



Mind, Brain, and Society

Neurocognitive Approaches to the Social Sciences

Luce Auditorium, Yale University
34 Hillhouse Avenue
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9:00am
www.yale.edu/tyi

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The Tetral-Yale Initiative
A Graduate Collaboration of The University of Tokyo and Yale University

Program

Mind, Brain, and Society: Neurocognitive Approaches to the Social Sciences

Morning Coffee Reception: Common Room, Luce Hall
(8:45~9:05)

Opening Greetings

(9:10~9:30)

President Hiroshi Komiyama, the University of Tokyo
President Richard C. Levin, Yale University

Panel I The Political Brain: Emergence of Neuropolitics

(9:30~12:00)

Chair

Frances Rosenbluth, Department of Political Science, Yale University

Scientific Analyses of International Relations

Bruce Russett, Department of Political Science, Yale University

Euclid was sometimes an unnecessarily sophisticated social scientist : Geometric modeling in cognitive science vis-à-vis spatial modeling in political science

Junko Kato and Kensuke Okada, The University of Tokyo

Limits and possibilities of neuroimaging approach to behavior in society: the case of sex differences in language function in the human brain

Kenji Kansaku

Department of Rehabilitation for Sensory Functions,
Research Institute of National Rehabilitation Center for Persons with Disabilities

fMRI neuropolitical experiment using the 1992 US presidential campaign video

Ikuo Kabashima and Hiroko Ide

Graduate School for Law and Politics, The University of Tokyo

Lunch Common Room, Luce Hall

(12:00~13:30)

Panel II Neuroeconomics of Intertemporal Choice: One Now or Two Later

(13:30~15:30)

Chairs

Koichi Hamada, Department of Economics, Yale University

Masahiro Okuno-Fujiwara, Graduate School of Economics, The University of Tokyo

Using functional brain imaging to dissociate uncertainty from delayed reward in choice tasks

Marvin Chun, Department of Psychology, Yale University

Neural basis of time discounting: critical evaluation of multiple-self approach
Daeyeol Lee, Department of Neurobiology, Yale University

Neurobiology of temporal and probability discounting
Taiki Takahashi, Center for Experimental Social Science, Hokkaido University (formerly at the University of Tokyo)

Coffee Break Common Room, Luce Hall
(15:30~16:00)

Panel III From Economic Choice to Social Decision-Making
(16:00-18:00)

Chairs

Truman Bewley, Department of Economics, Yale University
Masahiro Okuno-Fujiwara

How basic are behavioral biases?: Evidence from Capuchin Monkey Trading Behavior
Keith Chen, School of Management, Yale University

Decision-making in a social context: From intentions to decisions
Laurie Santos, Department of Psychology, Yale University

Determinants of economic interaction: behavior or structure
Shyam Sunder, School of Management, Yale University

Abstracts

Scientific Analyses of International Relations

Bruce Russett

International relations started to become a scientific field about fifty years ago, working partly from political science but drawing heavily on other disciplines such as economics and psychology. In sometimes eclectic fashion, contemporary analyses range across levels of complexity from individual decision makers to the entire international system. They differ from earlier work by responding to “revolutionary” changes in the international system, a massive revolution in the ready availability of data and hence in the possibility of replicating scientific analyses, the revolutionary elaboration of mathematical theory and especially game theory, and a continuing revolution in the sophistication of statistical methods.

Euclid was sometimes an unnecessarily sophisticated social scientist : Geometric modeling in cognitive science vis-à-vis spatial modeling in political science

Junko Kato and Kensuke Okada

People distinguish political “positions” and express their difference by “distance.” It is commonplace to say, for example, “Bush and Blair have closer positions on the US military presence in Iraq than Bush and Chirac whose positions are too far to make compromise with each other.” Observing the phenomena, political scientists have attempted to “measure” political “distance” as relevant data and, for their analysis, use spatial models exclusively based on Euclid metric. In cognitive science, on the contrary, the scarcity of data on semantic dissimilarity judgment has waned the Minkowski geometric modeling that had once flourished in multi-dimensional scaling (MDS) analyses of sensory perception. Our application of the MDS analysis to political data here, therefore, serves to cross a border of disciplines and make their distinct approaches run into one. The analysis of the survey data on positions of political parties based on Minkowski’s metrics involves a couple of findings across disciplines of cognitive and social sciences. First, in judging political (i.e., semantic) dissimilarity individuals more often use one or two-dimensional psychological space to simplify and contrast distinct positions. Second, among Minkowski-family metrics, either the city-block or the Euclidean metric fits well with geometric models representing political dissimilarity judgment. Third, the isometry of city-block and dominance metrics in two-dimensional space appears to underscore critical implication in psychological models of political space. More specifically, the isometry relationship provides theoretical support for observed tendencies in human cognition, that is, the discontinuity of as well as shift in attention. Fourth, the left-right ideological scaling answered by survey respondents is consistent with both the city-block and Euclid distances obtained from the MDS analysis.

