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## Contents

Fighting Snow on the New York Thruway

Tom Stewart Albany, NY

Judgments Under Stress; The Essential Brunswik: Beginnings, Explications, Applications

Kenneth Hammond Boulder, CO

Effect of Aging on Ability to Cope With Uncertainty in Learning Task

Gérard Chasseigne Tours, France

Extension of Probabilistic Mental Models

Mike Doherty Bowling Green, OH

Using Judgment Analysis to Improve Prescribing Decisions of Physicians

Petra Denig Groningen, The Netherlands

From Uppsala to Umeå

Peter Juslin Umeå, Sweden

Subjective Judgments of Confidence

Joshua Klayman Chicago, IL

Why Physicians' Practice May Not Be Evidence-Based

Roy Poses Providence, RI

A Lens Model Analysis of Vocational Interests

James Athanasou Sydney, Australia

Forecasting, Judgment Modeling, Occupational Therapy, Ageism

Clare Harries London, England  
Accuracy in Person Perception  
David Funder Riverside, CA  
Exploring the Complex Dynamic Texture of Behavior  
Ray W. Cooksey Armidale, New South Wales, Australia  
Evaluation of Expertise  
James Shanteau Manhattan, KS  
Conceptual Skills of Future Battle Commanders  
Shawn Noble Kansas City, KS  
Prostate Tests; Diagnosis, Treatment of Otitis Media  
Paul Sorum Albany, NY  
Effects of Increasing Time Pressure on JDM  
Len Adelman Fairfax, VA  
Vicarious Functioning and Representative Design  
Mandeep Dhani London, UK  
Application of Brunswikian Ideas to Human-Automation Interaction  
Alex Kirlik Atlanta, GA  
Brunswik Symmetry:A Golden Key Concept  
Werner W. Wittmann Mannheim, Germany  
Simple Heuristics That Make Us Smart  
Ulrich Hoffrage Berlin, Germany  
Studies in Personality, Intelligence  
Robert Gifford Victoria, BC  
Interpersonal Perception and Communication  
Linda Albright Westfield, MA  
Affirmative Action Policies in Admissions Decisions  
Jeryl Mumpower Albany, NY  
Professional Performance, Reliability, Hierarchical Linear Models  
James Hogge Nashville, TN  
Policy Persuasion; Correspondence, Coherence Correlations  
Elise Axelrad Weaver Albany, NY  
Research Projects on Adaptive Nature of Human Judgment  
Phil Dunwoody Athens, GA  
Theory of Coercive Sexual Strategies  
Aurelio José Figueredo Jaen, Andalucia, Spain  
Social Trust and Confidence in Environmental Risk Management

Timothy Earle Bellingham, WA  
Research on Pilot Use of Automation  
Kathleen Mosier San Francisco, CA  
Studies in Social Issues, Individual Differences, New Brunswikian Resources  
R. James Holzworth Storrs, CT  
Contingency Judgments  
Manuel Migeul Ramos Alvarez Jaen, Andalucia, Spain  
Information Presentation in Prostate Cancer Screening  
Robert Hamm Oklahoma City, OK

## **Fighting Snow on the New York Thruway**

**Tom Stewart**  
**Albany, NY**

I have been fortunate to have great collaborators who have described our projects in their research summaries. I have been involved in one rather offbeat study that has not been mentioned.

Roger Pielke, Jr., National Center for Atmospheric Research, and I have been funded by the National Oceanic and Atmospheric Administration to study the value of improved weather forecasts in surface transportation.

We chose, as a case study, the winter operation of the New York Thruway, where about \$10 million is spent on "snowfighting" (plowing and salting) every winter. The decision makers are the supervisors at 23 maintenance facilities distributed along the 500-mile toll road.

Doctoral student Radhika Nath and I visited several facilities and interviewed supervisors about how they cope with the uncertainty in their environment. We found that they try to anticipate snow and must begin preparations 2-4 hours in advance of a storm.

They have many sources of weather information, including forecasts, radar displays provided by a satellite link, and reports of approaching weather from toll barriers and maintenance facilities to their west. In effect, they make their own local forecasts. The supervisors must guard carefully against false negatives (not plowing and salting when it is needed) and are not so concerned about false positives (sending out snowplows and salting when it is not necessary). This is consistent with their primary mission, which is to serve public safety and convenience. The question that we need to answer is whether better forecasts can be used to reduce the unnecessary use of labor, fuel, and salt without compromising public safety or inconveniencing drivers.

In order to estimate the economic value of improved forecasts, we needed information on the quality of the current forecast, the costs of snowfighting, the incidence of various types of winter weather, and the expected improvement in forecast quality. The necessary data have proved difficult to obtain, but we have pieced them together from various sources. The completed study will provide an example of how descriptive decision studies can be used to estimate the value of information.

# Judgments Under Stress; The Essential Brunswik: Beginnings, Explications, Applications

**Kenneth Hammond**  
**Boulder, CO**

Although I have not carried out any empirical research recently, I have been attempting to develop Brunswikian theory. The results of my efforts became visible on 5 November 1999 when Oxford University Press published my *Judgments Under Stress*. In this book I develop a theory of stress based on the concept of constancy. It is the disruption of constancy that defines stress. To the best of my knowledge, this is the first noncircular, objective definition of psychological stress to appear since Irving Janis introduced this topic in 1958.

Part I reviews current hypotheses from neuroscience about the interaction of emotion and cognition, presents the major J/DM theories, and indicates the implications of each for the analysis of judgment under stress.

Part II presents the Brunswikian theory of constancy, indicates two major types of its disruption, and puts forward hypotheses concerning their effects derived from the cognitive continuum theory of cognition. Examples are drawn from documented events from commercial aviation, sea warfare, and fighting forest fires. A final chapter addresses the problem of moral judgments under stress. Using examples from some of the most stressful events that any human could encounter—trying to fly an uncontrollable airliner, commanding a ship that just hit a mine—psychology Professor Emeritus Kenneth Hammond of the University of Colorado at Boulder has drawn some conclusions about how to make good judgments under the most difficult circumstances. In *Judgments Under Stress*, Hammond examines the entire field to date and presents some new findings.

According to Hammond, it's a field that is much more difficult to study than it first appears, starting with the definition of the word stress. A leading expert on human decision making, Hammond did much of his research for this academic book by analyzing the words and actions of people who made good judgments under extremely stressful conditions. "You really can't do stress research in the laboratory," Hammond said, "because it's hard to create conditions that are stressful enough." He presents a theoretical framework that describes how people behaved during events like the Cuban missile crisis, being caught in a forest fire, or piloting the airliner that lost part of its fuselage over Hawaii. One of his recommendations is that if what you are doing to deal with the situation is not working, you should consider moving from an analytical response to an intuitive response, or vice versa.

"When the pilots of United 232 were able to land a plane in Iowa City in 1989 despite complete hydraulic failure, they did it not by analysis," Hammond said, "but by intuition. They didn't know what to think—literally."

Part III includes an extensive annotated bibliography of the literature of stress from the fields of human factors, judgment and decision making, clinical psychology, and social and personality psychology. It is my hope that this book will open a new field of research for Brunswikian scholars.

The Office of Public Information at the University of Colorado recently issued the following press release: "Analysis of the situation didn't work because no one had ever imagined that such a situation could occur. The crew had to learn how to fly the crippled plane as if they were learning to fly for the first time and by doing so saved scores of lives," Hammond said.

A converse situation occurred in the 1949 Mann Gulch fire in Montana when a fire crew leader resisted his intuition, which urged him to run for the ridgeline when a fast-moving fire flared up a gulch. Instead, he

analyzed that he would never make it out of the gulch in time and set fire to an area and laid down in the middle of it, letting the fire go over and around him. Other members of his crew perished, all of whom refused the crew leader's entreaties to follow his example and relied on their intuition to run. "How a person should respond always depends on the particular conditions of the event," Hammond said. Hammond taught psychology at CU-Boulder from 1948 until 1987. In 1996 he authored an award-winning book titled *Human Judgment and Social Policy: Irreducible Uncertainty, Inevitable Error, Unavoidable Injustice*, which also was published by Oxford University Press. That book illustrated the consequences of uncertainty with numerous examples from medicine, engineering, law, and economics.

In addition to the above, I have cooperated with Tom Stewart in the preparation of the Brunswik volume titled *The Essential Brunswik: Beginnings, Explications, Applications* (Oxford). Twenty-five authors contributed to this volume. The manuscript has been sent to the publisher; it should appear in late 2000.

## **Effect of Aging on Ability to Cope With Uncertainty in Learning Task**

**G rard Chasseigne  
Tours, France**

Studies of the effects of aging on performance in cognitive tasks have shown decreasing performance with age. However, nearly all previous studies of learning in the elderly employed tasks which are deterministic in nature (e.g., learning paired associations of symbols or words).

In contrast, learning probabilistic judgment is critical throughout life. Consequently, elderly people may be required to cope just as well as middle-aged adults, young adults, adolescents, or children with new environments that contain new probabilistic relations.

Learning these relations can be a difficult task for them because of the uncertainty inherent in the environment. Uncertainty is typical of situations requiring Multiple Cue Probability Learning (MCPL). The MCPL paradigm captures the essential qualities of many common life learning situations, notably the uncertainty as to the strength of cue-criterion relationships, and the probabilistic relations.

Most of the MCPL experiments to date have been conducted with young adults, usually students. The general finding is that uncertainty affects learning performance (e.g., Naylor & Schenck, 1968).

In the first MCPL study conducted on elderly people (Chasseigne, Mullet, & Stewart, 1997), we studied the relation between age and the ability to learn direct and inverse probabilistic relationships between cues and criterion.

