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Abstract:

The use of neurophysiological tools in the information systems domain has received increased attention over the last decade. The Hawaii International Conference on System Sciences has helped provide a home for rigorously exploring such work through related minitracks and symposia. This paper reports on a panel presented at the 49th HICSS conference held in 2016 during a symposium organized to help orient interested researchers to the usefulness of cognitive neuroscience in IS research. This paper first introduces the rise in the IS discipline for integrating the methodologies and tools of cognitive neuroscience. It then presents individual viewpoints from the varying panel members at the symposium as they addressed questions of longevity, applicability, and next steps for the neuroIS subdiscipline. The four panel members included Alan Dennis, Angelika Dimoka, Allen Lee, and Ofir Turel.

Keywords: Cognitive Neuroscience, NeuroIS, Neurophysiological Tools, Panel.

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1 Introduction

Human cognition has been a cornerstone of the information systems (IS) discipline. While academia has a long and ongoing tradition of measuring human cognition through abstract cognitive tasks, in the last decade, the ability to measure human cognition in IS through more concrete neuroimaging measures has increased dramatically (Mamun, David, Mai, Kim, & Parsons, 2018; Riedl, Fischer, & Léger, 2017). These methodological tools have the ability to uncover how individuals process interactions with IT with great temporal or spatial specificity and, thus, allow researchers to have the ability to locate specific phenomena, unveil cognitive strengths and limitations of virtual interactions, elucidate limitations in the design of IT, and so on. As such, researchers have the unprecedented opportunity to develop new theories about how cognitive neuroscience and psychophysiological phenomena impact IS-relevant human behaviors and to expand, enhance, and sharpen already existing theories of higher level cognition.

In conjunction, many scholarly outlets have been trying to capitalize on this new opportunity. In addition to journals, conference venues have offered a platform for discussion and orientation. For the 49th annual Hawaiian International Conference on System Sciences (HICSS), Randall "Randy" Minas, Adriane Randolph, and Raymond "Ray" Panko organized a half-day symposium titled "Cognitive Foreshadowing: Next Steps in Applying Neuroscience and Cognitive Science to Information Systems Research" to help orient interested researchers to the usefulness of cognitive neuroscience in IS research. The symposium sought to advance the use of these methodologies in IS by bringing together researchers to share their work and insights. This symposium included introductory presentations on cognitive neuroscience and brain-computer interfacing, selected work by a doctoral student, and a panel of four scholars with deep and varying expertise in the IS discipline who all used or considered using neurophysiological tools.

This paper presents the viewpoints of the four panel members (see Figure 1) at the symposium as they discussed the current state of cognitive neuroscience in the IS discipline as an emergent subdiscipline. The panel discussion provided insights from scholars on whether the neuroIS subdiscipline is here to stay, how it applies to their current line of research, and what the IS discipline can do better to further its development. The scholars offered key insights on the past, present, and future of neuroIS; the role of cognitive neuroscience in the IS discipline; and, more broadly, the application of neuroIS to the scientific venture. The four panelists in alphabetical order with their titles at the time of the session included: Alan Dennis, Professor and John T. Chambers Chair of Internet Systems in the Kelley School of Business at Indiana University; Angelika Dimoka, Associate Professor in the Marketing and Supply Chain Management and the Management of Information Systems Department at the Fox School of Business at Temple University and the Director of the Center for Neural Decision Making; Allen Lee, Professor of Information Systems in the School of Business at Virginia Commonwealth University; and Ofir Turel, Professor of Information Systems and Decision Sciences at the College of Business and Economics, California State University, Fullerton, and a Scholar in Residence at the Brain and Creativity Institute, Department of Psychology at the University of Southern California. In Sections 2 to 4, we chronicle the responses of these scholars to three questions posed during the panel.

Figure 1. Panel Members for the 49th HICSS Cognitive Neuroscience Symposium. Left to Right: Randall Minas (Facilitator), Angelika Dimoka, Ofir Turel, Allen Lee, and Alan Dennis.

2 Are Neurophysiological Tools and Techniques in IS (NeuroIS) a Trend or Here to Stay?

Turel: I may be more pessimistic than a lot of people in the room. I think it is here to stay—don't get me wrong—but I think it's going to stay in a much narrower form than we have seen it so far. So far, we have seen applications to a lot of typical IS questions: trust, technostress, errors, and so on. The IS, or the neuroIS discipline, is a bit different than many other disciplines. So, if you think about the technology adoption, or IT value, or virtual team success streams of research, and so on, these topics focus on problems—very specific problems that we try to address. With neuroIS, it's sort of the other way around. We have tools, we have some medical knowledge, and we're trying to find problems that would fit neuroIS research.

