

# The Brunswik Society

## Newsletter

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Edited by Lars Sjö Dahl, le.sjodahl@swipnet.se

In this annual Brunswik Newsletter, the 25<sup>th</sup> we remember Lenard I. Dalglish and his outstanding work largely formed by Egon Brunswik's theories and conceptual contribution to psychological research.

Among the contributions to this Newsletter there are several based on recent PhD work, a promise for the continuation of Brunswikian research, applied to new topics. This year's contributions cover a remarkable range of different subject areas like semiotics, prescription of antibiotics, aviation and process control, aging, sport, farming, forestry etc. On the methodological side the usefulness of Brunswik's Lens Model paradigm and Hammond's Cognitive Continuum Theory have been exemplified and learning studies have enriched our understanding of the effect of varying feedback conditions and our respect for the human being's amazing capacity for vicarious functioning with aging.

This widening of the Brunswikian research fields gives hope for the future realization of Brunswik's credo to psychology researchers to give equal attention to the environment as to the organism, in reality a Darwinian interaction-perspective. There are, however, important parts of our environment that are hardly at all represented in Brunswikian research so far, for example, music and visual art. Here, there are plenty of new research topics waiting in the wings.

**Many thanks to all authors for their contributions.**

Grateful thanks to my wife, Gillian, for language checking and support, and to Esther Kaufmann, University of Teaching Education, Zug, Switzerland for professional help with proofreading, the layout and downloading the contributions.

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**Lenard I. Dalglish**

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**Robert M. Hamm**

*Department of Family and Preventive Medicine,  
University of Oklahoma Health Sciences Center, Oklahoma City, Oklahoma,  
USA*

Brunswikian researcher Lenard I. Dalglish died August 8, 2010, of acute myeloid leukemia, 11 months after receiving the diagnosis, and 4 days after receiving the Vincent De Francis Award from the American Humane Association for his work (starting in the 1980's) on decision making in child protection (<http://www.americanhumane.org/protecting-children/len-dalglish.html>).

His last year was marked by mustering self, family, and social support systems for his initial chemotherapy treatments; consideration and rejection of bone marrow transplant; 4 months of remission during which he worked, travelled with family, and went to conferences; and then the recurrence much earlier than one would have any reason to expect. He leaves his wife Jo and two boys at the verge of being teenagers.

Len studied mathematics and psychology as an undergraduate (University of Queensland, Australia, 1972) and he got his PhD in Psychology there in 1981. This training in experimental psychology was reflected in the roles he played teaching statistics and teaching research collaborators how to study the decisions they make in practical situations. His early work on bootstrapping allowed him to introduce the topic to many conversations over the years, as the ultimate methodological answer to any modeling question.

In his many years working in applied clinical contexts, at the Department of Social Work (1981-1988) and the School of Psychology (1988-2005) at the University of Queensland, and at the Department of Nursing and Midwifery (2005-2010), University of Stirling, Scotland, he applied the psychology of judgment and decision making, often in the form of the Brunswik Lens Model, to a variety of problems. These included the social worker's judgment of child safety and the decision to remove the child from the home (Dalglish, 1988; Dalglish & Drew, 1989); the farmer's judgment of the likelihood of rain and the decision what and how much to plant (McCrea, Dalglish, & Coventry, 2005); the visiting nurse's judgment of the community dwelling schizophrenic's current ability to care for self and the decision to recommend commitment; and the emergency medical technician's assessment of the patient and decision whether to transport to hospital (or, decision to guide the patient to refuse to be transported to hospital, which may require less documentation).

He called his approach the "General Assessment and Decision Making Model", which has two components: the assessment model and the action threshold model. In the assessment model, the clinician's judgment of the child's or patient's degree of risk is modeled as a unidimensional concept depending on multiple factors

that influence risk. In the threshold model, the costs of the two possible errors a decision maker could make, not acting to avert the risk and thus allowing a bad outcome to happen, and acting unnecessarily to avoid the risk and thus causing suffering and inconvenience for patient and clinic, are combined and compared and indicate a threshold point, on the risk dimension, below which the clinician would not act and above which the clinician would act.

In his 2007 Inaugural Lecture at the University of Stirling, “Damned if You Do – Damned if You Don’t: Judgments and Decisions in Health Care,” he illustrated how this model (see Dalglish, Shanteau, & Park, 2010) could illuminate disagreements between clinicians. They might share the same action threshold, but disagree in the way they use the available information in assessing the patient’s situation. They might make the same assessments, but disagree in the way they weigh the components of false alarms and misses.

In a related line of work, he was interested in how people gain information informing their thresholds from case experience which provides only partial information about some decision options: e.g., no matter what one’s threshold for action, one gains no experience about how often, or how seldom, adverse events happen when one does not act.

Len’s research was methodologically and statistically sound, complex, and coherent in its manifestations. In my conversations while preparing this note, nearly everyone spoke of work not yet finished. This reflects his work personality as well as the unexpected illness, as he had many excitements and also viewed his role as the statistical advisor and guide. He loved to describe how his students misunderstood the “Lens Model” as “Len’s Model”. Let us encourage those who worked with him to finish those joint projects, and publish what they understood of the General Assessment and Decision Making Model, i.e., Len’s Model.

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**Research with Experienced Personnel**

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**Len Adelman**  
George Mason University,  
USA

Contact: [ladelman@gmu.edu](mailto:ladelman@gmu.edu)

I have continued performing research with experienced personnel on two projects this past year. In the first project, I have continued working with Dr. Kathryn Laskey and students at George Mason University to assess the value of geospatial tools to military decision-making. The tools are being developed by the U.S. Army's Geospatial Center to support soldiers' understanding and utilization of terrain information. In August, we evaluated the tools as part of an operational utility assessment where active-duty military personnel from five NATO countries used the tools to perform a wide range of representative missions.

The second project was a continuation of research with Dr. Paul Lehner and his colleagues at the MITRE Corporation with intelligence analysts. The project tested a method for measuring the forecast accuracy of products that use imprecise, verbal expressions of forecast certainty by measuring the accuracy of quantitative probabilities that judges infer from the imprecise text. What may be of most interest to Brunswikians is that we tested this *inferred probability method* using more documents ( $n = 10$ , including two open-source National Intelligence Estimates) than judges ( $n = 6$ ). Results indicate that the obtained accuracy profiles are comparable to those obtained from similar forecasts that were directly expressed as quantitative probabilities in the same substantive domain over the same time period, thereby supporting the general utility of this method.



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**Analysing the Expert Judgement of a Rehabilitation Counsellor**

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**James A. Athanasou**

*University of Technology, Sydney,  
Australia*

**Esther Kaufmann**

*University of Teacher Education, Zug,  
Switzerland*

Contact: [athanasou@optusnet.com.au](mailto:athanasou@optusnet.com.au)

This case study analysed the expert judgements of a rehabilitation counsellor. The counsellor was given 37 accident victims' self-ratings of health, energy, daily activities, self-esteem, personal relations, financial resources and living conditions. The accident victims also rated their own overall quality of life as poor or good. The expert was required to make judgements about whether the quality of life was poor or good in each case and matched the ratings of the accident victims in 64.8% of cases.

Had the counsellor relied on satisfaction with personal relationships as a guide to the quality of life then he/she would have been correct in more than four-fifths of all cases. This would have been an impressive outcome compared to the base rates for satisfaction or dissatisfaction amongst accident victims. The expert opted for a decision-making style that was complex whereas in reality a simpler heuristic was all that was needed. Certainly this confirms the utility of a fast and frugal heuristic in complex clinical decision-making.

The use of repeated judgements offered a valuable case-study paradigm for investigating the complexities of expert rehabilitation counselling decision-making. It was noted that the professional counsellor showed some level of accuracy but as the counsellor endeavoured to cope with the complexity of the available information, the expert resorted to a personal judgemental model. Unfortunately this natural tendency to integrate information from many sources means that the counsellors might overlook a parsimonious decision-making heuristic. A frugal approach to decision-making should now be evaluated routinely against more complex models in other areas of clinical rehabilitation practice. While there is every reason to believe that the judgement process described in this case was entirely idiosyncratic to our expert there is every reason to believe that it is representative of what can happen with other counsellors.

This work is in press – *Australian Journal of Rehabilitation Counselling*. A follow-up study has investigated the same issues but under conditions of partial information. The preliminary results indicate that this second counsellor also failed to maximise the available information. Interim results suggest that under conditions of uncertainty and complexity an expert may be more accurate than chance but still fail to use the properties of information to their maximum advantage.

Reference:

Athanasou, J. A., & Kaufmann, E. (in press). Analysing the expert judgement of a rehabilitation counsellor: A case study. *Australian Journal of Rehabilitation Counsellor*.

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**Avatars as Information:  
Perception of Consumers Based on Their Avatars in Virtual Worlds**

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**Jean-François Bélisle & H. Onur Bodur**  
Concordia University,  
Canada

Contact: [bodur@jmsb.concordia.ca](mailto:bodur@jmsb.concordia.ca)

Given the wide use of avatars and the increase in the number of consumers with avatars, there is further need to understand who these consumers behind the avatars are and how well avatars convey the creator's intended and true personality. The objective of this paper is to investigate how avatars reflect the personality of their creators (targets) in virtual worlds. Using the Brunswick Lens Model as the theoretical framework, an investigation of real consumers in the virtual world Second Life reveals that perceivers who view target's avatar use particular thin-slices of observations such as avatar cues (e.g., attractiveness, gender, hair style) to form accurate personality impressions about targets. The findings support the premise that real life companies that intend to expand to virtual worlds can use member avatars as a proxy for member personality and lifestyles. As a future research direction, avatars and other consumer-generated media could be used as the basis for targeting and segmentation of online consumers.