In one condition, we showed that when all cue-criterion relationships were direct, elderly participants were able to learn nearly as well as young participants. The level of task predictability ( $R^2$ ) was held constant and equal to 0.93.

The aim of my latest study (Chasseigne, Grau, Mullet, & Cama, 1999) was to investigate the effect of aging on the ability to cope with uncertainty in a learning task, keeping constant the direction of cue-criterion relationships.

A total of 220 individuals, 55 in each of four age groups (18-25, 40-50, 65-74, 75-90 years old) participated in this experiment. The materials consisted of four sets of 30 cards each, showing three cue values in the form of vertical colored bars (pink) whose heights varied from card to card. Five levels of task predictability were used (0.96, 0.80, 0.64, 0.48, and 0.32). The ecological validities of the three cues in each of the five uncertainty conditions were equal (0.56, 0.52, 0.46, 0.40, and 0.33).

The participants were told that the task which faced them was a weather forecasting task. They were asked to learn the relationships between the levels of the three indicators and the pleasantness of the next day's weather. They were presented with different scenarios, each of which was characterized by sets of three cue values displayed on the front of different cards and the actual value of the criterion displayed on the back of the same cards (outcome feedback, OFB). The subjects were also told that an exact weather forecast was nearly impossible because of a myriad of other factors acting independently.

Our hypothesis was that the relationship between uncertainty in the task and knowledge and control in the participants would not be strongly dependent upon age. In other words, we expected few differences between elderly people and young people in the way they cope with uncertainty in a learning task when all relationships are direct ones. We also expected no Uncertainty x Age interactions. This hypothesis was based on two considerations.

1. In contrast to a deterministic task, where elderly people would be less apt to keep information in memory than young people (Salthouse, 1994), and thus would show lower performance, our task was a probabilistic one. MCPL does not imply learning through associations. It implies the learning of the relationship between the cues and the criterion. This relationship is independent of predictability conditions. As a consequence, elderly people could perform well.
2. As suggested by Brehmer (1974), direct relationships are the relationships assumed by default. If nothing suggests alternative relationships at work in the task, there is no reason for participants, whatever their age, to change their mind about the nature of the relationships.

Our hypothesis of few age differences was supported by data. As in our preceding study (Direct Relationships condition), the present study found a slight effect of age on control and knowledge. Moreover, no Uncertainty x Age interaction was significant. As in several previous studies a strong effect of uncertainty on control was found. Uncertainty also had a slight effect on knowledge. Finally, in MCPL tasks with outcome feedback, the performance of elderly people is nearly equivalent to that of young people when relationships are direct, regardless of the amount of uncertainty in the task.

## **Extension of Probabilistic Mental Models**

**Mike Doherty**  
**Bowling Green, OH**

Gigerenzer and his colleagues have raised a fundamental issue about vicarious functioning, viz., whether the mechanism is cue integration or cue substitution.

The mechanism of cue integration is assumed implicitly in the use of regression models and often made explicitly, as well, in discussing judgment behavior. The assumption that it is cue substitution is explicit in the family of PMM models.

Below is the abstract of a paper (Slegers, Brake & Doherty, "Probabilistic Mental Models with Continuous Predictors") just accepted by OBHDP.

Gigerenzer and his colleagues have sought to develop psychologically plausible models of human judgment. Their models are classified as ones of bounded rationality based on a principle of one-reason decision making. The models associated with the theory of Probabilistic Mental Models (PMM) have been developed for tasks in which all predictors are binary.

This paper extends PMM to the case of continuous predictors. The current model employs the limitation on the number of categories people use in making absolute judgments along a single perceptual dimension ( $7 \pm 2$ , Miller, 1956). The algorithm transforms each continuous predictor to be consistent with this limitation, then implements a step-down one-reason decision procedure similar to previous PMM models.

Like previous PMM models, the  $7 \pm 2$  model predicts binary judgments as well as a multiple regression model. However, the model does not successfully predict the probability judgments of individual participants, which is also true of other models in the literature.

## **Using Judgment Analysis to Improve Prescribing Decisions of Physicians**

**Petra Denig**  
**Groningen, The Netherlands**

At the Department of Clinical Pharmacology, the Rational Drug Use group focuses on improving the prescribing behavior of doctors. Attention is given to the use of clinical judgment analysis as an educational tool.

In one project, the Drug Education Project, an educational program for peer groups was developed and tested. The program consists of providing individualized feedback about prescribing patterns, as well as on the underlying decision making process of the physician, based on clinical judgment analysis.

In a randomized controlled trial, the effectiveness of the educational program was tested on competence and performance in treating urinary tract infections (UTI) and asthma. Results of the asthma program, which was conducted in four different countries, have just been published in the American Journal of Respiratory and Critical Care Medicine (1999, 160, 1254-1262).

In another project, judgment analysis is used to study the decision criteria for the treatment of depression. Both general practitioners (GPs) and GPs in their vocational training are included as subjects. The aim of this study is to develop an educational tool for medical students, as well as practicing doctors, for teaching rational drug therapy for depression.

Also, we are working on a review of studies using cognitive feedback to improve the quality of treatment decisions of doctors. So far, however, it seems that most studies testing the effect of cognitive feedback on medical decision making either use students or focus on diagnostic, as opposed to prescribing, decision making.

# From Uppsala to Umeå

**Peter Juslin**  
**Umeå, Sweden**

This report is written in the midst of the turmoil of moving from Uppsala to Umeå, a 600 km drive by car with two very lively six-month babies (twins) in the back-seat.

As you may know, Umeå was once the site of Brunswikians like Berndt Brehmer and Mats Björkman, and the chair that I have received was indeed occupied by Mats in the 60s and 70s.

Our continued research on probability judgment in Uppsala has resulted in a couple of articles and manuscripts. In a recent article (Juslin, Wennerholm, & Olsson, 1999, *JEP:LMC*, 25, 1038-1052), we explore the phenomenon of format-dependence, the simultaneous observation of over- and underconfidence when the same judgment tasks are approached with different probability assessment formats.

In another article (Juslin, Winman, & Olsson, in press, *Psychological Review*) we perform a "meta-analysis" that compares the over/underconfidence for all representative and selected samples of general knowledge items that we could find. Across representative data sets over/underconfidence bias was .01 and across selected data sets over/underconfidence was .09, a difference that is not accountable in terms of the difference in proportion correct. Moreover, we demonstrate that most of the notorious "hard-easy effect" seems to be explained by statistical artifacts (e.g., linear dependency).

The manuscript where we apply the sensory sampling model (Juslin & Olsson, 1997, *Psychological Review*, 104, 344-366) to distinguish between cue-heuristic, inferential processes from direct-perceptual processes in a task that involves judgments of the relative mass of colliding objects, is now forthcoming in *Psychological Review* (Runeson, Juslin, & Olsson, in press).

In a more recent experiment, we compare probability judgments in simple sensory discrimination tasks to probability judgments in general knowledge tasks and document a number of additional differences between the two kinds of tasks, for example, in regard to additivity (Juslin, Winman, & Olsson, in preparation). Henrik Olsson will present his doctoral dissertation on the sensory sampling model in December 1999.

Magnus Persson and I are finishing a manuscript that applies the context model by Medin and Schaffer to probability judgment and decision tasks (the modification is entitled **PROBEX** for probabilities from exemplars). In the manuscript, we explore the ecological rationality (à la Gigerenzer and colleagues) of an algorithm that makes judgments by rapid retrieval of a small number of stored exemplars, and evaluates its quantitative fit to performance data for "real" participants performing the same task.

Finally, we have developed a rule-based account of the inverse base-rate effect in categorization studies that traces the effect to eliminative inferences (Juslin, Wennerholm, & Winman, 1999). This explanation, that may have novel normative implications, contrasts with previous accounts that revolve, in one way or another, around the theme of cue-competition (e.g., in the Rescorla-Wagner model).



## **Subjective Judgments of Confidence**

**Joshua Klayman**  
**Chicago, IL**

I'm spending the 1999-2000 academic year on leave at INSEAD, in Fontainebleau, France. While there, I plan to work with Jack Soll (who is on the INSEAD faculty in Technology Management), continuing our research on subjective judgments of confidence, along the lines of our paper with Claudia Gonzalez-Vallejo and Sema Barlas.

I'm also continuing to work on research with Chip Heath, George Loewenstein, and Chris Hsee concerning the cues people use to predict the feelings, preferences, and reactions of other people and themselves.

## **Why Physicians' Practice May Not Be Evidence-Based**

**Roy Poses**  
**Providence, RI**

Evidence-based medicine may be defined as medical practice based on a critical, systematic review of the best available evidence from clinical research.

There is considerable evidence, unfortunately, that physicians may often fail to practice in this manner. In particular, physicians often fail to use treatments even in the presence of extremely strong evidence that their benefits are much larger than their harms. Further, they often use treatments known to be risky in the absence of any evidence that they are beneficial.

With Mark Chaput de Saintonge, Wally Smith, Tom Tape, and Bob Wigton, among others, we have been attempting to understand reasons for this phenomenon. One hypothesis is that physicians may base their decisions on judgments about the benefits and harms of particular treatments for individual patients. Further, these judgments could be inaccurate because physicians may fail to attend to cues that predict benefits or harms, or may attend to cues that do not predict. We have been attempting to develop case-vignette based instruments to assess how physicians judge the benefits and risks of treatments for individual patients, and the relationships of these judgments to decisions.

We have developed instruments that assess how physicians make decisions about angiotensin converting enzyme inhibitors (ACE inhibitors) for patients with congestive heart failure, and how they make decisions about lipid lowering drugs for patients with high cholesterol values and coronary artery disease.