And the reality is that it's not easy. I mean, you've seen the PhD doctoral presentation today, and it's not very clear how we can apply neuroIS tools to some of the typical IS problems. I'm not saying we always should; we will always diverge from the typical IS problems. Like one of the presentations today, which have talked about people with problems, disabilities, schizophrenia, and so on. These are issues we can address with neuroIS tools, but they don't fall under mainstream IS research or, at least, not yet. I also think that we can learn from what happened in other applied disciplines. And that would be very interesting, and we could learn a lot from it about what may happen to neuroIS.

So, neuroadaptations of research disciplines are not new. I mean, neuroIS is not the only point of view. There's neuromarketing, neuroeconomics, neurostrategy, and so on. Last week, I ventured out and I looked at papers in neuromarketing, papers in neurostrategy, and so on. And I was a bit surprised—the seminal paper by Carolyn Yoon in neuromarketing was cited…can anyone guess? How many times—2009 paper? Ten times. There is a paper in the *Strategic Management Journal* (SMJ) called "Neurostrategy". Sounds very sexy, right? "Neurostrategy". Cited twice. *Journal of Applied Psychology* mentioned the term neuroscience twice. So, that pretty much raises the question: why is the IS discipline different? I reflected personally on this question, and I'm sure this panel could have their own opinions, but I don't think, in terms of need, we need neuroscience tools more than marketing, or more than strategy, or any other discipline—certainly not more than applied psychology. I think the big difference is in terms of the leadership and general interest of people, so maybe we are spearheaded by qualified researchers that move the discipline forward and makes it more appealing, which is okay, as opposed to other disciplines, which fail to, basically, reach a large mass of people. Even though, in marketing, I know there is renewed interest in neuroscience. So, basically, to conclude my opinion on this matter, I think it's certainly going to stay here, but we'll have to carefully think about it and have some questions that we want and should address with these tools.

Lee: This is a good question for the philosophy of science. I'll just focus on two lessons. The first lesson is that, for a research discipline to progress, it has to follow deductive logic, not inductive logic. A focus on induction would be a focus on the collection of more and more data such as larger sample sizes, the collection of more and more statistical findings such as more and more statistically significant rejections of null hypotheses, and the collection of more and more r-square values that are higher and higher. A focus on induction is not enough. Hume's problem of induction and Goodman's new riddle of induction tell us that collecting more and more data differs from building theory and testing theory. To build theory and to test theory, what do we need to do not instead of, but in addition to, collecting more and more data?

The answer is deduction according to a specific form of syllogistic reasoning: modus tollens. Modus tollens is the syllogism where the major premise is "if p is true, then q is true", the minor premise is "q is not true", and the conclusion is "therefore, p is not true". In empirical research, "p" stands for the theory and "q" stands for a prediction that the theory makes. And this deductive logic applies for positivist research, interpretive research, design research, and action research.

A focus on induction alone leads to theory that can vary at the margins but never really changes or grows. Inductive logic is self-sealing: it allows any and all non-supportive data to be argued away and the basic theory to always survive intact. Deductive logic opens the door to a theory's actually being rejected and then replaced by a better one.

The second lesson, from Thomas Kuhn's book *The Structure of Scientific Revolutions* is that neuroIS would eventually need to develop a paradigm—or what Kuhn calls a puzzle—that would drive constructive research in the form of puzzle solving. I will just repeat the names that Kuhn gives to the four components of a paradigm (for more details, you will have to read the book) 1) symbolic generalizations; 2) models,

which may range from heuristic to ontological; 3) shared values among researchers in the research community; and 4) exemplars. If neuroIS, as an explanatory science, is here to stay instead of just being a trend, then it will have to develop these four components, though I believe the most important one is the development of shared values that define a scientific community.