Limits and possibilities of neuroimaging approach to behavior in society: the case of sex differences in language function in the human brain

Kenji Kansaku

Communication has a central role in our social behavior, but its neural basis is not yet fully understood. Since the 19th century researchers have focused on the localization of cerebral function, and it has been noticed that the anterior language area (so-called Broca’s area) is primarily related to speech production, and the posterior language area (so-called Wernicke’s

area) plays a primary role in language comprehension. The language areas have been noticed to be preferentially located in the left hemisphere, which is one of two halves of our brain. However, in clinical fields, it has also been hypothesized that language functions are more strongly lateralized to the left hemisphere in men than in women, and patient studies and anatomical data have suggested that the posterior language areas should exhibit sex differences. Recent developments in neuroimaging techniques have begun to allow researchers to investigate human brain function non-invasively. We aimed to experimentally explore sex differences in lateralization in the posterior language areas. We applied functional magnetic resonance imaging (fMRI) while male and female subjects listened attentively to a story read aloud and to the same story replayed in reverse, and found sex dependent activations in the posterior language areas(1). Using a similar task, a recent large-scale fMRI study also showed sex dependent activations in the posterior language areas(2). Although some other imaging studies have yielded a variety of seemingly contradictory observations, the sex difference in language lateralization may be dependent on the task paradigms used in their experiments; listening to stories is processed differently between the sexes, whereas word-based tasks elicit left-dominant activity in both sexes(3, 4).

1. K. Kansaku, A. Yamaura, S. Kitazawa, *Cereb Cortex* **10**, 866 (2000).
2. V. J. Schmithorst, S. K. Holland, *Neuroimage* **35**, 406 (2007).
3. K. Kansaku, S. Kitazawa, *Neurosci Res* **41**, 333 (2001).
4. S. Kitazawa, K. Kansaku, *Brain* **128**, E30 (2005).

fMRI neurological experiment using the 1992 US presidential campaign video

Ikuo Kabashima, Hiroko Ide, Hiroshi Kadota, Kenji Kansaku, and Junko Kato

Television advertising is now the linchpin of electoral campaign in many democracies. While the impact of election campaign advertisements on the viewers' political behavior has attracted much scholarly attention little is known about how the human brain works in such a situation. To investigate the neuronal mechanisms underlying it, we asked subjects to see the 1992 US presidential campaign video as well as the advertisements of rival commercial products and measured the subjects' brain activities by using functional magnetic resonance imaging (fMRI). Our examination includes comparing the narrative (and/or) visual effects of electoral campaign advertisements and product commercials, controlling for ideologies of subjects. We especially focus on the effects of negative and positive advertisements of both electoral campaign and commercial products while observing changing attitude of subjects.

Using functional brain imaging to dissociate uncertainty from delayed reward in choice tasks

Marvin M. Chun

Brain imaging techniques allow scientists to probe differences in decision making processing that cannot be revealed by behavior alone. We explored this using temporal discounting tasks (Luhmann, Chun, Yi, Lee, & Wang, submitted). Decision-makers often face choices whose consequences unfold over time. To explore the neural basis of such inter-temporal choice behavior, we devised a novel two-alternative choice task with probabilistic reward delivery and contrasted two conditions that differed only in whether the outcome was revealed immediately or after some delay. In the immediate condition we simply varied the reward probability of each option. In the delay condition, the reward probability decreased monotonically with delay according to a constant hazard rate. Functional imaging revealed a set of brain regions, such as the posterior cingulate cortex, parahippocampal gyri, and frontal

pole, that exhibited activity uniquely associated with the temporal aspects of the task. These results suggest that during inter-temporal choice, decision-makers simulate the impending delay via a process of prospection.