We are trying to find funding for a large-scale field test of these instruments and to develop similar instruments for other important clinical problems whose management may not be evidence based.

# **A Lens Model Analysis of Vocational Interests**

**James Athanasou**  
**Sydney, Australia**

The purpose of this research is to analyze which components of an occupation contribute to an individual's self-judgment of likes or dislikes.

Adult participants (N=12) were administered the RAMAK interest inventory (Meir & Osipow, 1993) which is a 72-item questionnaire containing occupational titles such as flight attendant, research assistant, executive director, stage hand, shop employee, and geologist.

Participants judged whether they liked, disliked or were indifferent to the occupations, and results are provided as scores ranging from 0 to 18 for eight nominal categories (Business, Organization, General Culture, Science, Arts and Entertainment, Outdoor, Science, Technology).

These same occupations are being rated independently in terms of key occupational descriptors for Australian occupations. The occupational descriptors include qualifications, literacy, numeracy, physical strength, on the job training, activities, interests, competencies, and labor market characteristics.

A single lens model analysis will be used to capture the idiosyncratic policies adopted to produce each person's pattern of likes and dislikes. Unlike earlier research, the aim is not to combine the results into scale scores, but to analyze which components of an occupation are responsible for the judgment of liking or disliking. The research seeks to use the lens model to answer the question, "What does it mean when I say I might be interested in an occupation?"

The findings have implications for the assessment of vocational interests, which is currently almost exclusively conducted by self-report inventories. The extent of this is that one major publisher proudly announces that over 21 million copies of its particular interest questionnaire have been sold. Such questionnaires rely exclusively upon self-judgments of a "latent trait."

Secondly, the nature of the construct of interest is being addressed in this judgment approach which contrasts with the typical nomothetic approach to the assessment of interests. It is hypothesized that judgments of interest, liking or disliking are so idiosyncratic as to encompass wide individual perceptions and referents.

## **Forecasting, Judgment Modeling, Occupational Therapy, Ageism**

**Clare Harries**  
**London, England**

I've been working on a number of Brunswikian-related projects over the past year. Here's a brief summary.

### **Judgmental Combination of Forecasts**

The two-year Judgmental Combination of Forecasts project I've been working on with Nigel Harvey is coming to an end. We are about to start a new project looking at people's assessments of risk and, separately, how people take into account factors such as promotional effects when forecasting time series. The forecasting

project has involved a large number of experiments and has allowed us to explore the relationship between the multidimensional MCPL research paradigm and the unidimensional Advice Taking paradigm, both of which are naturally involved in real life forecasting situations. In all of our studies, we have used lens model analysis: looking at each individual's use of different forecasts in relation to how useful they might be, given the local environment. The experiments we have carried out have finally fallen into papers on the relationship between advice assessment and advice taking, on anchoring and adjustment and conservatism, and on the effects of factors such as extremism and redundancy in advice taking. In addition, we have tentatively explored the relationship between explicit and implicit understanding of the task and of behavior in relation to the differing complexities in uni- and multidimensional tasks.

### Modeling Decision Making

This year, despite a physical distance of about 1,000 miles, Mandeep K. Dhimi and I have continued to collaborate on our examination of the pros and cons of different techniques for modeling human judgment. We have concentrated on raising this issue among a number of different intellectual groups. We were able to compare our work to that of the machine learning (AI) researchers at a joint meeting of Artificial Intelligence in Medicine (Europe) and the European Society for Medical Decision Making. We also organized a symposium at SPUDM (the biennial meeting of the European Association for Decision Making) at which papers were presented on structural equations modeling, process tracing, dynamic systems modeling, regression modeling, and fast and frugal modeling. The symposium is being prepared for a special issue of Thinking and Reasoning.

### Occupational Therapy (OT)

Last year Cilla Harries (Lecturer in Occupational Therapy at Brunel University, U.K.) and I started to collaborate on an examination of what could be gained from analysis of OT judgment and decision making comparing both qualitative and quantitative techniques. Post-partum interruptions aside, we are currently using a judgment analysis paradigm to look at how Occupational Therapists prioritize referrals in a community mental health team. Qualitative data on this subject had already been collected during Cilla's MSc, using information processing techniques. The possibilities for this research are endless. Different professionals work within the community health team, and judgment analysis could be used to tease out the differences in how they perceive their own and others' roles in the team. However, the research is heading in an educational direction at the moment. OT is taught in some universities in England using a hybrid of problem-based learning (PBL) techniques. Throughout the undergraduate studies, OT students organize their learning around actual referral data. Lectures and clinical placements enhance learning through the exposure to real case descriptions and scenarios. Drawing both on the JA literature on feedback and on Robert Hamm's work with surgical scripts, Cilla intends to develop our initial descriptive work into a larger project comparing the current PBL with problem-based learning enhanced by scripts and by cognitive feedback.

### Ageism and Medical Decision Making

There is an ongoing debate on rationing in the British National Health Service (NHS). Nigel Harvey, Anne Bowling (an expert in Ageism), and I in London have just received three years of funding to use judgment analysis to look at General Practitioner and consultant decision making and the role this plays in age-related inequalities in the NHS. Damien Forrest is the full-time researcher on the project. More on this next year.

# Accuracy in Person Perception

**David Funder**  
**Riverside, CA**

I am continuing to do research on accuracy in interpersonal judgment, now based upon the Realistic Accuracy Model (RAM; Funder, *Psychological Review*, 1995). This model, inspired by Brunswik's lens model, proposes that accurate personality judgment is a function of four stages that lie between the distal stimulus (an actual attribute of personality in a target person) and a veridical judgment.

These stages are relevance, availability, detection, and utilization. The empirical and theoretical basis of this model, and some new extensions, are described in my book-*Personality Judgment: A Realistic Approach to Person Perception*-just published by Academic Press.

My latest work on this model involves extending it to the question of self knowledge (how can we know ourselves accurately?) and the task of improving judgmental accuracy.

# Exploring the Complex Dynamic Texture of Behavior

**Ray W. Cooksey**  
**Armidale, New South Wales, Australia**

A major aspect of my current conceptual work focuses on the implications, for psychological theory and method, of a Complex Dynamic Decision Perspective (CDDP) that attempts to situate human decision making within its rich context while maintaining as much of the textural complexity of the decision as possible.

Such a perspective is needed since the literature on human judgment and decision making reveals a markedly divided discipline where strong alliances among researchers adhering to a shared approach dominate the landscape. Skirmishes between different alliances are marked by exclusionary, rather than inclusionary, reasoning. Debate is frequently polarized between the laboratory and the field: quantitative vs. qualitative; normative vs. interpretive; the systematically designed vs. the representatively designed; the prescriptive vs. the descriptive or naturalistic; correspondence vs. coherence emphasis; practical vs. theoretical; and novice/student vs. expert/professional.

As a result, theorizing is closed rather than open and systemic, incremental rather than radical, and subjected to the law of parsimony, which sets up a preference for the simplest accounting of a phenomenon. Such thinking is no longer adaptive nor does it facilitate a cumulative science of decision making; it also falls continually short of meeting both the expectations and the needs of humans making decisions in everyday life.

While the implications of these arguments can easily be extended beyond the specific domain of human decision making (a development I am currently undertaking in a paper titled "Contextual Behavioral Dynamics: Reconceptualizing the Human Science of Psychology" for submission to the *American Psychologist* later this year), decision research provides a prototypical arena within which to demonstrate the force of the arguments. (I have anchored and illustrated many of these arguments in a very recent paper focusing on managerial decision making-"Mapping the Texture of Managerial Decision Making: A Complex Dynamic Decision Perspective," *Emergence: A Journal of Complexity Issues in Organizations and Management*, in press.)

The underlying problem in decision research is that each decision theory or approach implicated in the study of human decision making, when juxtaposed with methodological preferences and choices, forces simplifying assumptions to be made and, typically, linear processes to be posited.

This necessarily sterilizes and denudes the complex texture of decision making to the point where unrealistic expectations and linear thinking are inadvertently reinforced; many potentially important factors are excluded by assumption or by the simplistic models employed.

This then spills over into the design of decision support systems and other interventions which become locked into specific approaches forcing users to engage in Procrustean thinking to shape their decision problems to be suitable for a particular package or model, such as the Analytic Hierarchy Process, Multiattribute Utility Theory, or Decision Analysis.

The 'Kuhnian' selectivity aspect of this argument focuses on the problem that many authors bind their discussion of decision processes to research conducted within a restricted range of decision research paradigms and perspectives (e.g., heuristics and biases; decision analysis; lens model research; behavioral decision theory). Recognition of the larger contextual picture (behavior as emergent in context), lessons from various disciplines (e.g., complexity theory, nonlinear systems dynamics, evolutionary theory), and retention of flexibility in perspective are therefore lost.

This division in approach and discourse tends to lead decision researchers down somewhat narrow paths of investigation, fueled by simplified perspectives that stimulate self-reinforcing outcomes. The result in many cases is a split between what decision theories wish to say and what decision makers in situ find they experience in terms of increasing information load and competing demands and values juxtaposed against their own physical and cognitive limitations, needs and task demands (an outcome anticipated by Brunswik over 50 years ago in his 1952 monograph).

Additionally, it is becoming increasingly clear that the social and personal costs of making inappropriate or incorrect decisions are escalating in the context of the complex highly dynamic familial, societal, and work environments within which humans currently operate. This ecological trend seems quite unlikely to reverse itself in the near future.

