

**Behavioral and Social Research Program
National Institute on Aging**

NEUROECONOMICS AND AGING

August 12, 2005

Meeting Report

(Rev. 9-2-2005)

Invited Participants

David Laibson, Harvard University
Andrew Lo, MIT
Kevin McCabe, George Mason University
Antonio Rangel, Stanford University
Alan Sanfey, University of Arizona
Paul Slovic, Decision Research
Elke Weber, Columbia University

National Institute on Aging (NIA) Participants

Jeff Elias, Behavioral and Social Research (BSR), NIA
Lis Nielsen, BSR, NIA
John Phillips, BSR, NIA
Richard Suzman, BSR, NIA
Rose Maria Li (contractor)

Invited Guests

Dan Benjamin, Harvard University (Economics Department)
Christopher Chabris, Harvard University (Psychology Department)
Kaye Husbands Fealing, Directorate of Social, Behavioral, and Economic Sciences, Division of
Social and Economic Sciences (SBE/SES), National Science Foundation (NSF)
Richard Lempert, SBE/SES, NSF
Jacqueline Meszaros, SBE/SES, NSF
Daniel Newlon, SBE/SES, NSF
Robert O'Connor, SBE/SES, NSF

Introduction

The August 12, 2005 teleconference was the first in a series of two teleconferences¹ on neuroeconomics and aging initiated by the National Institute on Aging (NIA) Behavioral and Social Research Program (BSR). The aim of the teleconference was to solicit perspectives from psychology and economics experts on promising avenues for aging research in neuroeconomics, particularly areas of research that address multi-level interactions among psychological, physiological, social, and economic factors that influence how older adults negotiate important life decisions related to retirement, Medicare, and healthcare management.

¹ The second teleconference will take place on August 26, 2005 at 1 pm (EST).

Richard Suzman, BSR's Director, underscored his desire to put investment in the area of neuroeconomics on an exponential trajectory over the next few years as the topic goes right to the heart of BSR's interdisciplinary perspective. BSR also is interested in aging and development across the life cycle. Some NIA-funded studies deal with early adulthood, not necessarily with only the elderly. NIA-supported studies are underway to understand how people react to new complex set of issues related to Medicare drug plans and medical decision making.

Lis Nielsen thanked participants for preparing the requested 1-2 page statement of research priorities and directions, and invited first the psychologists, and then the economists, to briefly state the fundamental assumptions underlying their respective conceptual frameworks or models with respect to aging issues and neuroeconomics.

The View from Psychology

Alan Sanfey tries to understand decision-making from a cognitive psychology perspective that builds on basic cognitive processes (e.g., memory, attention, perception), and considers how these processes are instantiated in the brain, and how decision making emerges from these various levels of analysis. Quite a lot already is known about basic cognitive processes, so decision making theory must be constrained by how the cognitive models work, and how the brain operates to implement cognitive processes.

Elke Weber concurred with Sanfey's view and emphasized psychologists' interest in the decision process, rather than decision outcomes, noting this may be one way psychology differs from economics. Related to the process perspective is the use of mental constructs, which requires assumptions about how information, language, and learning are represented in the brain. In addition, psychologists have developed ingenious methods for measuring risks and preferences indirectly. Identifying the neural substrates of processes and phenomena that in the past have been measured only indirectly is an exciting prospect.

Paul Slovic has focused in recent years on the interplay between affect and reason. Much work on this topic has examined the degree to which there is balance between analytic and experiential thinking and how that balance changes with age, depending on the requirements of decision tasks. This is a very interesting theoretically-based area that is fundamental to psychology. At the same time, there remains much that can and needs to be done to reexamine how elderly people process information in many of the standard tasks that have been developed in the judgment and decision domain over the past 30-40 years. Slovic has found striking deficiencies even among high functioning people aged 80+ years in terms of ability to acquire a piece of information from a table (e.g., the deductible level for a health insurance plan). Documenting these processes, from acquiring information to processing information, is critically important. As it stands now, the agencies that serve the older population are sending out very complex information (e.g., how to choose among Medicare supplement plans) and appear to be oblivious to these challenges. Better research may demonstrate the need for older people to be assisted by agent-experts who can guide them through the complex decisions concerning both health and financial well being.