Dennis: I believe neuroIS—the application of neuroscience and physiological methods to IS research—is not a fad. It will be around in the discipline as a viable method for the foreseeable future. NeuroIS enables researchers to see things we cannot see with other methods (e.g., observation, self-reports). It helps us understand cognition and emotion—what is going on inside a user as the user interacts with technology. Observation and self-reports will remain useful, but understanding cognition and emotion in real-time is effectively impossible without neuroIS—especially when one considers that users are often very bad at self-assessment, so even they may not fully understand their own cognition and emotions.

NeuroIS offers a variety of techniques that enable different types of measurements at different levels of intrusiveness, expense, and expertise. Some of the techniques are not very intrusive or expensive, such as skin sensors and EEG. Equipment is less than $5,000, and it is easy to train master's students to do data collection. Experimental design and data analyses require more expertise but far less than some other techniques, such as fMRI.

Dimoka: I believe there is a lot of potential. I believe it is an area here to stay. For those of you that are new in this discipline and don't know much or heard much about neuroIS, it's a term that has been coined almost nine years ago. Let me back up a little bit: decision neuroscience is a research area that includes all business disciplines (such as marketing, economics, accounting, finance, and information systems). And decision neuroscience is definitely here to stay. It has been adapted very well in most business disciplines, and I strongly believe it is being adapted very well in IS.

Now, one of the things that we haven't done very well and have to commit on doing better is not to isolate ourselves. We have to make sure that we are part of the neurocommunity. It's not only about information systems: other business disciplines use neuroscience as well, and we can learn from each other. And the main reason is that the knowledge in neuroscience has been advancing so fast. I tell my PhD students that the knowledge that they are acquiring right now (e.g., how to use neuroscience tools such as fMRI) is way much better from the knowledge that I acquired; it is knowledge that is advancing very fast. If we isolate ourselves from the rest of the decision neuroscience community, I don't think we're going to be here to stay for long. Therefore, we have to make sure that we are part of the broader community and learn from each other. So yes, I believe neuroIS here to stay. Of course, I'm very, very biased because it's something that I've been working my whole life on, and I'm happy to see conferences like this one where people can come and learn more. There are a lot of new faces that have come to hear us talk.

3 Is the Use of Neurophysiological Tools and Techniques Applicable to Your Focal Area of Research and How?

Lee: Many interpretive researchers and philosophers would dismiss neurophysiological tools and techniques as reductionist—in other words, the naïve attempt to reduce the rich world of human values and social meanings to some sort of corresponding patterns of atoms, molecules, and electrons. However, after I did some reading in neuroIS to prepare for this symposium, I must say that I see nothing reductionist at all. And in fact, I see some research possibilities.

As a case in point, I saw a surprising research opportunity when I read the following by Dimoka et al. (2012, p. 691) in their 2012 *MIS Quarterly* paper:

> *It is well known that lean digital media such as e-mail have a smaller number of cues than audio or video. It has recently been argued that communication through such lean media is inherently biased, leading people to sense a more negative tone in e-mail (Byron 2008) and reducing their feeling of cooperativeness. Neurophysiological tools could assess emotional responses to e-mail (and other media) messages, thus enabling a better understanding of whether lean digital media is indeed more negatively biased than other, richer media. If so, IS researchers could strive to understand aspects that lead to this bias and find solutions to address them.*

Actually, Lee (1994) discounted the claim of the so-called "leanness" of email over 20 years ago in their paper in *MISQ.* They used hermeneutic interpretation to show that human beings are not passive recipients of bits and bytes but are actually intelligent processors who render richness from whatever cues

an email presents to them. Senders and receivers who belong to the same community—the same socially constructed reality—make such rendering possible because they each then enact when composing and reading an email, which makes the email far richer than just the words it contains. Well, just as a 2011 *ISR* paper by Dimoka, Pavlou, and Davis (2011) mentions (p. 689) that "Dimoka and Davis (2008) identified where the TAM constructs reside in the brain", it would be no less plausible for neurophysiological tools and techniques to identify where interpretive constructs, such as a shared social structure and culture, reside in the brain. Doing so could be a most interesting way of integrating positivist and interpretive approaches, where positivist researchers and interpretive researchers could see that we have really been engaged in one research enterprise all along.

Dennis: Over the past few years, my research interest has shifted to focus on cognition and emotion. I have examined these in the realm of team collaboration and social media use—in other words, what users thinks and feels when they works with others. When I read or write a comment in a group chat or in email (for work or pleasure) or read a social media story, what different emotions and cognitions are triggered? Such questions are virtually impossible to study without neurophysiological methods because users often cannot accurately express their thoughts and feelings retrospectively, and attempting to capture them in real time without neurophysiological methods interrupts the natural flow of technology use.