The Complex Dynamic Decision Perspective (CDDP) is argued to retain one's focus on the complex texture of human decision making by stimulating a systemic focus on major contextual factors that are further decomposed layer by layer to reveal the rich and dynamic tapestry beneath. The CDDP is implicitly Brunswikian in conception but extends his original ideas by marrying them with current knowledge emerging from nonlinear systems dynamics, open systems theory, and a variety of behavioral science disciplines.

By its very construction, the CDDP forces a triangulated perspective and a multifaceted methodological approach to decision research. The complex and messy texture of human decisions is thereby retained for detailed investigation and incorporation rather than boiled away. At the same time, the CDDP perspective can be used to spawn tools and methods that decision makers in situ can utilize to facilitate a priori or a posteriori audits of their own decisions. Finally, the CDDP can be seen to provide a template for investigating other important behavioral phenomena in the human arena.

Anyone wishing to obtain a copy of my recent work, in press or in development, please feel free to contact me. Any comments or observations would be appreciated.

# Evaluation of Expertise

**James Shanteau**  
**Manhattan, KS**

With support received from the FAA, our project team (see below) has successfully developed and tested a new approach to the evaluation of expertise where there is no independent criterion.

Labeled the Cochran-Weiss-Shanteau (CWS) measure, the index provides a high degree of predictive accuracy in the identification of expertise. To date, CWS has been successful in a variety of contexts, including research of experts in auditing, livestock judging, and personnel selection. In addition, CWS has been applied to data collected by FAA researchers in low-fidelity simulations of air traffic control (ATC). Indeed, we have yet to find a study of expertise where CWS has not done well in identifying who is, and who is not, an expert. (Of course, we have only examined a small fraction of the total number of studies done on experts. As more studies become available to us for reanalysis, we will continue to apply our approach retroactively.)

Our ongoing research both extends the work-to-date and expands the applications of CWS into new domains. Specifically, the purposes of our present efforts are four-fold. First, we plan to apply the index to the results of high-level simulations involving experts. This will allow us to "ramp up" the application of the index to more realistic settings using dynamic, real-time task environments.

Second, we will continue to develop the conceptual and theoretical underpinnings behind the CWS approach. While the index has worked remarkably well at the empirical level, there is much to be done to explain how and why the measure works as well as it does. In addition, it is necessary to explore both alternative definitions and boundary conditions for the approach.

Third, we will be conducting a wide-ranging set of empirical studies using both laboratory and field studies of experts. These studies will allow us to better understand the advantages and limitations of applying CWS to real-time data. For instance, we are using CWS to track the development of skills from naive to novice to expert. This will allow us to examine the usefulness of our approach for training and selection of experts.

Finally, a postdoctoral associate will be analyzing CWS using simulation methods. Through these methods, we will be able to examine in detail the conditions under which CWS works well and works poorly. The simulations will also allow for the evaluation of CWS under conditions that cannot be studied empirically, for example, unfriendly or hostile environments.

The CWS research team consists of James Shanteau, Rick Thomas, and Jack Windhorst at Kansas State University, David Weiss at California State University in Los Angeles, Ward Edwards at Wise Decisions in Los Angeles, and Julia Pounds at the Federal Aviation Administration in Oklahoma City.

## Conceptual Skills of Future Battle Commanders

**Shawn Noble**  
**Kansas City, KS**

Over the last year I have been challenged with the task of identifying the key conceptual skills that future U.S. Army battle commanders should possess.

This topic has sparked much interest due to the recognition that commanders will face an environment that is much more complex than in the past.

One reason that complexity will be increasing is because digitization is quickly heightening the flow of information to an incomprehensible rate. In addition, future commanders will be involved in operations that consist of: multiple missions, increased activity with joint forces, increased interaction with outside agencies, and an open environment that consist of media and civilians that are seemingly everywhere. Also, the commanders will be asked to complete their operation with fewer soldiers as the Army continues to downsize.

Thus, I am exploring how an individual navigates through the complex probabilistic environments described above. To help represent some of the important conceptual skills for leadership success, I have developed a framework called the S3 (S-Cubed) Model for Enhancing Thinking in a VUCA (Volatile, Uncertain, Complex, Ambiguous [Army Buzzword]) Environment.

The S3 model has three major cognitive processes that influence the goal: Situation Understanding, Simulation, and Self-Regulation. It has been well documented that Situation Understanding and Simulation are important components which help aid decision making in naturalistic environments (Klein et al.).

However, missing from the central components is the aspect of Self-Regulation. Preliminary research suggests that Self-regulation can be advanced as a central component. Furthermore, it is suggested that Self-Regulation may act as a switching mechanism that helps decision makers transition between an intuitive process and one that involves synthesis.

(Obviously this representation differs from the CCT view that we are able to move between intuitive and analytic modes. Currently the Army teaches a highly analytic tool that seems to contradict how officers actually think. It should be noted that the switching process in this model is conceptually similar to that described in Hammond, Hamm, Grassia, & Pearson, 1987.)

Future research hopes to develop a prescriptive approach that is based on naturalistic research (i.e., not based on normative theory) that is collected in a representative design. This approach will differ from MCPL as techniques such as feedforward will not be effective in environments in which a clear right or wrong answer does not exist.

## **Prostate Tests; Diagnosis, Treatment of Otitis Media**

**Paul Sorum**  
**Albany, NY**

I have been involved for the past two years in a logistically difficult Brunswikian study comparing diagnostic judgments of acute otitis media (of its probability) and treatment choices (whether or not to prescribe antibiotics) among U.S. family practitioners, French pediatricians and general practitioners, U.S. parents, and French parents.

My collaborators have included Tom Stewart and Junseop Shim in Albany (Junseop did most of the analyses) and Etienne Mullet, Gerard Chasseigne, and Maria Teresa Munoz Sastre in Tours, France.

I presented most of the major findings at the Boulder meeting and am slowly completing an article for submission to the others and then to a journal.

The six major findings of the otitis study were:

1. The large disagreement in diagnostic judgments and treatment choices within physician groups, but not among them;
2. The wide variation in internal consistency of individual physicians;
3. The reliance on the physical exam of the ear;
4. The similarity of the parents to the physicians in their decision making, even if they differed in many attitudes and opinions;
5. The participants' lack of insight into their judgment policies; and
6. The lack of impact of personal attitudes and opinions, except for a concern about fever, on the propensity to treat with antibiotics.

Our next project is to study decision making about the prostate. The specific issue-of importance in France as well as in the U.S-is why physicians order prostatic antigen tests even though this is discouraged by medical authorities in both countries.

Junseop has already done some work on it, and one of Etienne's students is also ready to go.

## **Effects of Increasing Time Pressure on JDM**

**Len Adelman**  
**Fairfax, VA**

My students and I continue to study the effects of increasing time pressure on the decision making of hierarchical teams performing a dynamic task (aircraft identification), as represented by the multilevel lens model.

Our two studies obtained the following results.

1. Team members accelerated their cognitive processing in an effort to maintain correspondence constancy.
2. Time pressure nevertheless affected performance because there was a point beyond which correspondence constancy could not be maintained.
3. There were strong differences in how teams adapted to increasing time pressure, and where constancy was lost, consistent with the concepts of vicarious mediation and vicarious functioning.
4. Because of task characteristics, team leaders who chose an adaptation strategy of maintaining the number of decisions, instead of decision accuracy, performed better at high time-pressure levels.



5. Consequently, changes to the human-computer interface that supported perceptual and memory processes and, in turn, the maintenance of decision quantity, were more effective than cognitive feedback with its emphasis on maintaining decision accuracy.

6. Lens model analysis indicates that time pressure caused significant decreases in subordinates' knowledge (G) and cognitive control (Rs). (There was no decrease in the calibration of their means and standard deviations, which are the other two components of mean square error.) The decrease in G was due to both using fewer cues and weighting them less accurately. Lens model analysis of the leaders' decision-making process is ongoing.

## **Vicarious Functioning and Representative Design**

**Mandeep Dhani**  
**London, UK**

I am currently finishing my Ph.D. on legal decision making and will be looking for a postdoc next year. I spent the last year indulging in Brunswikian thinking in Berlin, at the Center for Adaptive Behavior and Cognition, Max Planck Institute for Human Development.

I've been interested in two Brunswikian concepts, namely vicarious functioning and representative design.

**Vicarious Functioning.** How valid is the process of vicarious functioning as cue substitution rather than cue integration when describing human judgment behavior? Brunswik highlighted that an individual copes with uncertainty in the environment (as defined by probable cause-effect relationships) through the process of vicarious functioning.

Although Brunswik proposed that vicarious functioning could involve either cue substitution or cue integration, he placed more emphasis upon the latter.

Traditionally, the process of cue integration has been represented by a regression model, which was first proposed by Brunswik and later adopted by social judgment theorists.

In a set of studies on legal decision making (working with Peter Ayton, City University, London) and medical decision making (collaborating with Clare Harries, University College, London), I compared the relative descriptive and predictive validity of models that substitute cues and models that integrate cues when deciding on a case.

We found that a simple process model (called the Matching Heuristic) which substitutes cues and is nonlinear and noncompensatory proved better at describing and predicting professionals' judgment behavior than three different structural models (including a regression model), that integrate cues and are characterized by linear, compensatory processing of information.

These findings suggest that the "ritualistic" practice of using regression models to describe human judgment behavior needs to be seriously reconsidered.

**Representative Design.** What is the nature and extent of the use of representative design in judgment and decision-making research? And does representative design really matter?

Brunswik argued that if we want to understand how an individual adjusts to a probabilistic environment, then we must conduct studies that enable the participant to express any mechanisms developed for achievement.

