ **What kind** of NeuroIS research was published?

■ **Which major thematic orientation** was chosen by NeuroIS researchers?

■ **How** was the empirical NeuroIS research conducted?
Literature Search

Reviewed period: 2008-2016

Outlets: 55 peer-reviewed journals + 11 conference proceedings

Keywords:

<table>
<thead>
<tr>
<th>Generic Terms</th>
<th>Morpho*</th>
<th>Galvan*</th>
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<tbody>
<tr>
<td>Nervous system</td>
<td>NIRS</td>
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<td>Neuro-Information-Systems</td>
<td>Positron emission</td>
<td>Muscular</td>
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<td>NeuroIS</td>
<td>Transcranial</td>
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<td>CNS Terms</td>
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<td>Diffusion Tensor</td>
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<td>MEG</td>
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Result: 164 publications (95 journal + 69 conference)
Literature Analysis

Done by first and second author based on the following metrics:

<table>
<thead>
<tr>
<th>Question</th>
<th>Metrics</th>
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<tbody>
<tr>
<td>Who published NeuroIS research?</td>
<td>• Author names</td>
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<tr>
<td></td>
<td>• Number of authors of each paper</td>
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<tr>
<td>What kind of NeuroIS research was published?</td>
<td>• Contribution: empirical study (completed), empirical study (research-in-progress), methodological paper, conceptual paper, review</td>
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<tr>
<td>Which major thematic orientation was chosen by NeuroIS researchers?</td>
<td>• Thematic orientation (based on Dimoka et al. 2011): cognitive processes, emotional processes, social processes, decision-making processes</td>
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<tr>
<td>How was the empirical NeuroIS research conducted?</td>
<td>• Neurophysiological tools used</td>
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<td></td>
<td>• Setting: field or laboratory</td>
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<td>• Time scale: longitudinal or cross-sectional</td>
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<td>• Country of investigation</td>
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<td></td>
<td>• Sample: size, gender distribution, age distribution</td>
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</table>
Who published NeuroIS research?

1. Division of Labor

Average number of authors per article: 3.45 in our sample
MISQ (N = 51): 2.98
ISR (N = 48): 3.10
Collaboration with researchers from other disciplines such as medicine (Javor et al. 2016) or cognitive neuroscientists (Vance et al. 2014).

Still potential to grow if we use neuroscience as reference discipline, e.g.: Journal of Neuroscience (N = 98): 5.65
Who published NeuroIS research?

2. Inequality in Contributions

362 different authors from our sample of 164 papers

Small absolute number of highly engaged researchers:
36 authors with more than 2 NeuroIS publications
Top-36 contributors responsible for 35% of all publications

→ Scholars who are potential candidates to act in the role of editors and reviewers for NeuroIS papers are relatively scarce (on a top journal level)
Gini coefficient: .32 (0 = total equality; 1 = total inequality)
Who published NeuroIS Research?

3. Potential for Growth in High-Ranked IS Journals

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27 publications in Senior Scholar’s Basket (None in: ISJ, JIT, JSIS)
What kind of NeuroIS research was published?

- Empirical
- Empirical (RiP)
- Conceptual
- Methodological
- Review

Number of papers
Note: Journal of the Association for Information Systems (Vol. 15, No. 10) published a NeuroIS special issue with a focus on research methodology in 2014.
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Note: Journal of the Association for Information Systems (Vol. 15, No. 10) published a NeuroIS special issue with a focus on research methodology in 2014.
Which major thematic orientation was chosen?

Classification of N = 103 empirical papers based on four categories described in Dimoka et al. (2011, ISR, p. 691):

- **Cognitive processes**: all processes related to knowledge acquisition and understanding through experience and thought (e.g., cognitive effort)

- **Emotional processes**: all processes related to experience of positive or negative affect (e.g., fear)

- **Social processes**: all processes related to interaction among humans (e.g., cooperation)

- **Decision-making processes**: all processes related to selection of a course of action among several possibilities (e.g., purchase decision in online shopping)
Which major thematic orientation was chosen?

Cohen’s Kappa coefficient for the 103 classified completed empirical papers was 0.74 (= good inter-rater reliability)
More future research on:

Social processes

Decision-making processes
More future research on:

Interaction of cognition (C-system) & emotion (x-System)

Satpute & Lieberman (2006), *Brain Research*
How was the empirical research conducted?

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Miscellaneous = Tools used in only one paper.
Examples: vocal pitch measurement and diffusion tensor imaging.
How was the empirical research conducted?

- Eye tracking: 53 papers
- EEG: 22 papers
- Heart rate: 14 papers
- Skin conductance: 13 papers
- fMRI: 9 papers
- fEMG: 5 papers
- Hormones: 5 papers
- Blood pressure: 2 papers
- Miscellaneous: 6 papers
How was the empirical research conducted?

Activity of the ANS is studied more frequently than actual brain activity

→ likely due to costs and intrusiveness
How was the empirical research conducted?

EEG studies are (in some cases) based on gaming headsets (22 studies) → reliability and validity of such devices are questionable.
How was the empirical research conducted?

High share of laboratory studies → field studies are needed

Fischer & Riedl (2016), *Lecture Notes in Information Systems and Organisation*
How was the empirical research conducted?

Setting of a study (N = 103): 101 laboratory / 2 field

Time scale (N = 103): 52 cross-sectional / 51 longitudinal

Sample size (N = 110): median of 36 subjects (min: 5, max: 451)

Gender distribution (N = 80): average share of females of 48%

Age distribution in the sample (N = 75): average subject age of 26 years, min / max age (N = 45): min: 17, max: 88
Conclusion

- NeuroIS community has reached a critical mass of active researchers.
- **Expectations** regarding the potential of NeuroIS to contribute to both IS theory and practice seems to be **fairly realistic today**.
- NeuroIS has become an **established research field** in the IS discipline.
It is hoped that in the next decade the NeuroIS field will continue to make the same progress that it has made during the last ten years!
NeuroIS Retreat 2018 – VIENNA

- **Submission Deadline:** March 23, 2018
- **Retreat:** June 19-21, 2018 (Vienna, Austria)

www.NeuroIS.org