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Bélisle, J.-F., & Bodur, H. O. (2010). Avatars as information: Perception of consumers based on their avatars in the virtual world. *Psychology & Marketing*, 27(8), 741-765.



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**Brunswik's Representative Design and  
the Study of Visual Anticipation in Sport**

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**Matt Dicks**

*German Sport University Cologne,  
Germany*

*Contact: m.dicks@dshs-koeln.de*

Previous work has proposed that expertise in fast-ball sports including cricket and tennis is underpinned by an ability to anticipate the movements of an opponent prior to the onset of ball-flight information. Visual anticipation skill is believed to be predicated on the use of different visual information between skilled and less-skilled sportspeople as evidence by studies examining athlete gaze behaviours. However, the experimental conditions utilised to study such visual anticipation skill have been criticised over concerns that they fail to adequately sample the conditions of sport environments (for a review, see Dicks, Davids, & Button, 2009). For example, the vast majority of visual anticipation studies have tended to present observers with two-dimensional video displays that degrade the ambient array of optical information available to athletes in natural (in situ) environments. Moreover, a related and central limitation of visual anticipation studies (both video and in situ conditions) has been the failure to offer athletes opportunities to utilise functional movement responses in response to the opponent's action.

Following such criticism, Brunswik's representative design was recently drawn upon as a critical framework in order to advance understanding in the field of visual anticipation. Specifically, a study (see Dicks, Button, & Davids, 2010) was designed to examine the commonly held assumption that findings derived from existing video and in situ studies that use verbal and simulated movement measures generalize to in situ interception conditions that more closely represent the conditions of everyday sport performance environments. The gaze and movement behaviours of experienced association football goalkeepers' were compared for video simulation and in situ experimental conditions of the penalty kick. The study focused on five experimental conditions that have all been utilised in previous visual anticipation studies: two video conditions in which the goalkeepers were required to produce a verbal response or a simulated joystick movement and three in situ conditions in which goalkeepers produced a verbal response, a simplified body movement and an actual interceptive movement response. Goalkeepers ( $N = 8$ ) wore an eye movement registration system (MobileEye™, ASL, USA) while facing a total of 100 penalty kicks distributed evenly across the five different experimental conditions.

Results provided clear evidence demonstrating differences in the pattern of goalkeepers gaze behaviours for the distinct experimental conditions. The most pronounced difference was that goalkeepers fixated earlier and for a longer duration upon the ball location in the in situ interception condition in comparison with all other conditions – a finding consistent with previous in situ studies of visual anticipation. In comparison with judgment conditions, the study showed that biological motion

information from the penalty taker was fixated for less time when the task goal of a participant was to, not only anticipate the intentions of the opponent, but also to coordinate actions such as to attempt to intercept the penalty kick. Thus, evidence from the study indicated that empiricists may be incorrect to assume understanding on the visual information used by sportspeople when examining behaviour with video simulation and in situ tasks that only require judgment responses (e.g., a verbal response, a button press or a simplified body movement). That is, participants are not required to direct their gaze to pickup information that underpins the prospective control of movement as required when intercepting a moving projectile as per sport performance. A challenge for future research is to build upon the findings of the overviewed study which demonstrates the importance of the application of Brunswik's representative design for advances in the study of visual anticipation in sport.

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### News from Mike Doherty

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**Michael E. Doherty**  
Dept. of Psychology,  
Bowling Green State University,  
USA

Contact: [mdoher2@bgnnet.bgsu.edu](mailto:mdoher2@bgnnet.bgsu.edu)

A forthcoming article, What if industrial-organizational psychology decided to take workplace decisions seriously? in the journal *Industrial and Organizational Psychology: Perspectives on Science and Practice*, calls for a greater use of JDM ideas in I-O psychology. Among brief papers that were solicited to comment on the target article, we have one that describes possible applications of the lens model in I-O. That paper is *The Lens Model: An Application of JDM Methodologies to IOOB Practice* by Dalal, Diab, Balzer and Doherty.

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**Brunswikian Research at the University of Connecticut**

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**Jim Holzworth**

*Storrs, University of Connecticut,  
USA*

*Contact: jim.holzworth@uconn.edu*

Research in the Brunswikian tradition continues at the University of Connecticut. We are still working with Tom Stewart (University at Albany) and Jeryl Mumpower (Texas A&M University) on a project concerning how people learn to make decisions when feedback is limited (when the availability of feedback is conditional on the decision made). We are framing our work at UConn within the context of personnel selection. A manuscript entitled "Learning to make selection and detection decisions: The roles of base rate and feedback," was recently submitted by Tom, Jeryl, and me.

Scott Ryan recently completed a master's thesis project, conducted within the framework of cognitive continuum theory. Participants either provided justification before making job performance appraisal ratings, or simply made the ratings. This manipulation was meant to represent real world performance appraisal, in which supervisors provide both rating and justification for their rating. Study participants viewed a number of video scenes of restaurant servers waiting on dinner customers. Scott hypothesized that, when rating a specific aspect of performance, participants would be more accurate when making explicit judgments than implicit judgments; when rating overall performance, participants would be more accurate when making implicit judgments than when making explicit judgments. There were no differences between those who did and did not write out reasons on performance rating accuracy, memory recognition accuracy, or confidence in performance ratings. Overall, the effect of writing out reasons was quite weak. Scott also hypothesized that, under low cognitive load, participants would be more accurate when making explicit judgments than implicit judgments; under high cognitive load, participants would be more accurate when making implicit judgment than explicit judgments. Contrary to the prediction, the interaction between justification and cognitive load was not significant. Overall, results provided little evidence that order of tasks, providing justification first or making ratings first, affects performance appraisal ratings. Now we're not sure if this is good or bad.

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**Representative Design in the Cockpit of a Transport Aircraft**

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**Meike Jipp & Uwe Teegen**

*German Aerospace Center, Institute of Flight Guidance,  
Human Factors Department,  
Brunswick, Germany*

*Contact: meike.jipp@dlr.de*

Psychological studies mainly aim at generalizing over persons and, thus, sample a greater number of participants and confront them with an experimental situation. This – still very prominent – person-oriented methodological approach has been complemented by Brunswik (1943), who proposed a situation-oriented research methodology. Instead of sampling persons, Brunswik's representative design requests drawing situation / environment samples and asks to analyse the human behaviour of a single or a limited number of persons in situations, which are drawn from the "ecology". of the participant(s).

Many studies, quasi-experiments, and experiments conducted at the Human Factors Department of the Institute of Flight Guidance at DLR (German Aerospace Center) apply such a representative design approach:

Within the scope of a research project of the European Commission (HUMAN "Model-Based Analysis of Human Errors during Aircraft Cockpit System Design") flight simulation trials were performed in a generic cockpit simulator representing a fixed-based flight simulation facility. The cockpit's geometry refers to the Airbus A 320 aircraft, a commercial airline transport aircraft, whereas the simulation dynamics are based on the ATTAS ("Advanced Technologies Testing Aircraft System", a VFW 614 aircraft). The flight simulation trials were designed to identify operational errors with an advanced flight planning system under completely new operation conditions. The chosen scenarios represent a situation-representative design of the experiments. The situation events were selected to cover a broad-range of everyday situations of a professional pilot in a future environment and can, thus, be considered representative of a pilot's "ecology". More specifically, weather conditions, additional automation failures, as well as horizontal and vertical flight profiles were changed systematically over the different simulation runs. However, the situation events remain comparable, even in case of different flight plans. Each simulation run and, thus, the confrontation of the pilot with the situation events, lasted between 20 and 40 minutes. Person-representative design was implemented by not only testing one pilot, but in total 15 pilots, all of them holding a valid commercial pilot licence. Due to the complexity of the experimental design, each pilot was available for a two days session.

During the various simulation runs, all simulation data (aircraft and system state, aircraft position, display data) were recorded at a rate of 20 Hz representing the simulation update rate. The pilot's communication with the air traffic control was recorded event-based with a time-stamp provided by the simulation equipment. In

addition, the gaze behaviour of the pilot in command was recorded. The applied eye-tracking equipment consisted of a commercial head-mounted system provided by SensoMotoric Instruments (SMI), Germany [<http://www.smivision.com/>], of which the standard magnetic head-tracking unit was replaced by an optical unit to assure error-reduced data with regard to the magnetic field of the simulator environment. The data include the position of the cornea reflex for pilot view-point identification as well as head position/rotation and the online calculated “area of interest” (AoI) representing the actual view-point of the pilot (see Figure 1). The data recording rate of the eye-tracking unit was set to 200 Hz providing an update every 5 msec.



*Figure 1.* Picture of the generic cockpit simulator including the various areas of interest.

The resulting data set is currently used to model each pilot’s gaze behaviour. Due to the great “between-pilot” variance in the gaze behaviour and the resulting potential invalidity of a gaze model of an “average pilot”, it has been decided to work with one model for each pilot. The model can then be applied for practical reasons to reduce missing gaze data from the overall data set. In addition, the model can be used for scientific purposes and more specifically

- for developing an assistance system monitoring the pilot’s situation awareness,
- for developing training methods for (novice) pilots, or
- for gaining further insights into a mental model of a pilot.

First results show not only a strong relationship between a pilot’s gaze behaviour and the aircraft’s state, altitude, in particular, but also a nonlinear one. More specifically, a small change in the aircraft’s altitude provokes a change in the pilot’s gaze behaviour, which size greatly depends on the current altitude level. In



addition, the applied analyses give insight into a mental model of the pilot, who predicts future states of the aircraft and reacts with appropriate gaze behaviour to unforeseen aircraft's conditions (see Hazama, Jipp, Teegen, & Sawaragi, n.d.). Additional analyses will be applied, and we hope to share our results by next year's newsletter of the Brunswik Society.