An experiment must therefore present stimuli that preserve the structure of the environment (i.e., present all available cues, maintain cue values, cue distributions, cue intercorrelations and ecological validities of cues).

Not only is an experiment employing representative design capable of capturing an individual's natural process of vicarious functioning, it will also yield results generalizable to the individual's environment beyond the experimental situation.

Representative design is arguably Brunswik's most important contribution to psychology, although it has largely been ignored. Social judgment theorists have explicitly expressed their commitment to representative design.

But theory and practice are two different things. I have been working on a review paper (with Ralph Hertwig and Ulrich Hoffrage, Max Planck Institute for Human Development, Berlin) that maps the development of representative design, examines the implementation of representative design in empirical studies in the field of judgment and decision making, and assesses the effects of representative design upon research results.

We hope to present the results at the next Brunswik meeting.

## **Application of Brunswikian Ideas to Human-Automation Interaction**

**Alex Kirlik**  
**Atlanta, GA**

Reflecting over the past year, I realize I have spent a great deal of time pondering and describing interactions: among theories, data, people, methods, technologies, and so on.

When Hammond and Stewart put out a call for nominations for Brunswik's papers to be included in the *The Essential Brunswik*, I nominated a paper not written by Brunswik. I suggested that James Gibson's review of Brunswik's 1956 book ("Survival in a World of Probable Objects") should be included, and was appropriately punished by the editors by being asked to write an accompanying chapter: "Gibson's Review of Brunswik."

You are not likely to learn anything new there about either of these great theorists; instead, my goal was to use the benefit of hindsight to try to separate the real from the merely apparent in their disagreements at the time. It is a great understatement to say that this was not as easy (or as brief) a task as I had first thought. I also wrote a second chapter for *The Essential Brunswik*, a piece on Brunswik's implications for "Human Factors."

Two of my students, Rich Strauss and Ellen Bass are currently engaged in dissertation research applying Brunswikian ideas to human-automation interaction issues. We are relying heavily on the extension of the lens model equation by Stewart and his colleagues to also include base-rate and regression-to-the-mean effects.

Strauss is evaluating the suitability of this model in a "coming to periscope depth" submarine task. Bass is using the approach in a triple-system arrangement to analyze the interaction between pilots, cockpit alerting automation, and the task environment. The goal here is to come up with some new methods for coupling people and alerting automation for the forthcoming "free-flight" environment: Currently, pilots are faced with overly

conservative alerts (automation designers can be the subject of human error lawsuits as well!), yet they are often blamed when they perform the necessary task of separating false alarms from true alerts.

I am also working on a paper with my former student Ling Rothrock on inferring simple, noncompensatory judgment heuristics from behavioral data. In the dynamic command and control situation giving rise to this work, time pressure appeared to prompt our laboratory participants to develop simple if/and/not/or/then heuristics as coping strategies.

We did a lens model analysis of this data (a paper with another ex-student Ann Bisantz currently in review), but the results were less than encouraging: Participants reported simple heuristics during debriefing, and we found these rules to be consistent with their judgment data.

The technique Rothrock and I are now writing up consists of using a genetic algorithm for representing, generating, mutating, and crossing rules, and a multi-objective optimization algorithm to create rule fitness measures (maximizing a combination of rule completeness, parsimony, and concreteness). We applied the technique to inferring rules describing high and low performers, with very encouraging results.

Two additional writing projects are currently underway (also with Strauss). The first is a chapter on an ecological approach to human error in health care, for a forthcoming volume-Human Factors Interventions for the Health Care of Older Adults (Erlbaum); we are grateful in this regard to Gérard Chasseigne for sending us his aging-related papers. The second is a review (for Applied Cognitive Psychology) of the recent volume (edited by Juslin and Montgomery): Judgment and Decision Making: Neo-Brunswikian and Process-Tracing Approaches.

## **Brunswik Symmetry:A Golden Key Concept**

**Werner W. Wittmann**  
**Mannheim, Germany**

As I told those who attended the 14th meeting at Dallas, I'm deeply convinced that Brunswikian concepts have consequences and implications far beyond their success stories in judgment and decision research.

Fortunately, these oral promises are now written down and published in plain English-Wittmann, W. W., & Süß, H.-M. (1999). Investigating the paths between working memory, intelligence, knowledge, and complex problem-solving performances via Brunswik symmetry. In P. L. Ackerman, P. C. Kyllonen, & R. D. Roberts (Eds.), *Learning and individual differences: Process, traits, and content determinants* (pp. 77-108). Washington, DC: APA-books.

During the last few years I have tried to instill Brunswikian ideas in as many people as possible and proudly learned that John Nesselrode and Jack McArdle (1997) demonstrate the importance of these ideas in causal modeling.

Jan-Eric Gustafsson invited me to contribute to a symposium at the 27th International Congress of Psychology, July 23-28, 2000, in Stockholm. My talk is titled: "A Bright Future for Intelligence Research Under the Scrutiny of Brunswik Symmetry."

This fits well with a paper I have started writing: "Brunswik Symmetry: A Golden Key Concept for Successful Psychological Research." There I try to shed new light, for example, on the Epstein/Mischel controversy in personality research, the attitude/behavior relationship in social psychology, the cross-level fallacy in social sciences, the apple and oranges problem in meta-analysis, the irritating zero-effect problem in program evaluation, looking in the wrong direction in improving on predictability, successes and limits of simple heuristics, and so on. In my eyes all these topics can be related to Brunswik symmetry and its violations.

I'm especially grateful to Gerd Gigerenzer and his team for their willingness to organize the Y2K Brunswik Society meeting at the Max-Planck Institute in Berlin, July 20-22.

Looking forward to meeting many of you next year in Europe.

## **Simple Heuristics That Make Us Smart**

**Ulrich Hoffrage**  
**Berlin, Germany**

This is not a research report from an individual, but the announcement of the publication of a book that summarizes some of the research conducted by a group, namely the ABC Research Group (Center for Adaptive Behavior and Cognition at the Max Planck Institute for Human Development in Berlin).

Substantial sections of the book have been inspired by Brunswikian ideas, and three of the authors (Gerd Gigerenzer, Ralph Hertwig, and Ulrich Hoffrage) are also on the Brunswik mailing list.

In particular, this book might be interesting for Brunswikians for two reasons. First, it emphasizes the importance of studying the environment to generate candidate models of cognitive processes. As Reinhard Selten put it on the book's back cover: "This book is a major contribution to the theory of bounded rationality. It illustrates that the surprising efficiency of fast and simple procedures is due to their fit with the structure of the environment in which they are used. The emphasis on this 'ecological rationality' is an advance in a promising and already fruitful new direction of research."

Second, the book dispenses with (multiple) regression as a mode of information integration. It shows that simple heuristics that rely only on one good reason are well able to compete with complex algorithms, such as multiple regression, when the task is to predict some criterion (on the environmental side of the lens). Moreover, it demonstrates that these simple heuristics are also useful as behavioral models (on the organism's side of the lens).

Below please find the "official" announcement of the book that contains more details.

-Book Announcement-

Dear colleague,

We are pleased to announce the publication of our new book, *Simple Heuristics That Make Us Smart* by Gerd Gigerenzer, Peter M. Todd, and the ABC Research Group, from Oxford University Press (ISBN 0-19-512156-2, 416 pp., \$35 hardcover).

This book, stemming from the research of our group over the past four years, describes how fast and frugal heuristics can make accurate decisions using only limited knowledge, time, and computation. We explore several classes of these heuristics and their application in domains varying from mate search to stock-market investment, using experiments, simulation, and mathematical analysis to understand how and where such simple strategies can work.

We have written an extensive precis of the book to appear in Behavioral and Brain Sciences next year, along with multiple reviews. You can see the precis, along with calls for BBS reviewers on the web at <http://www.cogsci.soton.ac.uk/bbs/Archive/bbs.todd.html>.

Further information about the book, including a short description, table of contents, back-cover reviews, and links for ordering copies (we encourage you to look and ask for the book at your local independent bookstore, but after that, consider [www.bn.com](http://www.bn.com) at 30% off), are on the web at <http://www-abc.mpib-berlin.mpg.de/shtmus/>.

We welcome your feedback, and hope that you find the book and the results within stimulating! With best wishes,

Gerd Gigerenzer and Peter Todd

## **Studies in Personality, Intelligence**

**Robert Gifford**  
**Victoria, BC**

My colleagues and I continue to examine personality and intelligence with lens models.

Typically, we measure a dozen or so reliably measured behavioral or appearance cues during naturalistic interviews or conversations, and then examine ecological validity and the cue utilization policies of zero-acquaintance judges who view videotapes of the interviews or conversations.

My recent study with D'Arcy Reynolds involved intelligence. High school students with a wide range of measured IQ scores served as targets. They were taped while answering thought-provoking questions (the idea was to facilitate the manifestation of intelligence, or the lack of it).

Thirteen verbal and nonverbal cues were measured, and unacquainted near-peers (college freshmen) rated the targets' intelligence in auditory-only, visual-only, and auditory+visual conditions.

Accuracy was moderate, and it was shown that accuracy was greatest in the auditory-only condition; visual cues actually seemed to reduce accuracy. Also, almost half the variance in measured intelligence was accounted for by only 5 objectively measured cues.

We like to think we are picking up where Brunswik (1945) left off (see the 1956 book, pages 26-29, Experiment D).

# Interpersonal Perception and Communication

**Linda Albright**  
**Westfield, MA**

My current research in the area of interpersonal perception focuses on interpersonal communication. In conversation, people use combinations of words (statements or utterances) to accomplish a particular communicative intent (e.g., to show concern, to praise, or to criticize). However, the relationship between statements and intentions is probabilistic; there is no one-to-one correspondence between statements and the intentions they reflect.