One of the most challenging things about using neurophysiological methods is that some methods are similar to traditional quantitative measures, but some are more qualitative in nature. For example, skin sensors can be used to measure emotional valence and arousal. The data are numeric and it is easy to hypothesize changes in valence and/or arousal and use statistics to do hypothesis testing—akin to standard quantitative experiments.

EEG data differ. Once again, the data are numeric and statistics are used, so they are, at their core, quantitative. However, a common technique is event-related spectral perturbation (ERSP), which statistically calculates which areas of the brain are active/inactive between conditions. The result is a scalp map that the researcher needs to qualitatively interpret by matching the areas in the scalp map to brain regions that prior research has identified as playing different roles in different types of cognition, such as language processing, motor planning, sensory processing, divergent thinking, memory recall, and so on. By matching the areas in the scalp maps to brain regions in past research, the researcher can better explain the nature of cognition that the user is experiencing.

Dimoka: All my research, actually, uses neurophysiological measures. My training is in neuroscience, which explains how I come to the table: it is my expertise in neuroscience. The research that I have been doing has a focus on decision making and trying to understand how people make decisions, and, as a step further—which I haven't achieved yet, and we are going to talk about that on the third question—is how to actually get information systems to move above and beyond what other disciplines have been doing so far. So, in my research, I am trying to see and understand: how neuroscience can help us understand a little bit more about decisions, especially if we can localize specific IS constructs in the brain? A paper of mine has already discussed about where trust and distrust reside in the brain, which provides an example of an area of study by not only myself but a lot of other decision neuroscientists where we ask, "How can we use these tools to understand a little bit better some of the constructs that have been studied for many, many years in the IS literature?".

Of course, now we have to move above and beyond that because one of the most common questions I always hear is the "so what?" question. Why do we care if trust resides here and distrust resides there? How does this help us as IS researchers? We—as with my own research—are at that stage right now: trying to predict how people make decisions by looking on how their body and their brain responds as well. A lot of my research now focuses on studying marketing phenomena and trying to understand how consumers make decisions and how we can help consumers make better decisions. A study that has just appeared in the *Journal of Marketing Research* has demonstrated that we can predict which messages—communication messages, such as TV advertisements, more specifically—could be successful in the marketplace by looking on how the brain of the consumers' respond when they watch these TV messages. For my research, I have been using various neurophysiological methodologies, starting from fMRI (my training) to EEG, eye-tracking, heart rate, skin conductance, implicit measures, the traditional behavioral self-reported measures, and so on because I believe they will all advance IS research.

So, where I feel a lot of the research is going, and both me and a lot of my colleagues are moving in this direction, is that using only one of these methodologies is not enough anymore. So, not only using neuroscience tools is difficult from the perspective that it is something completely different, and, well, if

you don't have to train yourself as a neuroscientist, you have to get a very good understanding about neuroscience, now just one tool is not enough. It's good to combine multiple different methodologies. But these tools are becoming easier and easier to use, and they are. Even the software tools that come with these is very easy to learn. So, to conclude, my research is trying to understand decision making. I use extensively neuroscience knowledge to be able to open up that black box and see how we, as humans, make decisions. And I see that we need to use multiple tools to be able to get the better, more holistic understanding about how we make decisions.

Turel: Like Angelika, I am studying decision making but maladaptive decision making. So, mostly the dark side of information technology, technology addictions, addictions to video games and Facebook, and so on. I use fMRI and MRI tools for the most part. And basically these tools are needed in these situations because we cannot effectively examine implicit and automatic processes without them. And, as opposed to the many other examples here, we have an interesting situation because maladaptive decision making is rooted in the brain, and we are in a position where we could actually fix that using typical neurological tools, pharmacology, therapy, and others. The first step is basically to understand what is going on in your brain if you are addicted to Facebook or video games. The second step is to look into ways to fix these issues in the brain. So, my research has primarily been looking into these issues and also looking into elements of stress and decision making, and I plan to continue looking into such issues in the next couple of years.