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## Audit Litigation Risk: Determinants and Perception

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**Olivia Jouanen**

*Université de Toulouse 1 Capitole,  
IAE de Toulouse, France*

*Contact: olivia.jouanen@auditie.fr*

Through the lens model equation, this thesis wants to compare a model of determinants of audit litigation risk to the judgment of auditors in evaluating the litigation risk when they have to accept a new client.

We test a model of determinants of auditor litigation risk. We analyze litigation of French independent auditors from 1992 to 2003. We find that variation in benefit, audit complexity and intensity of earnings management increase the risk. Existence of loss, direction of earnings management and governance reduce the risk. These factors are used in an experimental within-subject design that controls first for risk factors and then for level of risk. The experiment is built on an Internet survey with twelve cards of seven factors relative to the client. We ask partners of audit firm to assess the litigation risk and risk factors and we compare these judgments with the model.

The accuracy of judgments on the evaluation of the audit litigation risk is significant but low. Audit partners perceive the level of risk on risk factors in the same way as the model, except for existence of loss. In function of characteristics of audit partners, like experience and specialization in audit, and in function of attitude on audit environment the perception of risk factors and the evaluation of litigation risk differ. These individual attitudes influence in a significant manner the perception of risk factors.

We conclude that auditors poorly evaluate the litigation risk compare to the real litigation risk in the environment.



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**Adaptive Benefits of Cognitive Aging:  
Evidence from Complex Category Learning**

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**Linnea Karlsson**

*Umeå University, Sweden and MPI for Human Development,  
Berlin, Germany*

**Edward T. Cokely**

*Michigan Technological University, USA and MPI for Human Development,  
Berlin, Germany*

**Angela Merritt**

*MPI for Human Development,  
Berlin, Germany*

*Contact: linnea.karlsson@physiol.umu.se*

Aging research tends to emphasize a “Brain Rot” view of cognitive aging, documenting costs associated with common age-related reductions in fluid abilities. On this view, aging is necessarily bad for cognitive performance. However, as we know, cognitive performance is the product of the relation between the environment and the cognitive system. Therefore, under some conditions cognitive aging could confer benefits. To document such benefits, we turned to complex category learning in part because use and acquisition of categories is an important task throughout one’s life span. While the literature investigating young adults’ category learning skills is vast, less is known about older adults’ category learning competencies. We reasoned that reductions in fluid capacities might bias older adults to adopt simpler and sometimes smarter strategies (i.e., one-dimensional categorization rules).

Many previous studies investigating aging and feedback-based category learning have been conducted within the general framework studied by G. Ashby and colleagues. The framework involves contrasting two different task types that are assumed to be best solved by two distinct learning systems (e.g., Ashby, Alfonso-Reese, Turken, & Waldron, 1998). The most basic difference between the tasks, as typically stated, is whether one or several dimensions of the probe determine category membership. In the so-called rule-based tasks, only one dimension of the

probe determines category membership and these tasks are supposed to be tackled by a learning system capitalizing on simple verbalizable rules. In information-integration tasks, the values of several dimensions determines membership, via a complicated combination rule. In these tasks, simple one-dimensional rules will not suffice for error-free performance. Learning in these tasks is thus said to be guided by a learning system employing integration of dimensions at a “pre-decisional” stage. However, the results with regard to older adults’ learning in these tasks are mixed, with some studies demonstrating impairments with older age (Ashby, Nobel, Filoteo, Waldron, & Ell, 2003; Filoteo & Maddox, 2004), while others don’t (Price, 2005).

Research indicates that older adults show reductions in working memory with age (e.g., Baltes, Staudinger, & Lindenberger, 1999; Herzog, Dixon, Hultsch, & MacDonald, 2003). Individual differences in working memory have been shown to be a factor on success rates in category learning (DeCaro, Thomas, & Beilock, 2008). DeCaro et al. demonstrated that high-ability individuals learned faster than low-ability individuals in a rule-based task. In contrast, in an information-integration task, low-ability individuals learned faster than high-ability individuals. However, follow-up studies opened questions about underlying mechanisms. Tharp and Pickering (2009) demonstrated that considerably fewer participants in an information-integration task were able to sustain performance long enough to reach a stricter learning criterion.

What would we expect if we contrasted young and old adults on the same rule-based and information integration tasks? There is evidence that older adults prefer simpler strategies in various tasks, for example in mental arithmetic (Geary, Frensch, & Wiley, 1993), in memory (Dunlosky & Hertzog, 1998) and decision making (e.g., Mata, Schooler, & Rieskamp, 2007). We hypothesize that any progress or even advantages demonstrated by older adults in an information-integration task presumably stem from them capitalizing on simple rules to a larger extent than the young adults, who might be caught in futile attempts to use different multi-dimensional rules.

In one experiment we tested this with a categorization task where the stimuli consisted of geometrical drawings with four binary cues and the task was to learn to categorize the stimuli into two different categories with guidance by outcome-feedback. The task was an exact replicate of DeCaro et al. (2008). Critically, we found a crossover interaction between age and performance. While the younger adults’ ability to reach the learning criterion deteriorated significantly in the information-integration compared to the rule-based task older adults showed only modest reduction. To investigate whether the observed interaction reflected differences in the use of strategies we performed a rough strategy assessment for the information-integration task. We were mainly interested in whether the age groups differed in how many dimensions they utilized. The results suggest that for younger adults about equally many of the information-integration tasks were best described by a one-dimensional strategy (52.5%) as by a multi-dimensional strategy (47.5%). However, for the older adults more of the tasks were better described by a one-dimensional strategy (76.7% v. 23.3%).

In a task where category membership was governed by the integration of several dimensions older adults were able to produce good levels of performance somewhat faster than younger adults thanks to their use of simpler strategies. These

results are unlike other important benefits of aging, such as improved emotional regulation or increased knowledge (Baltes et al., 1999; Gross et al., 1997): It is not that as abilities wane with age other abilities must compensate but instead that as abilities grow (e.g., crystallized knowledge) we may benefit if others wane. Indeed, we started this project reasoning that as we age and gain more knowledge our predictions could run the risk of over-fitting noise in our past environments. Hence, organisms that are tuned to rely on simpler judgment strategies as they age and acquire information could benefit if their cognitive systems were constrained to rely on only a few best cues. This unusual hypothesis provides an evolutionarily inspired “cognitive tuning” alternative to the dominant “brain rot” view of cognitive aging. Of course, this is only one example and much more research is needed. Nevertheless, we know that simple heuristics, used in our fundamentally uncertain and complex world, can make us smarter (Gigerenzer et al., 1999). Perhaps when used by knowledgeable older adults these simple strategies also make us wiser.

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**Teacher's Judgment Achievement Through the Psychometric Lens**

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**Esther Kaufmann**

*University of Teacher Education, Zug,  
Switzerland*

**Werner W. Wittmann**

*University of Mannheim,  
Germany*

*Contact: [esther.kaufmann@gmx.ch](mailto:esther.kaufmann@gmx.ch)*

Teachers judge children all day long about their reading comprehension or if they are interested in learning. If these judgments are inaccurate they have real consequences for children in their learning processes and their school careers. Within the Social Judgment Theory (Hammond, 1955) it is unique to evaluate judgments against criteria (e.g., actual end of year scores of the students in a reading test) and to break it down by the Lens Model Equation (Tucker, 1964) to reveal the underlying factors for accuracy. Are environmental (e.g., task) or personal (e.g., teacher's ability) factors responsible for accurate educational judgments? It is extremely important to know these factors and to inform teachers and improve their judgments. So-called expert models that build on these factors are constructed to improve and support teacher's judgments (Camerer, 1981; Goldberg, 1970). Hence, we applied a psychometric analysis to reveal the artefact-corrected true judgment accuracy and to reveal the underlying components.

For our analysis we used a part of the data base by Kaufmann (2010), where a detailed description of our literature search and our coding scheme can be found.

### *Psychometric meta-analysis*

Since the development of the social judgment theory many studies have been interested in revealing judgment achievement values and their underlying reasons for accuracy. To evaluate these studies so called bare-bones meta-analyses are used (see Karelaia & Hogarth, 2008; Kaufmann & Athanasou, 2009), although psychometric meta-analyses are more accurate as they correct additional artefacts (see Wittmann, 2009). To sum-up, with a bare-bones meta-analysis there is a danger of six too two to underestimate the true judgment achievement value, compared to a psychometric analysis.

Contrary to previous studies we also focused on single teacher judgments to prevent any aggregation bias (Robinson, 1950). Finally, the results were checked by several robustness analyses (e.g., publication bias, different weighting strategies and different correction strategies, see Kaufmann, 2010).

Our results shown that single judgments and their underlying factors reveal high heterogeneity (see Figure 1).

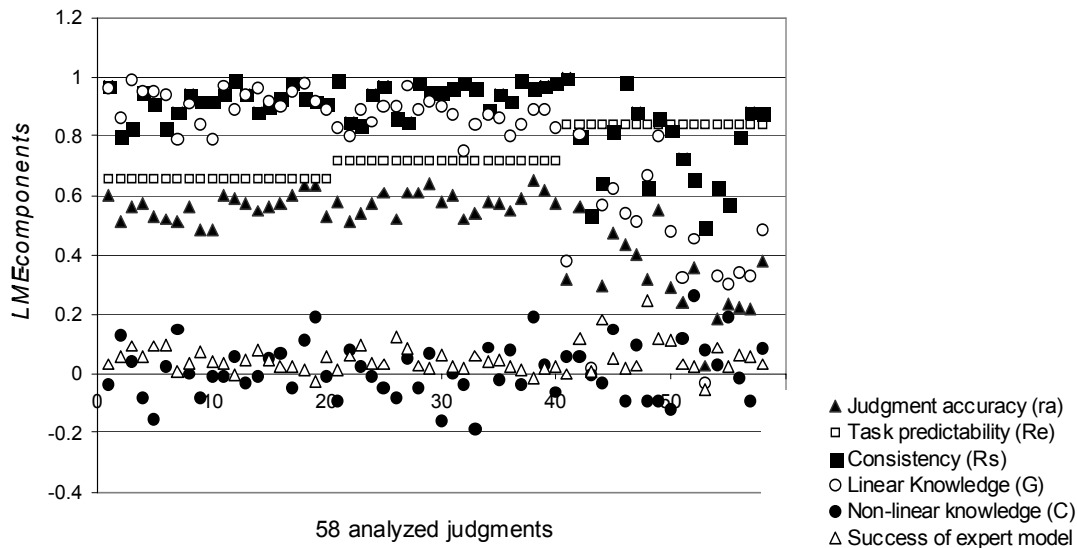


Figure 1. The scatter plot of the lens model equation in 58 analyzed judgments of 3 different tasks (see Kaufmann, 2010).