To what extent do people accurately determine the communicative intent of other people's conversational statements? In a recent study conducted with A. Cohen, T. Malloy, and T. Christ, we videotaped groups of four well acquainted participants engaged in five-minute conversations with each of the three other members of the group.

From these videotaped conversations, we randomly selected six statements, three of which were made by one participant, and three of which were made by the other participant. Subsequently, participants watched the videotapes of their own conversations and judged the selected statements on eight "verbal response modes" (Stiles, 1978), or response intentions. In other words, they were asked to judge the intent (speech act) of the conversational statement.

We estimated the extent to which participants agreed about the intent of their statements. That is, to what extent do people agree that a given statement was intended to advise versus to provide information? We found high levels of agreement in judgments of communicative intent.

Is this agreement a function of participants' "inside perspective," or is the reality of these communicative intentions apparent to "outsiders"? To address this question, two or three observers, who were unacquainted with the participants, were assigned to observe these videotapes under one of three experimental conditions: audio-visual, audio-only, and text. They also judged the selected statement on the eight response intention categories.

We found substantial levels of consensus among observers in all experimental conditions, although consensus was somewhat higher in the audio condition. Thus, in this study, there was no evidence that perspective influenced the ability to judge communicative intent in conversation.

In other research, we are exploring the links between personality, quality of conversation and social interaction, and judgments of personality and social behavior. Can we predict which conversation will be pleasant, for example, on the basis of the participants' personalities? Does personality affect conversational behavior in systematic ways? Does exposure to others' conversational behavior provide an adequate basis for more general social judgment of the individual? We are in the process of analyzing the data to address these and other questions.

# Affirmative Action Policies in Admissions Decisions

**Jeryl Mumpower**  
**Albany, NY**

During the last year, I have been working to finish a paper that analyzes affirmative action policy from a Brunswikian perspective. The paper is jointly authored with Tom Stewart and Radhika Nath, and I presented the work at the July Brunswick meeting for those of you who were there.

The research on affirmative action policy follows from some closely related work on psychiatric emergency room decision making, breast cancer screening policy, and global warming.

Only true Brunswikians are likely to understand the link between such disparate topics! The link is that for each of these problems we are applying the key ideas that Ken Hammond explored in his 1996 book-*Human Judgment and Social Policy: Irreducible Uncertainty, Inevitable Error, Unavoidable Injustice*.

We are studying affirmative action in the context of admissions to highly selective undergraduate institutions. Although it would seem that little new could be left to be said on this topic, which has received extensive attention in recent years, the 60-year old Taylor-Russell approach sheds new light on the subject, just as Ken told us it would.

Admissions decisions can be divided into four exhaustive and mutually exclusive categories: false positives (admit unqualified applicants), false negatives (reject qualified applicants), true positives (admit qualified applicants) and true negatives (reject unqualified applicants).

To understand the full implications of different affirmative action policies, four factors must be considered simultaneously:

- o selection rate, or percentage admitted;
- o base rate, or percentage of those applying who could do the work if admitted;
- o predictive accuracy, or degree of correspondence between predictions of performance and actual performance; and
- o the costs associated with false positive and false negative errors, as well as the
- o benefits associated with true positive and true negative diagnoses.

The paper reports a series of nine analyses, which were conducted under varying assumptions concerning the presence or absence of an affirmative action plan, whether observed racial differences in college admissions test scores reflect systematic bias, and whether there are racial differences in the level of random error associated with predictors of future performance.

To give a flavor of the results, the analysis illustrated the following: Assume there is comparatively greater random error in predictors of future performance for African-American applicants (a proposition for which there is reasonably good circumstantial evidence). Then under a program of affirmative action, proportionately more false positives (matriculated students who do not succeed) would be found among minority group students

than among majority group students. In other words, proportionately more admitted students would fail to graduate.

Further, the number of false negatives (rejected applicants who could have succeeded) would also be proportionately higher among minority students. In other words, proportionately more deserving applicants would be rejected.

Moreover, if we reduce the number of admitted minority applicants in order to address their higher failure rates, we simply aggravate the false negative problem, rejecting an even higher percentage of deserving minority applicants.

In sum, Brunswikian-inspired judgment analysis sheds new light on the notion of fairness in affirmative action, demonstrating that, in this context, what is "fair" for majority group applicants is unlikely to be "fair" for minority group applicants, and vice versa.

## **Professional Performance, Reliability, Hierarchical Linear Models**

**James Hogge**  
**Nashville, TN**

During the past year I completed three chapters (two with Steve Schilling) for *The Essential Brunswik*.

### **Application of the Lens Model to the Evaluation of Professional Performance**

In this chapter, I argue that the value systems of evaluators can be made explicit through ideographic modeling with multiple linear regression in a way that facilitates examination of those values. The clarification of both expressed and implemented values (inferred from subjective and empirical weights, respectively) can improve communication among evaluators and persons whose professional performance is to be assessed. This is particularly important where the evaluator also serves as supervisor (e.g., a classroom teacher supervising practice teaching).

Inter-evaluator agreement is decomposed by the lens model equation into components that can guide training of evaluators to improve the consensus among them and, hence, the reliability of the assessment of professional performance.

Statistics obtained in the modeling process (e.g., the squared multiple correlation) and from the decomposition of inter-evaluator agreement (e.g.,  $G$ ) can be used as indices of the adequacy of the functioning of individual evaluators and as the basis of comparisons of groups of evaluators.

Finally, further examination of the evaluative consensus through cluster analytic methods can lead to the description of evaluative typologies consisting of evaluators with similar implemented value systems.

### **Assessing the Reliability of Judgments**

Within the Social Judgment Theory (SJT) framework, the reliability of judgments is typically defined as the consistency of repeated ratings of the same cases by the same judges. This approach yields a separate test-retest



correlation for each judge and is sensitive to temporal variation. Reliability could also be assessed in terms of agreement among the judges (interrater reliability), but this would yield as many sets of interrater reliabilities as occasions. Averaging across occasions is possible, but this would ignore variance due to occasions.

Fortunately, generalizability theory (Cronbach, Gleser, Nanda, & Rajaratnam, 1972) provides a comprehensive analytic framework that can be used to estimate the magnitude of multiple sources of error in an SJT investigation to permit the design of a subsequent study that will yield the required reliability of judgments.

In this chapter, Steve Schilling and I provide a brief overview of generalizability theory, relate it to ideographic and nomothetic levels of analysis as well as representative design, and demonstrate its application to data collected in an SJT study of hail forecasting (Stewart, Moninger, Grassia, Brady, & Merrem, 1989).

### Hierarchical Linear Models for the Nomothetic Aggregation of Ideographic Descriptions of Judgment

Steve Schilling and I hope that this chapter will provide a useful way to reconcile the apparent tension between ideographic and nomothetic approaches to the analysis of judgment data.

Beginning with a summary of the distinction between the ideographic and nomothetic orientations and Brunswik's view of the tension between them, we note strategies that previously have been employed to aggregate ideographic judgment data.

Next, we provide a brief overview of hierarchical linear models (HLMs; Bryk & Raudenbush, 1992) and show how they can be used to analyze a set of judgments based on multiple cues.

Finally, we suggest that when undertaken after the ratings of judges have been analyzed and understood at the individual level, HLMs provide a means to simultaneously model judges at the ideographic and nomothetic levels. In addition, HLMs clearly indicate whether quadratic relationships detected in ideographic descriptions of individual judges should be included in an overall, nomothetic description of the aggregated data. Finally, HLMs lead to a parsimonious nomothetic model of the aggregated data, and provide significance tests that can detect (a) differences among the judges with respect to the weights they assign individual cues (ideographic level of analysis) and (b) appreciable cue utilization in the population from which the sample of judges was drawn (nomothetic level of analysis).

Steve and I have also been working on an ever-expanding presentation of the material in the HLM chapter in a manuscript titled *Multilevel Judgment and Reliability Analysis: Hierarchical Linear Models as a Bridge Between Generalizability Theory and the Lens Model Equation*.

In this paper, we deal with such additional topics as modeling variability as a function of judge characteristics.

## **Policy Persuasion; Correspondence, Coherence Correlations**

**Elise Axelrad Weaver**  
**Albany, NY**

In the past year, I completed my Ph.D. at Duke University, working at the interface of Social Cognition and Judgment and Decision Making. My committee consisted of Philip Costanzo and Allan Lind on the Social Cognition side and John Payne and Jim Bettman on the JDM side.

In my Ph.D., I developed a measure of relative judgment policy change under persuasion in order to test competing claims from reactance theory and impression management theory as to why people resist advice.

The measure was a Euclidean distance measure indicating the component of change from prior to updated policy in the direction of policy advice.

This year, I am a post-doctoral research associate at the Center for Policy Research at the University at Albany, SUNY, working with Tom Stewart.

We will be testing whether correspondent accuracy in a multiple cue judgment task correlates with IQ (i.e., the WAIS score) and/or/nor with successful coherence at the kinds of probability tasks highlighted in the heuristics and biases literature.

## **Research Projects on Adaptive Nature of Human Judgment**

**Phil Dunwoody**  
**Athens, GA**

My research during the past year has been heavily influenced by the social and cognitive psychology literature. The unifying theme I have chosen is the adaptive nature of human judgment.

I am currently working on a paper with Leonard Martin that examines the tacit paradigm of modern cognitive and social psychology within an attribution framework. More specifically, we argue that researchers are usually involved in attribution tasks (i.e., researchers make causal attributions about participant behavior). While experiments are often designed to induce specific behavioral effects, the power of the experimental context is often under appreciated, resulting in an attribution bias toward the participant. This work utilizes the findings on attribution and a systems orientation to explain-and hopefully reduce-researcher bias by attempting to make some of our implicit assumptions about human nature and research explicit.