The View from Economics and Finance

Antonio Rangel has designed experiments to test not only the behavioral implications of choices but also whether assumptions about the processes, including brain processes, are valid. He cautioned that very different choices can be solved in different ways. Thus, whether to take another pull on a slot machine is very different from filling out a series of Medicare forms. The latter is significantly more complicated than the former.

Andrew Lo presented a narrower focus on financial decision making and financial markets. The efficient market hypothesis provides an overarching paradigm for financial markets that claims that all decision making is highly rational and market prices fully reflect all available information. Many economists, including Lo, have been drawn to neuroeconomics because the efficient market hypothesis has failed so miserably in so many different contexts, and very specifically with respect to financial decisions. His work has focused recently on developing alternatives to efficient markets by incorporating evolutionary psychology, neuroeconomics, and psychophysiology, to understand how the most experienced traders make their decisions, and the emotional responses they exhibit in real time.

Kevin McCabe comes to neuroeconomics with formal economics training and exposure to the conduct of behavioral experiments. He was drawn to personal exchange issues dealing with trust and reciprocity. Optimization models of classical economics and classical game theory were not giving very good predictions of people's behavior in his earliest experiments. In evolutionary psychology, McCabe discovered a rich field for generating hypotheses. Although there are methods for testing hypothesis in evolutionary psychology, it has become increasingly clear that these hypotheses should be tested in brain function. McCabe has used neuroscience methods to study how brain processes influence personal exchange, in particular, how the mind acts as an "alternative critic" in the usual actor-critic model, and how motivations lead to different forms of behavioral/cognitive control that allow for personal exchange among people. One of the driving reasons to be interested in neuroeconomics is that we carry personal modes of exchange into the marketplace, which creates real competition between using institutions and relying on other people to maintain our advantage. His research interests therefore include how people make tradeoffs between the market and personal exchange.

General Discussion

David Laibson asked how this new neuroeconomic/psychological research program addresses issues in aging. He proposed a 2x2 framework that might include variations in outcomes due to (fixed) individual differences along one axis, and due to life cycle experience (aging effects) on the other. Individual differences might arise from variation in cognitive ability, and from differences in self-control or capacity for self-regulation. Many of the participants in this conversation have been referring to these issues implicitly. To what extent is there a research program that can link these aspects to outcomes relevant to aging questions at the center of the NIA research program?

Weber commented that Laibson's contrast of individual versus life cycle refers to methodological issues that can be addressed with large sample sizes and random sampling. The other issue is more interesting and more challenging – the need for a longitudinal study to follow people over time. One could capture information on a longitudinal study like savings behavior,

intertemporal choice, decisions under uncertainty, self-control – all behaviors that seem to vary over the life cycle. One then can provide paradigms that require judgment or decisions and see how subjects respond in each particular context, and over time (e.g., 1 year later, 10 years later).

There seemed to be wide agreement that it would be useful to develop a battery of decision tasks on a basic level of what taps into decision and choice. This battery could certainly be implemented longitudinally and perhaps go beyond aging to permit cross-cultural comparisons. The agreed-upon set of tasks should adequately capture the range of decisions that people must make over the life span.

Suzman is rather intrigued by the longitudinal study proposed by Weber. Very good longitudinal data on economic decisions are already being collected with increasingly more measures of cognition, but it would be fascinating to have a longitudinal imaging component and also to use imaging to try to understand what people are doing when they provide various answers on a questionnaire. He provided general diffuse encouragement.

Although none disputed that in the long term, a longitudinal data effort is an incredibly valuable path to follow for all of social science, Rangel encouraged NIA to fund the basic research to make a longitudinal study truly high quality and worthwhile. He was not convinced the group could agree in 6 months on what decision-making or imaging tasks should be done to measure lifetime behavioral outcomes. Maybe the time horizon is 5 years or 10 years of basic work before we understand which tasks tap the relevant processes, how to measure critical emotional variables, and what the relevant brain structures are. Basic research is needed before we can get there.