Our psychometric meta-analysis clearly reduced the heterogeneity. Judgment achievement ( $r = .51$ ,  $var_{corr} = .00$ ,  $N = 156$ ,  $k = 4$ ) across tasks reached a high level. The underlying environmental ( $r = .74$ ,  $var_{corr} = .00$ ) or personal ( $r = .93$ ,  $var_{corr} = .00$ ) factors were both high, revealing that educational tasks can be evaluated well and teachers actually judge very consistently. Our bare-bones meta-analysis revealed only a moderate judgment accuracy implying that teacher’s accuracy is clearly underestimated without psychometric corrections or in all previous bare-bones meta-analysis within the Social Judgment Theory. Finally, our psychometric corrected expert-models are useful tools to increase judgment accuracy ( $\Delta = .33$ ).

To summarize our study shows that without artifact-corrected analysis judgment accuracy and the underlying components are underestimated. Hence, our study shows from a methodological point of view the need of artifact-corrected data analysis (see Schmidt, 2010) before any conclusion in relation to judgment accuracy can be made. Moreover, judgment accuracy is an assumption to the correct promotion of students. Hence, our study is also important for the recent debate on student promotion (left no child behind).

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**Brunswikian Research at Illinois**

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**Alex Kirlik**  
*Human Factors Division,  
University of Illinois at Urban-Champaign,  
USA*

*Contact: kirlik@illinois.edu*

In collaboration with colleagues, we continue to explore how Egon Brunswik's probabilistic functionalism and representative design may serve as useful organizing principles in disciplines beyond solely scientific psychology. Here are three examples published in 2010:

1. Editorial: Brunswikian Theory and Method as a  
Foundation for Simulation-Based Research on Clinical Judgment

One of the primary reasons for the launch of this journal, and the types of research it reports and stimulates, was a desire to bring to the study of healthcare the same types of simulation-based research methods that have made important contributions to theory and practice in other safety critical industries, such as aviation and process control. It is not a surprise, then, to see that many of the same questions and dialogues associated with issues such as simulator fidelity and realism appearing among the pages of this journal that have appeared in the human factors literature involving a substantial use of simulation in experimentation.

Now, the authors [of the target article] have asked us to consider how we think about simulator fidelity and realism using yet another concept, representative design, drawing on the work of yet another psychological theorist, Egon Brunswik. Is there anything truly new here or is this simply another case of old wine in new bottles? Or, in the words of one reviewer of a previous version of this Editorial, "That is, is there any other credible way to do this experiment that is counter to Brunswik's theories?" My answer to this question is "certainly not", which should itself go some way in prompting the readership to become curious to educate themselves about Brunswikian theory and method. I believe that what the reviewer believes Brunswik (and the authors) to be advocating is nothing other than the way the use of simulation-based research is most commonly discussed today, i.e., in terms of simulator properties such as fidelity and realism. It is this point I intend to dispute.

Due to the fact that Brunswikian theory and method are not likely to be familiar to the large majority of readers of this journal, the Editor-in-Chief has asked me to provide some additional information on these topics to complement the original article by the authors. In agreeing to do so, I also set myself the task of trying to communicate this information in a compact, yet tutorial, way, with the hope that the wider community of those engaged in healthcare simulation research who might marshal these techniques to their own advantage will be better positioned to do so.



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Kirlik, A. (2010). Editorial: Brunswikian theory and method as a foundation for simulation-based research on clinical judgment. *Simulation in Healthcare*, 5(5), 255-259.

## 2. Naturalizing Peirce's Semiotics:

## Ecological Psychology's Solution to the Problem of Creative Abduction

The study of model-based reasoning (MBR) is one of the most interesting recent developments at the intersection of psychology and the philosophy of science. Although a broad and eclectic area of inquiry, one central axis by which MBR connects these disciplines is anchored at one end in theories of internal reasoning (in cognitive science), and at the other, in C.S. Peirce's semiotics (in philosophy). In this paper, we attempt to show that Peirce's semiotics actually has more natural affinity on the psychological side with ecological psychology, as originated by James J. Gibson and especially Egon Brunswik, than it does with non-interactionist approaches to cognitive science. In particular, we highlight the strong ties we believe to exist between the triarchic structure of semiotics as conceived by Peirce, and the similar triarchic structure of Brunswik's lens model of organismic achievement in irreducibly uncertain ecologies. The lens model, considered as a theory of creative abduction, provides a concrete instantiation of at least one, albeit limited, interpretation of Peirce's semiotics, one that we believe could be quite fruitful in future theoretical and empirical investigations of MBR in both science and philosophy.

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Kirlik, A., & Storkerson, P. (2010). Naturalizing Peirce's semiotics: Ecological psychology's solution to the problem of creative abduction. In L. Magnani, W. Carnielli & C. Pizzi (Eds.), *Model-Based Reasoning in Science and Technology: Abduction, Logic, and Computational Discovery* (pp. 31-50). Springer: Heidelberg/Berlin.

For more information, see: Naturalizing Peirce's Semiotics  
(<http://www.springerlink.com/content/8735230q508n084/>)

3. New Book: *Human-Tech: Ethical and Scientific Foundations*  
New York: Oxford University Press, 2010

By Kim Vicente, Edited and with Commentary by Alex Kirlik

For more information, see: Human-Tech: Ethical and Scientific Foundations

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**Measuring the Accuracy of Personality Judgments  
with Lens Model Analyses**

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**Albrecht C. P. Küfner**  
Johannes Gutenberg University, Mainz,  
Mainz, Germany

Contact: [kuefner@uni-mainz.de](mailto:kuefner@uni-mainz.de)

The accuracy of personality judgments at zero-acquaintance is a major topic of personality research that is studied across a wide range of social contexts. One of them is rather seldom studied – written material. Apart from content-specific aspects of language we were rather interested in the linguistic *style* – Is there a difference in people not only what they write, but *how* they write, what words they use? And are readers sensitive to differences in language style? In our study (Küfner, Back, Nestler, & Egloff, 2010) we elucidated the accuracy of personality judgments based on creative writing by means of Brunswikian lens model analyses (Brunswik, 1956). Targets of two different samples wrote short stories with five predefined words. These stories were given to lay observers who rated the Big Five dimensions and general knowledge of the stories' authors. Three main findings were revealed. First we found, that the Big Five and general knowledge were consensually judged by observers. Second, judgments of openness to experience, agreeableness, and general knowledge were accurate. Third, using multiple mediator analyses we could show, that the found accuracies were achieved due to the correct usage of valid cues. In detail this indicates that in fictional texts – without self-reference – valid information of one's personality is contained. Readers are somewhat sensitive to that information – they perceive and make use of it to judge an author's personality.

Since the personality research group here at Johannes Gutenberg University in Mainz, Germany (Mitja Back, Boris Egloff, Sarah Hirschmüller, Steffen Nestler, Juliane Stopfer and myself) makes extensive use of Brunswik's Lens Model, I want to introduce some of our current research projects. Feel free to let me know if you would like more information on any of these!

Juliane Stopfer also studies the accuracy of personality judgments at zero acquaintance. Her main focus are online social networks (OSN, Facebook, Myspace etc.), which became hugely popular during the last years. In a recent paper (Back, Stopfer, et al., 2010) together with our colleagues Simine Vazire and Sam Gosling among others, she could show that people represent themselves in OSNs as they actual are – not some sort of idealized self. By doing so they are being judged accurately by perceivers based on their profile pages. At the moment she focuses on the "lens" itself, investigating what parts of OSN profiles are most valid and useful for judging profile owners personality.

A study also in the context of computer mediated communication was realized by Mitja Back (Back, Schmukle, & Egloff, 2008). He was able to explain the accuracy of personality judgments (Big Five, narcissism) based on email-addresses via the

actually observable features of email-addresses. Neuroticism, openness to experience, agreeableness, conscientiousness and narcissism could be judged in part accurately by observers based solely on these email-addresses.

Sarah Hirschmüller is examining a new framework for understanding the accuracy of interpersonal judgments at zero acquaintance: The *dual process lens model* is an integration of the Brunswikian lens model and dual process models of self-representations, behavior determination, and social cognition. It can be used to analyze processes linking the explicit and implicit self-concept of personality via observable controlled and automatic cues to deliberative and intuitive interpersonal judgments. At the moment, she investigates this comprehensive conceptual model by running multiple diverse experiments.

A somewhat different approach is taken by Steffen Nestler who investigates whether the hindsight bias (i.e., the tendency to exaggerate in hindsight what one has known in foresight; see Fischhoff, 1975; Nestler, Blank, & Egloff, 2010) also emerges in the context of personality judgments and whether its occurrence can be explained by the processes posited in Brunswik's lens model. Up to now, he has found that individuals exhibit the bias. Also, evidence suggests that hindsight bias appears because individuals use more valid cues when they make their hindsight judgments. This supports the assumption that hindsight bias rests on an adaptive learning process (see also Nestler, 2010); a contention that he currently investigates.