Another project of mine is a review paper examining how introspection and judgment interact in the world. Nisbett and Wilson (1977) made the claim that we do not have access to higher order processes, but only to the output of such processes. More recent work by Wilson and colleagues (Hodges & Wilson, 1993; Wilson & Kraft, 1989; Wilson & LaFleur, 1995; Wilson & Schooler, 1991), has emphasized that judgment satisfaction decreases after introspective analysis. A review of the literature shows that this decrease in judgment satisfaction is contingent upon the type of judgment task used and that the effect can be reversed given the appropriate task. I suggest rather than the statement "we do not have access to our higher order processes," it would be more appropriate to state that our language module only has direct access to some types of information. If one views these findings from a modular mind perspective, one would not expect the language module to have universal access to all other modules. This view is consistent with current work in cognitive neuroscience (Gazzaniga, 1992, 1995) and provides a framework from which research involving verbalization may be understood (i.e., the nature of insight problems, the effects of talk aloud procedures).

The review paper on how judgment and introspection interact also draws on Cognitive Continuum Theory (CCT). Indeed, the early work with CCT related different cognitive modes of processing with brain structure. Both Hammond's CCT and Gazzaniga's work with split-brain subjects have reached similar conclusions. The hemispheres have different processing styles. The left hemisphere is more analytic and serial while the right is

more intuitive and holistic. I hope to follow up this parallel when the facility for functional Magnetic Resonance Imaging (fMRI) that is being built here at UGA is finished.

On a related note, my colleagues and I have recently completed a test of CCT within a simulated environment (Dunwoody, Haarbauer, Mahan, Marino, & Tang, in press). The results are promising and support many of the CCT derived hypotheses. We found that processing style (analytic to intuitive) did indeed fluctuate with task parameters. However, the fluctuation was not always in the direction predicted, and we stressed the need to consider subjective task characteristics more explicitly. This work is currently in press at the Journal of Behavioral Decision Making and should be out shortly.

Finally, I have one more research project under way. Adam Goodie and I are examining base-rate neglect in a single cue probability-learning task. We have some preliminary data that shows participants weight consistent information (either the base-rate or the cue) more heavily than inconsistent information even though, in the long run, there is no adaptive benefit (their utilities are equal). We are extending this to examine how consistency affects base-rate usage when the utilities, or ecological validities, are not equal. For example, we have a condition where base-rate neglect, in the normative sense, is functionally adaptive. We are hypothesizing that people will show functional adaptation by using and not using base rates as a function of their utility. The task is a simple dichotomous judgment of whether a person is nice vs. not nice as a function of group membership.

In summary, I have been pursuing a research agenda that draws from diverse bodies of literature in order to gain a more thorough understanding of person-environment interactions on judgment. I plan to follow up on these related lines of research with a post-doc or an appropriate teaching and research position in the near future.

## **Theory of Coercive Sexual Strategies**

**Aurelio José Figueredo**  
**Jaen, Andalucia, Spain**

Much of my recent research has involved the application of Brunswikian approaches to the behavioral evolution and development of coercive sexual strategies.

Over the past several years, my various collaborators and I have been systematically applying these Brunswikian perspectives to the evolutionary psychology of spousal abuse, spousal rape of women, stranger and acquaintance sexual assault of adult women, parental physical and sexual abuse of children, child molestation by adolescents, and juvenile delinquency.

The proposed genetic basis for these coercive sexual strategies is the evolution of conditional adaptive strategies involving elements of reactive heritability. Any hypothetical gene or set of genes controlling the choice of sexual strategy, which we might term Sexual Strategy Regulator Genes (SSRGs), must be sensitive to critical environmental contingencies, including the presence of other strategically relevant genetic traits.

To determine which strategies work best for each individual, one must assess both its environment and itself within that environment. Psychosexual development thus involves a comprehensive self-assessment of sociosexual capabilities and opportunities, calibrating optimal utilization of physical assets such as size, strength, health, and attractiveness, as well as psychosocial assets such as intelligence, self-efficacy, social skills, personality, and socioeconomic status and/or prospects (Figueredo, 1999; Hunter & Figueredo, 1999).

An emergent construct, also derived from evolutionary theory, that is relevant to this proposed etiology of coercive sexual strategies is that of the Competitively Disadvantaged Male (CDM). The designation CDM was first used in a study examining the causes of domestic violence (Figueredo & McCloskey, 1993).

In this work, CDMs were theorized to rely on coercion as their primary means of obtaining sex. CDMs were thought to be unable or unwilling to effectively use mainstream sexual strategies; hence, they are forced to acquire sex by coercing their partner through verbal threats, manipulation, or physical force.

CDM characteristics may include: (1) poor competency/skills in social or sexual situations, (2) physical unattractiveness to women, and (3) low socioeconomic status. CDMs may possess some or all of these characteristics, and as a result, have a "relative disadvantage in the sexual marketplace" (Figueredo & McCloskey, 1993).

This formulation suggests that those males who have psychological or social problems would be more inclined to utilize more aggressive (criminal) tactics in order to stay competitive in the sexual marketplace (Figueredo, 1992, 1995).

More recently, Figueredo et al. (1999) applied this same framework to address the ultimate causes of adolescent sex offending behavior by proposing a Brunswikian Evolutionary Developmental (BED) Theory, wherein an inability to use mainstream sexual strategies leads an individual to develop deviant sexual strategies.

Because some adolescents suffer psychosocial problems and consequent competitive disadvantages in the sexual marketplace, sex offending behavior may represent the culmination of a tragic series of failing sexual and social strategies, leading from psychosocial deficiencies to sexual deviance, thence to antisocial deviance, and finally to sexual criminality.

When indirect means of sexual competition fail, more direct means are selected (Thornhill & Thornhill, 1992). Alternatively, noncoercive mate diversification strategies may be developmentally selected by individuals who are supernormally endowed with certain sexually attractive attributes, such as men low in Fluctuating Asymmetry (a cue indicating high pathogen resistance) and women low in Waist-to-Hip Ratio (a cue indicating high fecundity). Such sex-specific factors alter the relative cost-benefit ratios of mating effort with respect to parental effort in these individuals (Gangestad & Simpson, 1999).

One distinctive feature of the evolutionary applications of Brunswikian perspective is that when an organism establishes its hierarchy of alternative ("vicarious and intersubstitutable") responses based on experience with the relative ecological validities of alternative means for producing a given distal achievement (Petrinovich, 1979), it may be assessing the relative efficacies of various biologically prepared adaptive strategies with respect to genetically predetermined goals.

Thus, Brunswikian learning need not be totally *de novo*, but might be based instead on evolved behavioral programs of some sophistication and complexity, in a manner analogous to that of human language acquisition (see Pinker, 1994; see also, Garcia & Ervin, 1968; Garcia et al., 1974; Mayr, 1974; Seligman, 1970; Seligman & Hager, 1972; Waddington, 1957).

# **Social Trust and Confidence in Environmental Risk Management**

**Timothy Earle**  
**Bellingham, WA**

At the 1999 Brunswik meeting, I outlined the results of some of the recent research on social trust carried out at Western Washington University by George Cvetkovich, our visiting colleague from Zurich-Michael Siegrist, and myself. In this note, I describe two of the questions our research will address in the coming year.

First, we will attempt to clarify, and provide persuasive evidence for, the distinction between social trust and confidence. This distinction, first proposed by Niklas Luhmann and subsequently elaborated by Adam Seligman, has never been closely examined empirically. This neglect is a consequence of the general conceptual confusion that has long frustrated progress in this area.

The confusion may be only on the surface, however. When we reviewed recent studies of trust, across disciplines and issue contexts, two distinct concepts were consistently identified (as indicated by measures, not concept labels): trust and confidence.

Trust is the willingness to make oneself vulnerable to another based on judged similarity of values, and confidence is the belief, based on experience or evidence, that certain future events will occur as expected.

Trust and confidence are alternate paths to cooperation. Cooperation can be driven by confidence based on past performance; or it can be supported by trust based on shared values; or it can be based on some mixture of the two.

Our context of application is environmental risk management. In many risk management controversies, information about past performance is either unavailable (due, for example, to newness) or difficult to interpret (because it is highly technical, because it deals with nonintuitive probabilistic concepts, because it deals with rare events, etc.).

In such cases, there is little basis for confidence. But there is still the possibility of trust, and, therefore, of cooperation. In addition, trust can contribute to the development of confidence, thereby establishing the basis for a stable relationship. Finally, in cases of past poor performance, trust can act as a bridge between lost and regained confidence.

In our study of social trust and confidence, we will test a latent variable structural model that consists of seven constructs: (1) social trust, which is based on (2) value similarity; and (3) confidence, which is based on (4) past performance. Both social trust and confidence affect judgments of (5) risk and (6) benefit, which in turn lead to (7) cooperation.

All the paths in the model are positive except for those to and from risk. Several questionnaire items will be designed to measure each of the constructs in the model, and confirmatory factor analysis will be used to test the construct validity of the central factors of interest, social trust and confidence.

In our second major research effort, we will attempt to demonstrate the importance of social trust to the resolution of environmental disputes. One of the characteristics of environmental disputes is lack of confidence that the system of dispute resolution will work properly. Social trust, therefore (based on the structural relations described above), may provide a new, alternative means of dispute resolution.