If neuroIS is applied to study general IS phenomena such as use, decision making, and so on, there may be a "so what?" issue. If we know a region is involved in trust, perceptions of ease of use, and so on (which is a typical finding of a neuroIS study), are we going to run lobotomies to fix peoples' IS attitudes and behaviors? Release dopamine to make them enjoy a system? Stimulate their brain with pharmacology or electrical currents to achieve desired IS use behaviors? These seem like far-fetched practical implications that may be relevant to only a few aversive situations that require correction (e.g., addiction). Keep in mind that our discipline is not about mapping the human brain and that such mapping of regions and tracts involved in decision making has been done in non-IS contexts (see many years of research on cognitive neuroscience). Hence, the ability of neuroIS to add to this body of work is still there but may be limited.

The neuroIS path is often risky and expensive and, hence, can be prohibitive for junior researchers. As opposed to traditional research tools (e.g., survey, SEM, etc.), neuroIS requires additional training (sometimes out of one's comfort zone), sometimes substantial funding, and often collaboration with neuroscientists. Thus, while it may be an interesting choice, it is certainly not the easiest and most natural way for junior faculty.

4 What is Next or What can We be Doing Better as a Subdiscipline?

Dimoka: First, and to reiterate, we have to make sure not to create any silos. And that is something that has been discussed by a lot in the other disciplines as well. We talked about marketing and economics, which are two disciplines that neuroscience has been picked up quite a lot. One of things that researchers in these disciplines are doing well is connecting with each other, talking to each other, and learning from each other. IS researchers need to put a lot of effort to connect with colleagues from other business disciplines that use neuroscience and develop and open dialog with them.

My second suggestion is we have to move above and beyond description validity, which we have been quite successful at doing so. By description validity, I mean which are the parts of the brain that are activated for particular constructs; we have done that seven to 10 years ago. A lot of the research right now focuses on examining prediction validity (i.e., can I predict behavior). Can we predict how people will behave by looking at how their bodies are responding? Where I see neuroIS actually taking off and differentiating from other disciplines is mostly in the prescription validity: how can we use this knowledge acquired from neuroscience tools to better prescribe IS tools? Information systems is a unique discipline in which we are trying to understand how we can prescribe better IS tools. Therefore, I see that neuroIS could help a lot on this endeavor. I do not think marketing can do that, and I do not think economics can do that, but I see that information systems can. And some of my colleagues on this panel, actually, have been doing quite excellent work on prescription validity using neuroIS.

Dennis: Fifteen of us attended the first Gmunden Retreat on NeuroIS in 2009 (Riedl et al., 2010). Our goal was to establish neurophysiological methods as a viable and normal research method in IS. As I reflect on the past eight years, I believe we have come a long way. I believe that neurophysiological

methods are well accepted; although they are not a routine part of IS research, they are widely seen as viable methods for answering important questions that cannot be answered with our traditional methods.

As research advances and research questions become more nuanced in a variety of different subareas in IS, I expect to see a slow but steady growth in the use of neurophysiological methods. Not all researchers will embrace them, but not all researchers embrace experimental methods. We each have our own preferred approach to research, which is as it should be. So, I encourage us all to be open to the different methods employed.

Lee: I am presuming that the question means "What is next or what can we be doing better as a sub-discipline of the IS discipline?".

Well, my answer depends on how we see the IS discipline. Do we see IS as explanatory science modeled on the natural sciences and social sciences? Or do we see IS as a professional discipline modeled on the professions, such as medicine, engineering, and architecture?

There's a big difference here. If we see IS as a professional discipline, then we don't need to develop explanatory theories like they do in the natural and social sciences. Explanatory theories can contribute to problem solving and action taking in the real world, but problem solving and action taking do not wait for explanatory theories to be ready and available. Sure, professions such as medicine and engineering can apply explanatory theory, but they don't wait for explanatory theory either. They go ahead and use knowledge in forms in addition to, if at all, explanatory scientific theories made up of independent and dependent variables that are subjected to statistical hypothesis testing. They use knowledge in forms that include design theory and what I call action theory. The bottom line is whether we see IS as more like a natural and social science where "theory" gets priority or more like a profession where "problem solving" and "action" get priority.

There is a big advantage to neuroIS in supporting IS as a professional discipline instead of IS as like a natural or social science. The advantage is that neuroIS could then free itself from having to develop explanatory scientific theories made up of independent and dependent variables that are subjected to statistical hypothesis testing. Instead, neuroIS research could then proceed directly to finding out what works in problem-solving and action-taking. Yes, theory would still need to be developed, but it would not be explanatory theory. It would be theory which works, even if the theory itself is only heuristic, but also where the research is rigorous in showing the conditions under which the theory works. The profession of medicine provides an excellent example of this.