In another set of studies (Back, Schmukle, & Egloff, 2010, in press), Mitja Back used a combination of Brunswik's lens model and the Social Relations Model (Back & Kenny, 2010; Kenny, 1994) to understand the interplay of personality, observable cues and interpersonal attraction at zero acquaintance. In line with the new model he could show that personality differentially predicted who was a liker and who expected to be liked (perceiver effects), who was popular and who was seen as a liker (target effects), as well as who liked whom and who expected to be liked by whom (relationship effects). Moreover, the influence of personality on attraction was mediated by observable physical, nonverbal, and audible cues.

And this is basically where we are heading. In future studies we plan to investigate real life social contexts using the Social Relations Lens Model to investigate multiple different phenomena of social interactions including accuracy, liking and competition.

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## Use of Cues to Forecast Results in Sport Events

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**Guillermo Macbeth**  
School of Psychology,  
Universidad del Salvador, Buenos Aires,  
Argentina

**Guillermo Campitelli**  
School of Accounting, Finance & Economics, Edith Cowan University, Perth,  
Australia

Contact: [g.campitelli@ecu.edu.au](mailto:g.campitelli@ecu.edu.au)

Our research project aims at understanding how experts and novices use cues to forecast results of sport events. This research follows the brunswikian ideas concerning the adaptive processing of cues in uncertain environments (Dhmi & Harries, 2001; García Retamero & Dhmi, 2009). With that purpose we conducted a pilot study with postgraduate psychology students and we are currently analysing data. Our target samples are a group of chess players and a group of non-chess players and the conditions are forecasting of results in two chess tournaments and in a golf championship. In chess tournaments participants predict points that players will obtain in the tournament and rank. In the golf championship participants predict number of strokes and rank. In chess the cues are current international ranking, number of games to be played with white pieces, percentage points obtained by each player in the last 12 months, percentage points obtained in the last tournament, Elo rating, age and gender. In golf the cues are current international ranking, position obtained in the last tournament, profits, years of professional activity, nationality, age, height and gender.

We predict that chess players will make predictions based on usually useful cues like Elo rating and number of games to be played with white and they are not going to use irrelevant cues such as percentage points obtained by each player in the last 12 months. Since playing with white is an advantage, using current Elo rating and correcting for number of games with white is the best strategy for predicting

results. We also predict that novices will tend to use the cue current international ranking, which is predictive of future performance but not as precise as Elo rating.

In order to test the less-is-more effect (Goldstein & Gigerenzer, 1999) we adopted the following strategy. We told participants that they would have to predict results of sport events that will occur in the near future. However, instead of presenting participants with a sport event that will occur sometime in the future, we presented them with tournaments that occurred recently. In order for participants not to recognise the tournaments, we did not give the information of the players' names (i.e., the list of players was Player A, Player B, etc.). We chose a chess tournament in which results correlated with the most relevant cues and another tournament in which results correlated poorly with the most relevant cues. Therefore, we predicted poor prediction of chess players in the second tournament.

Finally, we predict no differences between chess players and non-chess players in the forecasting of results in the golf championship. This would be consistent with theories of expertise in which skill level is domain-specific and with fast-and-frugal approaches in which heuristics to make judgments are also domain-specific (Campitelli & Labollita, 2010).

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## **Re-Inventing Model-Based Decision Support with Australian Farmers Aided by Brunswick's Framework**

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**Bob McCown**

CSIRO Ecosystem Sciences, Toowoomba, Qld.,  
Australia

Contact: [Bob.Mccown@csiro.au](mailto:Bob.Mccown@csiro.au)

This contribution has its origins in the highly uncertain environment experienced by many Australian farmers due to the extreme unreliability of rainfall. Research institutions with responsibility for this sector expected that decision support system technology would provide relief, but after a decade of substantial R&D investment it was clear that farmers were not experiencing such benefits. In 1992, research on a new approach to implementing computer-based information systems was begun featuring Action Research with farmers and their advisers. The aim was to learn if farmers could experience value from an information system (IS) in reducing uncertainties about *what to expect* and *what to do* when the IS was implemented in



ideal conditions. Farmers were provided with (a) easy access to a versatile crop production simulator in planning and decision situations, (b) local weather data and field-specific soil measurement for inputs, and (c) direct personal support in creating value for practice. The strategy was to create conditions as close as possible to the ideals of accurate simulation of situated performance, high relevance to management, and low demands for managers' time, attention, computer skills, and familiarity with a modelling approach to production planning. To make a long story shorter, this approach has by now a long history of success in changing attitudes and practices of sceptical farmers. A growing number of farmers now subscribe to online access to models that were earlier dismissed as "toys for scientists". Others have new decision rules, conditional on monitored soil states, that they formulated using the flexible simulator in intensive "what-if" sessions with scientists, giving opportunities for Brunswik's vicarious functioning on a covert level.

As systems scientists we concur with the view expressed by Kirlik:

"... research in fields such as human factors and cognitive engineering nearly always begins (or should begin) with a *qualitative naturalistic phase* to identify and distill the central features of a target problem to be solved or phenomena to be investigated. Yet if attention then turns directly to creating an intuitive solution or qualitative account (regardless of how well received by stakeholders), without bringing these central features to an *abstract level*, it is often impossible to know the conditions in which that same solution will prove useful. As such, each cognitive engineering problem will have to be solved largely from scratch." (Kirlik, 2006, p. 6; italics added).

Our Action Research was conducted in the reflective mode advocated by Checkland and Howell (1998), periodically asking ourselves "what do we think we are doing?" As related by McCown et al. (2009), as we read and learned, our schemas of what we were doing evolved in the direction of "using analysis to facilitate cognitive change for intuitive practitioners". We discovered Hammond's 1996 book and thereby Brunswikian ideas. As systems ecologists by discipline and novices in matters of cognitive psychology, the appeal of an ecological psychology was immediate and enduring. The ecological dynamics between task and judgement mode on the cognitive continuum became a central element of a theoretical framework for our intervention approach (McCown, under review).

An explicit activity in our Action Research was evaluation of participants' experiences using recorded longitudinal interviews. This information was of enormous formative value throughout the project, but putting it all together, summatively, always loomed formidable. However, having an appropriate theoretical framework has made the putting together a very doable and enlightening experience (McCown et al. under review). Although the framework is not explicitly Brunswikian, I will highlight aspects of our story that seem to conform to key concepts of Brunswik.

The action research project quickly and naturally became two distinct activity spheres that relate directly to the two sides of the lens model: (a) feasible assessment of conditions at planting relevant to crop yield (*proximal cues*) and (b) estimation of final yield utilising this information on conditions (*cue utilisation*), with the *achievement* as a probability distribution of yield for all years of historical weather data. At the outset farmers and scientists had different sets of planting cues having



contrasting degrees of *ecological validities*. With time of year as background, predominant farmer cues were amount of recent rain or surface soil soft (wet) enough to push a small screwdriver to the hilt. The ecological validity of these is high for the short-term criterion of crop establishment but negligible for the ultimate criterion of crop yield. On the other hand, the scientists' analytic "cue" is measured soil water, down the soil profile, and this has substantial validity for the criterion crop yield. However, this relationship is masked by subsequent variable rainfall during a long lag time and is made evident in the analysis. There is also a marked difference between intuitive and analytical cue sets concerning effort and cost of information.

A surprise that begs theoretical explanation was the readiness of farmers to adopt the onerous soil measurement technology. Farmers' own explanations focused on reducing risk of low, unprofitable yields. Adjustments in enterprise structure in response to markets were making planning/forecasting tasks more demanding, thus inducing new interest in analytic judgement. With the aid of simulation for cue *utilisation* and collaborative on-farm measurements for validation, the superior *ecological validity* of measured soil water and impressive yield *criterion achievement* were demonstrated. The validation of a flexible system of virtual *cue utilisation* enabled much-valued thought experiments on issues that mattered to them, a process that achieves what seems to be expected of *representative design* or at least avoids what *representative design* is intended to avoid.

Interviews with farmers several years after interactions ceased produced two further surprises. All farmers had ceased measuring soil water but they had substituted various techniques for estimating this variable. They explained that the loss in accuracy was small relative to the gain in efficiency. It seems they learned by experience the *vicarious functioning* of cheaper cues for soil water. The second surprise came in response to the interviewers' announcement that a commercial service for providing customised simulation was soon to be available.

"From that experience [with the simulator] we can put some numbers on it and even predict some of the outcomes in the normal type seasons. We now have a rule of thumb about planting dates for wheat or sorghum. Yields will decline after a certain date and we know the effect of more starting moisture. We can sort of generally know and predict the outcome. There is still a place for simulation when you've got a planting situation out of the ordinary."

This is a case of farmers using facilitated *probabilistic functional* analyses of what to *expect* in the long term to formulate conditional rules of what to *do* in the face of irreducible uncertainty of the single event. For years scientists had misinterpreted farmers' enthusiasm for timely seasonal analyses as a need for a recurrent service when in fact at least some were quietly developing rules that work in every season. Although I am unable to link this to a specific Brunswikian concept it qualifies as a product of *probabilistic functionalism* as a case of a

"...proper object of study for a scientific psychology [as] the *organism-environment* system as a whole, where the behaviour of the organism is molded by the forces of adaptation and intertwined with the properties of the environment." (Juslin, 2001, p. 404).

It could also be mentioned that our evaluating interviews gave evidence of a need for categorizing different situations, i.e. a representative sampling of situations was required.

“Re-inventing model-based decision support...” in the primary title of the series of papers that reports this research may appear to some as hyperbolic. But this *ideographic* support for farmers’ adaptive learning appears to us to be a paradigm apart from the traditional *nomothetic* decision support system.