Lo suggested one particular focus that might be considered. Asset allocation choice in retirement accounts of individuals is very well-defined, can be easily measured, and there are a variety of different sources that provide fairly high quality data. Before a cognitive study is fielded, it still can be valuable and cost-effective to undertake a cross sectional study with different age groups. If such data collection is coupled with psychological profiles and physiological measures, as well as various kinds of decision making tasks around asset allocation, they might go a long way to linking the cognitive sciences with the economics of decision making in financial markets – albeit in a relatively narrow and focused way. Lo strongly advocated cross sectional studies, e.g., from TIAA-CREF data. Linking psychological profiles and medical data to TIAA-CREF or brokerage house data would be enormously useful in the near term. Given ongoing discussions about privatizing Social Security, critical studies cannot wait.

McCabe agreed with the attraction of cross sectional studies. What is even more important is a good theory about the aging brain; its functioning and functional significance, etc. To proceed without theory may lead down many paths that, while interesting, may turn out to be dead ends. Theory development should proceed, with cross-sectional approaches to start, and later longitudinal studies will make a lot more sense.

Nielsen noted that the prepared statements highlighted focusing on decision processes, and understanding individual differences including age-related differences, as well as on outcomes of decisions, and how the two disciplines have tended to focus differently on these. Nielsen

wondered where to focus first or whether efforts can occur in tandem? Is it too early to think about research on interventions (e.g., decision aids to handle the complex choices faced by older adults, or to promote savings earlier in life)?

One phenomenon being studied by Lo's group is burn-out among professional securities traders who no longer can engage in productive and profitable decision making. Lo is exploring the possibility of using physiological measurements to characterize these traders' decision making process and developing biofeedback to help them overcome this burn-out trader phenomenon. Lo acknowledged that this would be a narrow context and may not apply to decision making in general.

Slovic always keeps the possibility for intervention in the background since there is a pressing need to provide information to people to help them make choices so vital to their quality of life. This has been a neglected area among people charged with designing programs, be they in financial arenas or health care. For example, when Medicare sends out a new information booklet to 30 million people, it may be incomprehensible to 80 percent of the targeted population. Basic testing would identify these comprehension deficiencies and the percentage of people who need different kinds of assistance.

Weber remarked that so many documented, very reliable results in the decision making literature can be applied immediately with respect to how people process and use information. Any type of causal model, including Lo's more narrowly construed example above, offers potential for effective intervention. Intervention should not dictate the agenda, but it should be considered in any research.

Most types of decisions that people have trouble with are high stakes and difficult to solve (e.g., investment decisions). Yet, noted Rangel, the millions of small decisions that are made over time, when aggregated, make a big difference in people's lives, in terms of financial and health outcomes. The right approach is to move in parallel and build on the robust set of results about how people process information. When thinking about interventions, it pays to be a bit of a dreamer, to think beyond technology available today. In a short time, we will be able to record brain measures with high resolution. The goal of understanding processes driving different types of decision making across the life cycle can be accelerated.

With respect to evolutionary psychology as a theoretical framework, Nielsen asked if there were some developmental reason for older adults to be less motivated to acquire more information, or certain types of information, that could impact decision outcomes. This is part of the reason for McCabe's interest in three generational systems and implications for functional requirements for the older brain. Another issue is time horizon. As people get older, their time horizon over which decision making makes sense is shrinking. This should have lots of implications for what areas of the brain become more important in maintaining homeostatic equilibrium and quality of life and how one would expect to see functional deterioration.

Although good theories are always sought after, to some these are empirical questions for which data are needed. Such empirical work could help point the way to theories. We want ultimately to have policy or intervention strategies.