Neural basis of time discounting: critical evaluation of multiple-self approach

Daeyeol Lee

People and animal tend to prefer immediate reward to delayed reward, sometimes even when this decreases their overall benefit. This implies that the subjective value of delayed reward decreases according to its delay. When the consequences of our actions are delayed, therefore, such time discounting greatly influences our choice behavior. For example, in multi-round experimental games, such as the prisoner's dilemma, cooperation and altruistic punishment are more likely to emerge, when the individual decision makers are willing to forego immediate small rewards to increase their long-term payoffs. Although the neural mechanisms for time discounting are still poorly understood, it has been proposed that inter-temporal choice depends on the competition between two separate brain systems biased to maximize immediate reward vs. long-term benefit. For example, the dorsolateral prefrontal cortex might be specialized in coding actions for large reward, whereas the mesolimbic dopamine system, including the ventral striatum, might be biased for harvesting immediate reward. To test this hypothesis, we analyzed the activity of individual neurons recorded from the dorsolateral prefrontal cortex of non-human primates performing a computer-controlled inter-temporal choice task. The results showed that the neurons in the dorsolateral prefrontal cortex often encode the temporally discounted value necessary to predict the animal's actions during the inter-temporal choice. These results suggest that the dual-self model of inter-temporal choice might be overly simplistic.

Neurobiology of temporal and probability discounting

Taiki Takahashi

Impulsivity (impatience) and time-inconsistency in temporal discounting have been attracting attention in psychology, behavioral economics, psychopharmacology, and neuroeconomics. The relationship between temporal discounting and risk aversion (probability discounting) has also been investigated in behavioral and social sciences. We have demonstrated (i) addiction and abstinence were associated with impulsivity in temporal discounting in positive and negative manners, respectively, (ii) arousal-related neurochemical substrates (e.g. salivary amylase and cortisol) were associated with patience in temporal discounting, (iii) intertemporal choice for someone else was more time-inconsistent and impulsive than that for oneself, (iv) depression was associated with exacerbated time-inconsistency and impulsivity in temporal discounting behavior, (v) although certainty for delayed rewards decayed hyperbolically, temporal discounting was not attributable to aversion to uncertainty associated with delay, and (vi) time-inconsistency in temporal discounting may be attributable to psychophysics of time-perception, rather than a proximal reward-induced emotion. In order to show (iii) and (iv), we develop a novel model of temporal discounting (i.e. a q-exponential discount function) which can parametrize impatience and irrationality (time-inconsistency) separately. Examination of the inconsistency by utilizing the q-exponential model may help understanding free will. Regarding implications for economics, finding (i) is consistent with an economic theory of rational addiction, finding (iii) does not support "libertarian paternalism" proposed by behavioral economists, findings (ii) and (vi)

suggest that several types of psychopharmacological treatments may enhance economic rationality, and finding (v) helps to develop evolutionary and game theory incorporating uncertainty into hyperbolic discounting.

How basic are behavioral biases?: Evidence from Capuchin Monkey Trading Behavior

Keith Chen

Behavioral economics has demonstrated systematic decision-making biases in both lab and field data. Do these biases extend across contexts, cultures, or even species? We investigate this question by introducing fiat currency and trade to a colony of capuchin monkeys and recovering their preferences over a range of goods and gambles. We show that capuchins react rationally to both price and wealth shocks but display several hallmark biases when faced with gambles, including reference dependence and loss aversion. Given our capuchins' inexperience with money and trade, these results suggest that loss aversion extends beyond humans and may be innate rather than learned.

Decision-making in a social context: From intentions to decisions

Laurie Santos

I will explore the extent to which primate decision-making utilizes mechanisms for understanding the social world. Specifically, I'll review work in primate examining how they make sense of intentional action. I'll then explore how this intentional reasoning affects their decision-making, and in particular, how it may give rise to phenomena like cognitive dissonance and other biases.

Determinants of economic interaction: behavior or structure

Shyam Sunder

Experimental economics originated as examination of the behavior of aggregate phenomena, especially markets, populated by human participants motivated by their desire to attain their goals. The past two decades have brought two newer trends. One is a gradual but steady shift in the focus of the questions sought to be addressed through human experiments towards examination of micro level phenomena – individual preferences and behavior. The second is the expansion in the role of computer simulations to examine questions about aggregate level phenomena. This shift to individual behavior has accentuated the ever-present dilemma of social sciences in trying to be a science on one hand, and to understand our own self-conscious selves – human beings – on the other. To address this dilemma, it would be useful to recognize three streams of experimental economics: (1) macro stream to examine the properties of social structures, (2) micro stream to examine the behavior of individuals, and (3) agent stream to explore the links between the micro and macro phenomena using computer simulations. At least the structural stream can be firmly rooted in the tradition of sciences (bypassing the free-will dilemma of social sciences), while the agent stream can span the gap between the behavioral and structural streams.

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