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## Lens Model for Analysing Perception-Action-Coupling in Dynamical Environments: Brunswikian Research in Brunswick

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**Christoph Möhlenbrink & Meike Jipp**  
*German Aerospace Center, Institute of Flight Guidance,  
Human Factors Department,  
Brunswick, Germany*

Contact: [Christoph.Moehlenbrink@dlr.de](mailto:Christoph.Moehlenbrink@dlr.de)

There is little research concerning the Brunswikian lens model for dynamical task environments. Bisantz et al. suggest a “time-slice” approach to model and analyse judgments within a dynamical command and control environment (Bisantz, Kirlik, Gay, Phipps, Walker, & Fisk, 2000). The need to consider such dynamical task environments is grounded in the fact that operators such as pilots or tower controllers do not have a single static perception of their task environment, but many perceptions changing quickly over time. The contribution at hand stresses an “event-based” alternative to the “time-slice” approach of Bisantz et al. It allows analysing and modelling human behaviour in dynamical task environments by integrating the Brunswikian lens model.

Therefore two major aspects are integrated into the lens model: First, the operators' action will cause a new task situation  $S$ , so that the perceived situation  $S'$  at timepoint  $t+1$  will differ from the perceived situation  $S'$  at time  $t$ . Second, there are changes in the environment which result in differences between the objective situation  $S$  at time  $t+1$  and the one at time  $t$ . These changes are not caused by any action of the operator, but by the dynamics at the airport. Due to these two issues, the traditional lens model is enhanced with one input arrow on the left that covers environmental changes as influencing effects on the objective situation, while a feedback loop takes into account the changes caused by the operator's action (see Figure 1). These theoretical considerations are important to comprise the perception component, the action component, and the timing aspect for describing interactive behaviour.

At the Human Factors Department of the German Aerospace Center in Brunswick microworlds are used to research about human decision making in dynamical task situations (e.g., Möhlenbrink, Oberheid, & Werther, 2008). In this contribution we refer to the microworld *FAirControl*, representing a simplified task environment of a tower controller at a regional airport (see Figure 2). The microworld simulation is run by a coloured Petrinet model, using CPN-tools (Jensen, 1997).

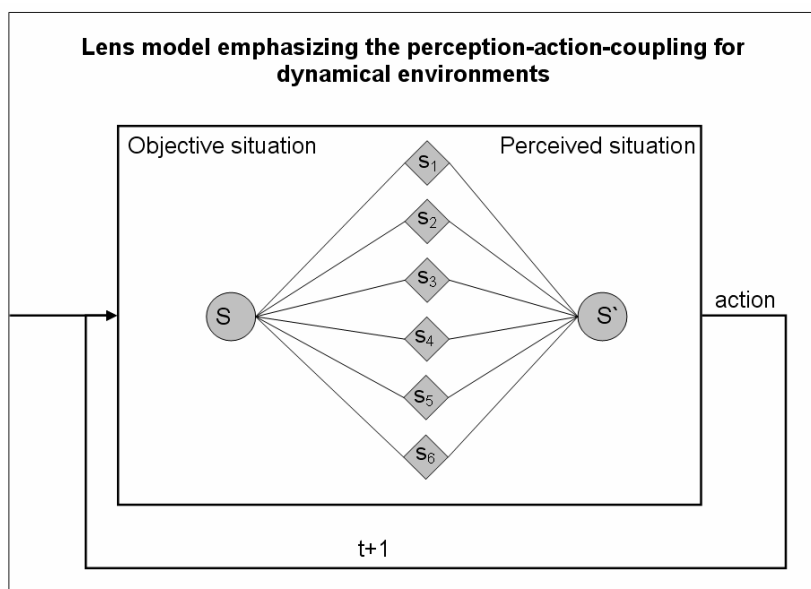


Figure 1. Brunswikian lens model emphasizing operators' actions and environmental changes over time.

Microworld FAirControl representing work aspects of the tower controller

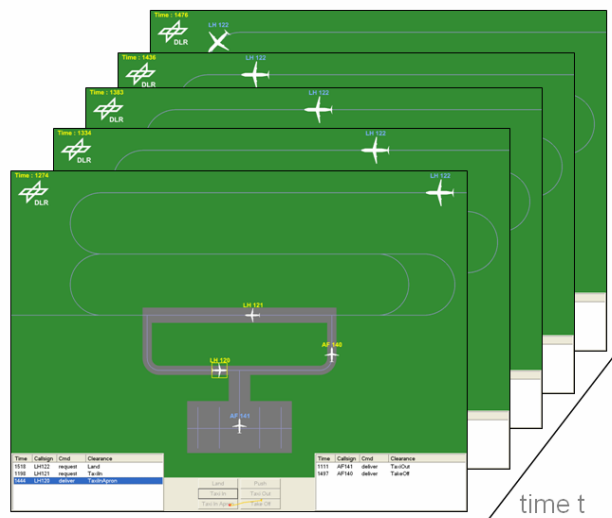


Figure 2. Microworld FAirControl: Modelling and analysing behaviour in dynamical task environments.

On the one hand the microworld approach allows for data acquisition, to research how people interact within the dynamical task environment. On the other hand a human-machine Petrinet model was developed to model the interactions of the human-machine system on a functional level.

As the following description will show, there are significant similarities between the enhanced lens model (see Figure 1) and the changes within the Petrinet model over time: As predicted by the lens model the controller does not gather all available information on the regional airport to control the traffic, but only information relevant for the task ( $s_{1-6}$ ). This is why, the controller model is reduced to the functional units of the task. Realising the human-machine system with timed coloured Petrinets offers an event-discrete representation of the processes at the airport and the controller's tasks over time. Herewith it is possible that the controller model can operate quite successfully when three important information classes of the airport are considered:

- (1) Where are the aircraft within the system? (runway, taxiway, parking position etc.)
- (2) Which aircraft are waiting for clearances? (landing, taxiing, starting etc.)
- (3) Are the airport's resources occupied by aircraft? (yes, no)

This reduction of the information within the dynamical system focuses on a crucial idea of the lens model, that is that not all information of the system is perceived by the controller. Instead, humans rely on cues that allow for successful interaction with their task environment.

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**News from Jeryl Mumpower**

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**Jeryl Mumpower**  
Texas A&M University, College Station, Texas,  
USA

Contact: [jmumpower@tamu.edu](mailto:jmumpower@tamu.edu)

With Tom Stewart and Jim Holzworth, I have continued to investigate how people learn to make decisions when feedback is limited because the decision itself eliminates the possibility of feedback (e.g., when the decision is not to hire an applicant, the company will not learn whether the applicant should have been hired). We call this conditional feedback because the presence or absence of feedback is conditional on the decision. We have been reporting about our progress on this work for some years now and I am happy to report that our first paper based on this research should be available in the very near future.

I also completed two other papers this year, both of which are under revisions after review. One is entitled "Playing Squash Against Ralph Keeney: Should Weaker Players Always Opt to Play as Few Points as Possible Against Superior Opponents?" It takes a Brunswikian approach to analyzing the task environment facing a squash player. In games such as squash, it is generally assumed that weaker players maximize their chances of winning when they play as few points as possible against superior opponents. Failures of squash players to recognize this have been cited multiple times in the literature as evidence of the foibles of lay decision makers. This error has been categorized as an error of application (Kahneman & Tversky, 1982), attributed to the representativeness bias (Bar-Hillel, 2002), and ascribed to sudden death aversion (Thaler, 2000). Analyses demonstrate, however, that under certain conditions the maxim to minimize the number of points played against better players does not lead to optimal decisions. This holds true for choices about how many points to play in tiebreaker situations and the choice between playing games to 9 or to 15 points. The analyses illustrate the danger in over-generalizing without careful analysis of the task environment about lay tendencies to make irrational or sub-optimal choices. The analyses also illustrate that optimization will not necessarily involve a corner solution that minimizes or maximizes total number of points played either for such a straightforward game as squash or in analogous circumstances off the court.

The second paper is entitled "Disproportionality at the "Front End" of the Child Welfare Services System: An Analysis of Rates of Referrals, "Hits," "Misses," and "False Alarms"." This paper makes use of analytic techniques from the Taylor-Russell model, which is quite familiar to Brunswikians. Data from two large national data sets and from the State of California were used to analyze the front end of the child welfare services system – the referral and substantiation components – in terms of the system's ability to diagnose or detect instances of child maltreatment. The analyses show that Blacks are disproportionately represented in rates of referral into the system. Moreover, the system is less accurate for Blacks than for other racial or



ethnic groups. There is a higher rate of false positives for Blacks than for other groups – that is, referrals leading to unsubstantiated findings. There is also a higher rate of false negatives for Blacks than for other groups – that is, children for whom no referral was made but who are in fact neglected or abused. The rate of true positives – children for whom a referral has been made and for whom that allegation has been substantiated – is generally higher for Blacks than for other groups, but this is attributable largely to the higher rate of referral for Blacks. In sum, the system demonstrates lower levels of accuracy for Blacks than for other groups. A model is proposed demonstrating that random error, as opposed to systematic bias, could produce a pattern of results much like that observed in the data.

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**A Nomothetic Approach of the Brunswikian Lens Model –  
A Variable- and Person-oriented Approach**

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**Rüdiger Mutz**  
ETH Zurich,  
Switzerland

Contact: [mutz@gess.ethz.ch](mailto:mutz@gess.ethz.ch)

In research on judgement and decision making (JDM) within-individual concepts (e.g., decision strategies, expectancies, options, risks) are often used in theory formation, although the associated empirical work is based mainly on inter-individual data. However, such *variable-oriented research strategy* may give rise to false conclusions: Firstly, it is assumed that the same relationships among variables are as valid on the within-subject level as on the between-subject level. Secondly, it is assumed that the same structures and processes (e.g., decision formation process, decision strategy) are applicable for all individuals in the same manner. A solution to this central issue is seen in a *person-oriented research strategy* in which individuals are observed over time (single-subject design) in order to reveal characteristic *individual patterns* (Eye & Bergman, 2003). Alternatively, with respect to JDM we suggest to observe single individuals using samples of judgment tasks in order to model individual judgment and decision making.