Given that there already are large databases in economics like the Health and Retirement Study (HRS), what other types of data are needed? Lo suggested subjecting a large cross section of people (like in TIAA-CREF) to a battery of psychological and health variables of interest. Right now, there are cross sectional studies that look at psychological profiles, and also those that look at investment decisions, but nothing that links the two. Doing field experiments on top of this is an excellent idea – we need to proceed in parallel track – replicating phenomena observed in laboratory experiments.

Laibson noted that the HRS does encourage researchers to submit ideas for experimental modules or even the core survey as well. Anyone with suggestions for a module or scale should be in touch with Bob Willis and David Weir, the Principal Investigators at the University of Michigan, Ann Arbor. Suzman would like to see some neuroimaging of HRS participants; all that could be done are structural, not functional, MRIs. The study already is collecting bloods and neuropsychological measures. Getting volumetric analysis of the hippocampus would be interesting (and perhaps measures of adrenal function for day traders as well).

Proposed Interim Steps for Advancing Research on Neuroeconomics and Aging

In considering particular obstacles to the advancement of their research, participants identified a number of interim steps that can be taken to encourage research on neuroeconomics and aging:

- 1) Agree on a standard battery of decision making tasks, and what decision making processes are being assessed with these tasks. Also consider a set of neuroscience (e.g., scans at 10-year intervals) and trait measures that the group can agree upon to collect. Greater standardization will facilitate comparisons across studies.
- 2) Develop a common language. A workshop format could be employed where each participant presents basic, introductory lectures in his or her own area to bring everyone up-to-speed on the literature of each field. Many acknowledged that the Neuroeconomics Conference started that way and it was amazing how quickly collaborations formed. Now in its third year, the Neuroeconomics conference will be held in South Carolina in Sept 15-18. For information on this meeting, see: http://www.neuroeconomics.org/neuroeconomics_society_009.htm. It was also recognized that the next generation will be the one to develop the formal language that is only just emerging now.
- 3) Create more opportunities for interdisciplinary (e.g., economics, psychology, neurosciences) interactions.
- 4) Host exploratory workshops. Given the strong interest, BSR/NIA intends to begin to plan one or more exploratory workshops on neuroeconomics and aging. These can be organized by NIA, or NIA can entertain a meeting or conference grant application from an outside group, a process that generally requires 6-9 months. Suzman emphasized that participants should not wait for a formal announcement to submit an application. The National Science Foundation (NSF) also is interested in collaborating with other agencies to help develop interdisciplinary workshops. The NSF generally is interested in social variables and how different life experiences contribute to the different levels at which people are able to function over their lives.

- 5) Focus on recruiting new talent to the field. This can be challenging because neuroeconomics is not a traditional discipline so often does not have a departmental home. With funding from the NSF, Stanford is hosting a 2006 summer program on neuroeconomics, to bring the minimum set of tools needed to get people started on this research agenda. Increasing familiarity with and cross-referencing of works from other disciplines can help lead to interdisciplinary convergence. Perhaps computational science will provide a common framework.

Jeff Elias reported that the NAS will be holding a meeting in November on decision-making that will dovetail with a working group on decision making as well as a working group on neuroeconomics. Perhaps it would be helpful for these two working groups to interact. He was persuaded that communication and common language across fields are very important.

Weber proposed the benefit of having virtual centers funded to focus on particular issues and to communicate with others. Issues could be focused around topics, tasks, tools, or processes. Some institutionalized incentives for collaboration could help direct attention by busy people with many other competing interests. Others voiced preference for incentives that are more oriented toward conferences, post-docs, and training support that do not create barriers to entry.

Suzman added that BSR is very interested in and wants to support more basic research, but applications must be structured in such a way that they would be assigned to BSR, which staff would be happy to discuss with individuals. Applications also are welcome that vertically integrate a more applied perspective. Elias shared the possibility of supplement awards to grants already awarded as part of the Neuroscience Blueprint that NIH is spearheading. BSR will consider developing targeted Requests for Applications with set aside funds, and also is open to providing large scale program project (P01) support. BSR staff welcomed recommendations from participants. Nielsen invited participants to join the August 26 teleconference, and to forward any additional thoughts.