So, as for the question, what can neuroIS be doing better as a subdiscipline, my answer is that neuroIS can be doing better by supporting IS as a profession (similar to medicine, engineering, and architecture) rather than supporting IS as an explanatory science like the natural and social sciences.

Turel: I think we've seen a couple of examples today of some hype associated with neuroIS. I love neuroIS, and I frequently use neuroscience tools, but we have to realize that neuroIS tools do not provide an absolute truth. They are not necessarily better than other measures, and we start getting into this discussion about whether they complement or supplement traditional measures. And I think we should go deeper into that because people should not use neuroIS tools in all situations. Can they use neuroIS tools? Of course they can. But is it the best way to measure things, for example, implicit associations? Yes, you could measure implicit associations using neuroIS tools, but it's not necessarily the only or best way.

So, I think we should develop deeper discussion about what can and cannot be done with neuroIS tools; that's very important for us moving forward. I like this discussion about professional discipline versus natural science discipline. I'm wearing two hats, so I'm also editing a journal in psychology and there I'm meeting with submissions from people in the medical discipline, for the most part, and I can see major differences. For example, in IS, theorizing is a 20-page report about why you expect something and so on, whereas, in the more medical papers, we know that A is associated with B. That's it. Why? Ask God, I don't know. We just know. Alright, so, we have to be more accepting—going back to Alan Dennis' point—we have to be more accepting of other paradigms. It's not necessarily what we're used to. Things could be different if we just accept them.

And my third point is: I don't want to force *MISQ* or *ISR* or other journals to change their editorial statement, but they are currently very prone to lean towards the more applied side of neuroIS. It's not about mapping the brain or understanding how things work. So, either these need to be adjusted eventually for us to develop better understanding of what works in the brains of IS users, or some of us

will find ourselves submitting papers to other outlets that are more accepting of the mapping the brain, trying to understand where trust and distrust work, and so on.

And, last thing, I don't want you guys to be discouraged or saddened—the more junior researchers—by the cost or problems of doing neuroIS research. Yes, it's a steep learning curve. Yes, it requires a lot of time, and, as opposed to SEM, for example, or other research techniques, it requires some funding, which it makes it somewhat difficult, especially if you're working in a really tight business group that, you know, will not give you $50,000 to run scans. So, there are solutions: don't work on your own—collaborate. And many of us have done. You talk with neuroscience departments and/or neuroscientists. Not all of us have neuroscience training and should not even try to be jack of all trades. I don't think it's efficient. You find people to be experts in running fMRI—you need to have the basic knowledge, though, to understand how to communicate with them, how to work with them, but you don't have to be *the* expert in running the fMRI scans.

And, last point: consider outsourcing, like any other thing, and run expensive experiments in countries where the cost is lower. These are a couple pieces of advice for the more junior researchers if you're looking into easier ways to get into neuroIS.

5 Conclusion

Overall, the panel discussion provides insight into the current and future state of the neuroIS subdiscipline. The scholars agreed that the neuroIS subdiscipline is here to stay. Although some noted that, after a period of increased publications, the subdiscipline will likely settle into a smaller but regular stream of research in the IS discipline. To help strengthen the area, we must take care not to engage in isolationism. We also need to be thoughtful about using the tools when they create value and to examine areas of thinking and behavior that we might not otherwise uncover with traditional psychometric tools alone.

The IS scholars see the methods and tools of cognitive neuroscience as relevant to many areas of the IS discipline, including collaboration research, decision making, systems analysis and design, and others. Indeed, scholars have produced neuroIS publications that have furthered knowledge and increased understanding in each of these areas. The panel also identified a need for more individuals familiar with or trained in neuroscience to conduct high-quality reviews and strong research in the IS discipline.

The panel encouraged scholars entering the area to seek collaboration with experts in decision and cognitive neuroscience while possessing enough knowledge to have credible conversations. Junior faculty may wish to defer engagement due to the significant learning curve and resources needed. However, all scholars should consider neuroIS tools as another method akin to choosing experimentation or field studies; by each selecting different methods, we collectively develop the discipline's expertise and can select the method that best pertains to the questions we ask.

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