A so far unresolved problem of the Brunswikian lens model is how to move from individual models of judges to generalized models across all judges (or types of judges) in the sense of a nomothetical extension of the lens models without drawing the previously mentioned false conclusions (Brunswik, 1955). Following the example of Schilling and Hogge (2001), multilevel models will be proposed for this purpose which explicitly take into account the hierarchical structure of data (task, judge) in the statistical analysis (Mutz & Seeling, 2010). In extension of the concept of Schilling and Hogge multilevel models, especially hierarchical latent class regression models allow both to identify types of decision strategies (modelled by classes of different restricted regression models), and to identify classes or types of individuals with different decision strategies, whereas the types of individuals might be explained by exogenous variables (e.g., age, experimental groups).

Data of a project on foresters' subjective judgement of the quality of wood, called "Forstlicher Götterblick" (forest glance of the gods) are used to illustrate the proposal: In a paper-pencil test, 29 forest persons (forestry students, foresters) each estimated the internal wood quality of 40 trees on a 6-point rating scale using information provided about six well known external wood properties for each tree. Two judgement strategies were identified (random, "Take-The-Best") which could also be assigned to two different types of subjects ("novices" vs. "experts"). In its nature, this approach is both variable-oriented and person-oriented.

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## **Social Ecology: Lost and Found in Psychological Science**

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**Shigehiro Oishi**  
University of Virginia,  
USA

Contact: [soishi@virginia.edu](mailto:soishi@virginia.edu)

This paper argues for a socio-ecological approach (taking into account physical, societal, and interpersonal environments) to psychological theorizing and research. We will first demonstrate that economic systems, political systems, religious systems, climates, and geography exert a distal yet important influence on human mind and behavior. Second, we will summarize the historical precedents of socio-ecological psychology. There have been several waves of ecological movements with distinct emphases in the history of psychological science: the molar perspective introduced by Edward Tolman (1932) and Egon Brunswik (1943), Kurt Lewin's (1936, 1939) field theory, and Bronfenbrenner's (1977) ecological approach to human development. Environmental and community psychologies created in late 1960s and early 1970s promoted social activism through basic and applied research on ecological factors and social outcomes. Most recently, the rise of cultural psychology has helped psychologists to pay attention to cultural factors in basic psychological processes, though less attention has been paid to socio-ecological factors per se. We will highlight the benefits of bringing the socio-ecological perspective back to mainstream psychological theorizing and research.

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**A Multiple-Cue Learning Approach as the Basis for Understanding and Improving Football Referees' Intuitive Decision Making**

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**Henning Plessner**  
University of Heidelberg,  
Germany

**Geoffrey Schweizer & Ralf Brand**  
University of Stuttgart,  
Germany

**David O'Hare**  
University of Otago,  
New Zealand

Contact: [plessner@uni-hd.de](mailto:plessner@uni-hd.de)

About a quarter of all referee decisions during a football match are about fouls and misconduct. The possible responses of a referee who identified a foul vary from indirect free kick, direct free kick, to penalty kick in combination with a warning, a yellow card, or a red card (sending off). All of these sanctions have clearly an impact on the course of a game. Although the importance of referee decisions has been acknowledged frequently, little research has been conducted that directly addresses the cognitive processes underlying referees' decisions. To our opinion, most foul decisions can be considered as a perceptual-categorization task in which the referee has to categorize a set of features into two discrete classes (foul/ no-foul). Due to the dynamic nature of tackling situations in football, these features share a probabilistic rather than a deterministic relationship with the decision criteria. Accordingly, these processes can be studied on the basis of a multiple-cue learning framework as proposed by Brunswik (1943) which focuses among others on how people learn from repeated exposure to probabilistic information. Such learning processes have been studied on a wide range of tasks, but (to our knowledge) until now not in the area of judging sport performance. We will present a corresponding analysis of which and how cues are used by football referees when making foul decisions. In addition, we show how decision accuracy of referees can be improved by creating a learning environment that fits the requirements of this theoretical perspective.

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**Brunswik's Lens Model Adjusted to Interpretation of Factor Analysis**

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**Lars Sjö Dahl**

*University of Lund, Sweden*

*Contact: le.sjodahl@swipnet.se*

In the article "The Application of Exploratory Factor Analyses in Applied Psychology" the authors present a list of guidelines for improving the quality of applied factor analysis (Ford, MacCallum, Tait, 1986, p. 311). Among their several guidelines "strategy for interpreting factors" is a major issue. Our small-scale, pilot study, presented below, including 2 subjects allocating a randomized assembly of 20 "significantly" loaded attitude items to 5 already defined factor categories is based on Brunswik's lens model. It illustrates one possible way to check factor interpretations.

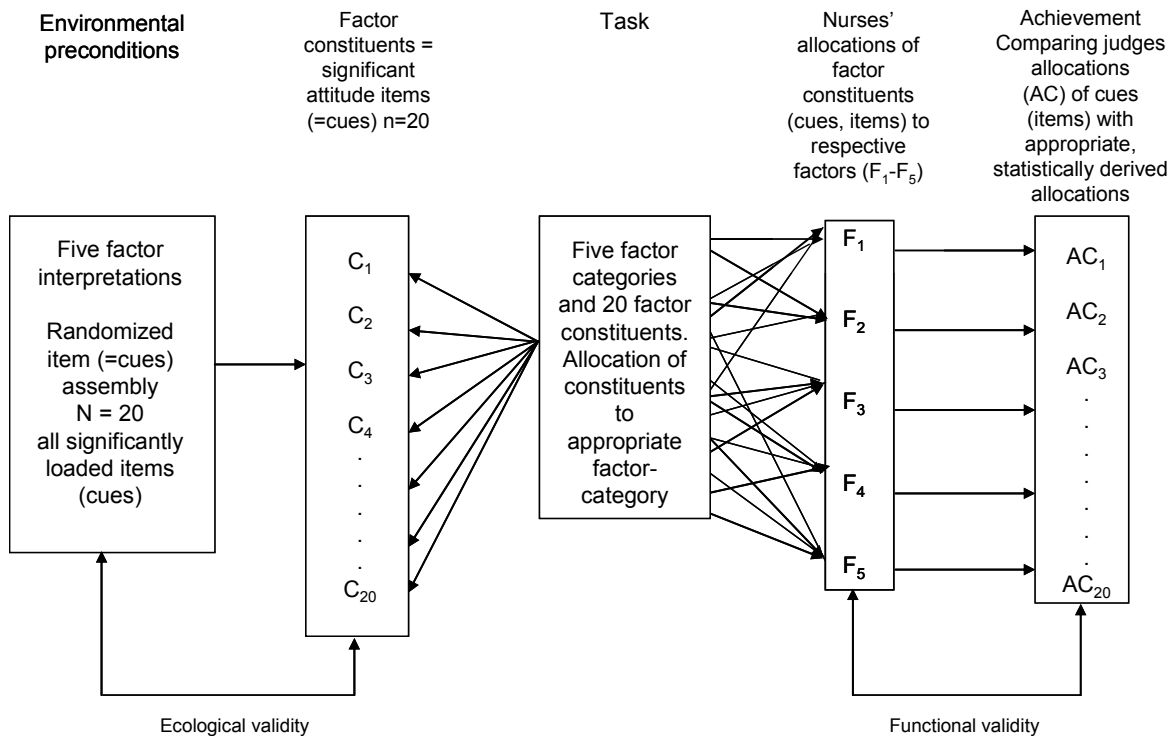
Factor analysis, including factor interpretation, can be seen as a transformation of more proximal, concrete cues to more distal, meaningful foci, in the terminology of Brunswik. The interpretation process, resulting in categorial factor-descriptions is of a double nature, a within-category convergence among items constituting a factor, and a between-category-divergence. Probably it also includes relative discriminations by pair-wise comparisons of the constituents. This double nature is illustrated in Figure 1. The arrows from the "Task Presentation" diverge towards the item assembly (our cues) and converge towards the abstracted already defined factors in analogy with Brunswik's lens model.

The content of the attitude factors and items used to illustrate our model all deal with patient-nursing ecology, i.e. social relations. For representativeness of our item-situation sample, (see Sjö Dahl, 2006, 2009). Judgements about social relations may be far more uncertainty-loaded than more analytical, intellectual judgements of non-personal issues. Even though observed phenomena often can be interpreted in a variety of non-conflicting ways, a choice is usually made based on its particular utility context. Armstrong and Soelberg (1968) point out that researchers often claim their factor interpretations, based on intuitive understanding, to be useful in an explorative sense. However, what is meant with such a statement when no next step to follow is mentioned? What are the intuitive interpretations going to be used for? This is not a trivial question.

Our factor-interpretations (Sjö Dahl, 2009) were meant for support in structuring the content of a comprehensive case material, collected by critical incident interviews with nurses on the floor, and intended for use in educational goal-settings, i.e. in nursing education. Therefore we find it justified to check our intuitive factor interpretations against judges representing our target group, i.e. registered nurses. As the method suggested for this, the proper allocation of items (cues) to factor description, is meant just as an illustration, no aspiration on representativeness regarding person-(judge)-sample is claimed. The model outlined in Figure 1, presents one way of comparing statistically derived factor interpretations with target-persons' structuring of the relevant factor constituents. Depending on how we

operationally define the variables involved in these comparisons, our matching process can be seen as a kind of reliability test or a content validation of our own factor interpretations.