We have designed two experimental studies to test the efficacy of two different ways of encouraging social trust. One involves making inclusive-group characterizations available and salient to disputants; the other is based on suggesting expectations of trust rather than distrust. Both of these procedures should produce signals of similarity, leading to increased trust and, subsequently, to cooperation.

We hope to report progress on these studies of social trust at next year's Brunswik meeting.

## **Research on Pilot Use of Automation**

**Kathleen Mosier**  
**San Francisco, CA**

This year, we are continuing our NASA-sponsored work on pilot use of automation. With Beth Lyall at Research Integrations, Inc., we are following up on previous work addressing automation bias and situation assessment issues, and exploring the issues of risk perception (event criticality), information source, and a preference for action in decision making.

Prior research has established that a tendency toward automation bias exists among pilots as well as in the student population, and that this tendency can result in omission or commission errors.

Other findings have suggested that individuals tend to be proactive, and to choose action over inaction whether the suggestion comes from an automated or other source-unless the action involves high personal risk.

The research on the interaction between risk, information source (automated vs. nonautomated source), and proactivity (action vs. inaction) has previously been conducted using student participants and a combination of aviation and other scenarios. The interaction among these factors has not yet been explored with professional pilots in scenarios that reflect real situations and potential events.

Building on the previous work, these issues are being investigated via a paper-and-pencil study utilizing regional pilots as participants. Scenarios have been constructed (using events from previous studies and from incident and accident reports) that are directly relevant to flight operations, and that vary as a function of risk or event criticality, action vs. inaction suggested or indicated, and source of the information or suggestion (automated vs. traditional or nonautomated vs. human).

The results of this study will pinpoint circumstances or factors that are likely to result in inappropriate reliance on automated cues, or inappropriate action, and will provide a valuable resource for scenario and training development purposes.

## **Studies in Social Issues, Individual Differences, New Brunswikian Resources**

**R. James Holzworth**  
**Storrs, CT**

Research in the Brunswikian tradition continues at the University of Connecticut. An annotated bibliography of all published cue probability learning studies was prepared along with my contribution to The Essential

Brunswik. Access to this Microsoft Word 6.0/95 document file (MCPL bib.doc) is available through a link on the Brunswik Society web page, or may be accessed directly at <http://www.sp.uconn.edu/~holz/MCPLbib.doc>.

My colleagues Steven Mellor, Dan O'Shea, and I are investigating judgments concerning becoming a replacement worker and crossing a picket line. Four situational cues (number of vacated positions filled, publicity for the strike, number of striking workers on the picket line, and threat of violence by striking workers) and an individual difference factor (financial need) were included in a multilevel judgment model.

Regression parameters from within-person judgment analyses indicated that situational factors did influence judgment polices about willingness to cross a picket line to accept a position. Using parameters as outcome variables, between-person analyses indicated that financial need did not impact on situational influences.

Two Brunswikian studies were presented as posters at the SJDM 1999 Meeting in Los Angeles. The first is a study of sexual harassment in the workplace. Lisa Kath, Carrie Bulger, and I compared court rulings with lay persons' judgments of sexual harassment. We identified important facts (cues) from actual court cases, and asked raters to judge impact levels (scale values) of each cue. Achieving consensus on cue level ratings proved difficult, so cues were coded dichotomously by two subject matter experts.

We conducted judgment analyses to capture individual policies concerning severity and pervasiveness of harassment cases and compared three methods of determining cue values (personal scale values, group mean scale values, and dichotomous).

We accounted for significant judgment variance, and the three methods of cue scaling produced roughly equivalent results. Research on sexual harassment will continue with new and different tasks.

The second poster concerns my attempts to relate biographical data (biodata) to styles of inductive reasoning. A biodata questionnaire was developed for assessing demographic and biographical variables potentially related to analytical and intuitive styles of cognition. The 195 items assess individual differences concerning exposure to science, math, and fine arts, tolerance for uncertainty, tolerance for ambiguity, and decision style.

Biodata questionnaires were completed by 378 students representing more than 34 majors within several colleges. Four criterion measures (essay items) known to induce different modes of cognition were also completed.

Results indicate individual differences in styles of cognition for the study participants. These individual differences were related to biodata variables.

At the Brunswik Society Meeting in Boulder this past summer, Tom Stewart and I presented a proposal for creation of a Social Judgment Data Network (SJDN). This SJDN will be sort of a co-op for judgment and decision making (J/DM) researchers. Researchers from around the world will be able to access the SJDN over the World Wide Web, borrowing task materials for research and instructional purposes. In turn, hopefully these researchers will contribute their data sets to the SJDN for use by other researchers and their students.

Tom and I are now working out details for recommended formatting and cataloging of task materials and data sets. Anyone interested in receiving a copy of our proposal, and helping with this effort, should contact one of us.

# Contingency Judgments

**Manuel Migeul Ramos Alvarez**  
**Jaen, Andalusia, Spain**

I'm very grateful for this opportunity to introduce my work. I'm conducting research in causal/predictive processing, with a particular focus on contingency judgments. My work could be organized around three areas.

My first research area, tutored by Andres Catena at the University of Granada (Spain) deals with predictive processing in situations which present more than one potential predictor. The blocking paradigm we are using is considered within a diagnostic context, to simulate diagnostic processes, either medical or psychological. In fact, we have created a computer program in Visual Basic 5.0. which allows a very wide range of judgment experiments.

We also found that predictors are processed independently in some situations, such as the blocking paradigm. These results defy the competitive mechanism we see in the relevant literature. The use of competitive or independent processing seems to depend on the beliefs the person has about the situation.

An extensive series of experiments led us to propose an Information Integration Model based on Norman Anderson's theory. In addition, we have directed our attention toward the lens model, in an attempt to enrich such a proposal, both cognitively and methodologically.

According to the Brunswik lens model, the environmental structure and the organismic system are joined with a linking function that incorporates the subject's beliefs or assumptions about the causal texture of the environment (in the spirit of Tolman & Brunswik).

The second research area arises from a more elemental point of view. Ana Raquel Ortega and I are conducting research from a descriptive (more than normative) perspective about the processing strategy in judgments of contingency within binary tasks. We have suggested a formal model with three possible algorithms according to the way in which the information is integrated. These strategies include four basic parameters that reflect the subjective weight attached to the four types of information relevant in binary situations. We have also developed a computer program, which allows us to implement this theoretical proposal, and are checking its validity through a series of experiments on stereotypes.

In our formal model, the different kinds of predictions are deduced in terms of three types of strategies and the values of the weight parameters. After we carry out the corresponding estimations, the predictions are then contrasted. The lens model was also very useful in this line of research, particularly in its nonmetric variant (i.e., Castellan), as we are adapting our formal proposal to include the different indexes allowed by the lens model (such as consistency).

In addition, we are studying in depth the inferential apparatus that allows us to attach-in a univocal way-a strategy to each participant in the experimental situation.

Last but not least, both the Brunswik methodology of regression and the Generalized Linear Model constitute a very useful framework to conceptualize the general research process in psychology. I have found this very useful in teaching my experimental psychology students. In fact, I'm writing a textbook using this integration perspective.



In my view, the methodology should include the data coming from research in basic psychological processes, in order to understand the researcher's reasoning and decision making. In other words, my aim would be to progress from the methodological to the cognitive contents and vice versa, so that we can include ideas or data about heuristics and biases and judgment and decision making in causal processing, hypothesis testing, et cetera. From this descriptive framework, the Brunswikian ideas bring forward the possibility of organizing the above dynamic model from theory towards data.

## **Information Presentation in Prostate Cancer Screening**

**Robert Hamm**  
**Oklahoma City, OK**

I am preparing to run a study of the effect of a clear presentation of the tradeoffs inherent in prostate cancer screening on men's understanding of prostate cancer screening and on their screening behavior in the next six months.

Men will be randomized to (a) read a standard patient handout, (b) read an "extended balance sheet" that we are producing, or (c) go through the extended balance sheet step by step with the research assistant playing the role of the infinitely attentive, nonrushed patient educator.

The balance sheet will differ from the typical presentation by giving the probabilities of events and outcomes using a single reference population (1,000 men who decide to get screened). You will recognize this to be an absolute frequency type display which Gigerenzer and Hoffrage have advocated.

We will actually put up a display with a thousand circles, similar to that used by Annette O'Connor (e.g., *Medical Decision Making*, 1998, 18, 295-303). This display will be used to illustrate the prevalence of localized prostate cancer for men of a particular age group, screening accuracy (true and false positives and negatives), treatment effects (those helped, those for whom treatment was unnecessary because they wouldn't have gotten advanced prostate cancer anyway, and those for whom treatment was useless because they got advanced prostate cancer despite the treatment), and side effects of treatment. The summary will display the eight men (out of the 1,000 screened) who avoided getting prostate cancer, versus the 20 or so who became permanently incontinent or impotent.

The effects we will measure include whether they get screened in the next six months. (We only enroll men who have not been screened in the last year so that if they decide screening is for them, they would be "due.") Also, we have measures from the health beliefs model (concepts of perceived benefit from screening, etc., which can be mapped onto a subjective expected utility model), and we will look for changes in these measures.

Our outcome with the biggest theoretical baggage is that we will measure the men's utilities and plug them into an individualized decision analysis (Markov model). We can then see whether their action is consistent with their utilities and determine whether our extended balance sheet helps them take actions more consistent with their utilities.

As I look over this and ask whether this is Brunswikian rather than simply "judgment and decision making" or "medical decision making," I think it qualifies: People on the extended research team have come from a broad sample of academic environments, including psychology (linguistics, animal behavior, and judgment and

decision making), medicine (family medicine and urology), sociology, health promotion sciences, bilingual education, human ecology, and decision analysis.