Figure 1. Brunswik’s lens model adjusted to factor interpretation.



The preconditions, making up the contextual ecology for our two nurses (judges) consist of 20 given, significantly loaded attitude items and five factor descriptions derived from an earlier explorative attitude study, (person-sample  $n = 131$ , item-(situation)-sample 50). The 20 items’ (cues’) statistical belongingness to the respective, given factor interpretations reflect their ecological validity, while the judges’ use of the cues in the allocation task compared with their statistically derived factor placements reflect the items’ (cues’) functional validity in our “small-scale” illustration trial.

A factor is a generalization or abstraction including a number of constituents, which satisfy certain statistical requests, i.e. size of factor loadings (see Pawlik, 1971, pp. 265-266). The factor interpretation, which is of a qualitative, intuitive character, defines the psychological nature of the relationship, which ties the relevant constituents together as a unit or a category. Despite statistical rules for deciding which items should be considered in this inference process, it is difficult to determine to what extent the constituents of a factor category can be tied together by the verbalized, psychological interpretation. The question is: which constituents, within a statistically defined factor category, are content related or non-content related? The answer to this question may very well depend on the choice of interpreter, a stand we will try to illustrate below by applying the adjusted Brunswik Lens Model to a small-scale example.

Some data about the attitude items used in our factor analysis.



A pool of 175 excerpts actualizing Maslow's 11 psychosocial needs were extracted from 27 written works (=situation sampling) and were reformulated into Likert statements, positive as well as negative ones. All 175 statements were rated along an 11-interval empathy-scale by 64 judges, all registered nurses. The two poles of the scale were defined as very poor understanding and very great understanding respectively of the patients' psychosocial need-situation.

Median scale values and the inter-quartile ranges were calculated for each item. To test the reliability of the scale ratings, the 64-group was randomly split into two 32-groups, and two 16-groups were selected randomly without replacement. Rank correlations between the groups' median scale values are given Table 1 below. A sample of 50 items representing the different scale intervals were selected as the attitude test to be answered by 131 registered nurses and factor analysed. The 5 factor interpretations and 20 significantly loaded factor constituents, which are used in our small-scale illustration, are supplied from this applied factor analysis.

Table 1

*Rank correlations ( $r_s$ ) between the 64-groups' median series and the median series for the 32- and for the 16-groups*

	32 <sub>1</sub> -group	32 <sub>2</sub> -group	16 <sub>1</sub> -group	16 <sub>2</sub> -group
64-group	$r_s = .99$	$r_s = .99$	$r_s = .98$	$r_s = .98$

To get some guidance for deciding the significance of our factor loadings, Burt-Bank's formula has been used (Child, 1970, pp. 97-98). This formula takes into account the size of the person sample, the number of variables and the number of rotated factors. The formula gives for  $n = 150$  and for the 10<sup>th</sup> factor a loading of absolute value .23 as significant on 1 percent level. With regard to our number of rotated factors (9) and the size of the person sample (131), factor loadings with an absolute value of at least .24 have been regarded to be of interest in this context.

**Instruction to judges**

The judges were informed on the following points;

1. Maslow's psychosocial needs as basis for excerpts transformed into attitude statements. The needs illustrated on a list, as exemplified below:
2. Factor analyses as a method for structuring, grouping of attitude items into factors (categories).
3. Task-presentation. Five factor definitions and 20 attitude items, four "significantly" loaded per factor category, randomly presented to the judges. Judges were asked to allocate the items (factor constituents) to the relevant factor description, by selecting the four best fitting items for each factor description, just four, no less, no more. The judges worked isolated from each other with no time limit and noted their allocations in the square to the left of the respective item (see illustration, Figure 2). It was emphasized that the task was a measure of their own attitudes. The task was just to allocate the statements to an appropriate factor description, four items to each factor. A simple demonstration example was included in the instruction showing how three specific items, related to the teaching profession, could be allocated to three more broadly defined educational field (factors), i.e. 1) teacher competence, 2) work-atmosphere 3) pedagogic aid resources.

Figure 2. Examples, attitude items to be allocated to proper factor description.

In order to receive the best of care, the patients must accept that their freedom is limited

Paying attention to the patients just in order to activate them is hardly part of the nurse's work.

The outcome of the comparisons between the judges' item allocations and the allocation given to the item in the statistical factor interpretations was classified as either compatible (c) or specific(s), the former conforming to the statistically given item location, the latter allocated to "wrong" factor description. To get some estimate of the judges' comparison success an achievement index (Ach) was created by the use of following parameters.

Judge No. 1.  $a_1 = 20$ , number of cues, (items to allocate).  
 $s_1 = 11$ , number of specific allocations.

Judge No. 2.  $a_2 = 20$ , number of cues, (items to allocate).  
 $s_2 = 12$ , number of specific allocations.

Based on the two judges' allocations, an achievement index (Ach = degree of compatibility with the given factor interpretations) can be calculated according to the following formula

$$\text{Ach} = \frac{(a_1 - s_1)(a_2 - s_2) - s_1 s_2}{a_1 a_2}$$

Taking the extreme values of the relation between "a" and "s" into consideration "Ach" will vary between -1 and +1. In our example, Ach amounts to -.15. Conclusion: It may not, judged from our illustration, be so easy to answer the question about which items (situations) are the typical constituents of our factor interpretations.

The presented model for "content-validation" of factor interpretations can be applied on different problem-levels as:

1. on nomothetical level, for example comparing achievement-indexes between groups, e.g. nurses-doctors
2. on item (situation) level, some items (situations) may be more uncertainty-loaded than others
3. on idiographic level, for example inter-individual differences related to nurses' self-conceptions (see Dodds, Lawrence, & Wearing, 1991)

It has been demonstrated by Barsalau (1985) that some category examples may be seen as better examples of the category as they represent additional attributes, i.e. ideal goals and functional values not explicitly included in the prototype description. There is a tale (or it may be true) that Charlie Chaplin once, anonymously, took part in imitation contest: "Who is the best Charlie Chaplin look-alike?" He did not succeed very well, ranked only as number four. There were thus three "combatants" who were more like Charlie Chaplin than Charlie Chaplin himself.

This enhancement effect or typicality distortion has been demonstrated by Barsalau (1985). Some category examples can be perceived as “better” examples than other category-examples as they contain additional functional, ideal goals or values not explicitly represented by the category-prototype. If we look at knowledge as a process, knowing instead of fixed content (Polanyi, 1958, 1967; Rosch, 1978) there may be reason to ask oneself: What influence might this enhancement-effect has on shallow labelling in diagnostic contexts, for example in psychiatric diagnostics and on social stratifying within our societies?

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## News from Tom Stewart

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**Tom Stewart**  
University at Albany,  
USA

Contact: [t.stewart@albany.edu](mailto:t.stewart@albany.edu)

The work on threshold learning with conditional feedback (when the availability of feedback is conditional on the decision made) has resulted in a submitted paper with Jeryl Mumpower and Jim Holzworth, “Learning to make selection and detection decisions: The roles of base rate and feedback.” Two students, April Roggio and Navid Ghaffarzadegan have developed system dynamics models of threshold learning with conditional feedback. April's work builds on and extends previous modeling work. Navid is working on a paper on the policy implications of his work for selection and detection tasks, such as screening passengers at airports.

Elise Weaver and I have submitted a paper entitled, "Dimensions of judgment: Factor analysis of individual differences in judgment." This is based on our work comparing performance in correspondence tasks, coherence tasks, and cognitive abilities.

In her dissertation work, Chris Muller is investigating the health care priorities at two levels. One is the policy level of prioritizing treatments in an era of scarce resources and the other is at the clinical level of deciding which patients get a treatment that is in short supply. The same values can be involved at both levels, but priorities might conflict and lead to unintended consequences.

Andy Whitmore completed a dissertation on the implications of incomplete information in product labeling for coffee, particularly non-price information such as "organic", "fair trade", and "shade grown." He developed a system dynamics model that incorporated the results of hierarchical judgment analyses of consumers' judgments based on product information. This is a "linkage" model (see papers by Hammond and Mumpower in the 1970's) and he is working on a paper about linkage systems.

Lucy Dadayan continues her investigation of the effect of information technology on medical decision making. She is using mammography as a case study and is surveying radiologists about the effects of film vs. digital mammography on their decision making.

Dosuk Lee is investigating the effects of graphical vs. tabular display format on judgment. He plans to compare cognitive fit theory with cognitive continuum theory. Although cognitive fit theory dominates much of the research, it appears that cognitive continuum theory has some advantages.

During a recent visit to Albany, Claudia González Vallejo described her pilot work on consumer nutrition judgments. The project places judgments about nutrition within the framework of cognitive continuum theory and investigates how contextual information moves judgment from being more analytical to more intuitive. This is an appropriate and important area for applied judgment work, and we hope to have some collaborative work to report in the future.

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**News from Bob Wigton**

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**Robert S. Wigton**  
*University of Nebraska Medical Center,  
USA*

*Contact: wigton@unmc.edu*

Last month, Tom Tape, Rob Hamm, Esther Kaufmann and I gave an afternoon short course at the annual meeting of the Society for Medical Decision Making in Toronto, entitled "Modeling Judgment, the Brunswikian Approach". The presentations were lively, seemed to be well received and good discussion ensued.

Also, I presented the following study at the spring meeting of the European Society for Medical Decision Meeting in Hall, Austria.

#### Do Cue Interactions Matter?

As part of a study of an educational intervention in Denver CO to reduce excessive antibiotics for acute respiratory infection (ARI), we asked primary care practitioners to respond to case vignettes regarding whether they would give antibiotics in ARI. The results about the choice of treatment but not diagnosis were published 2 years ago.

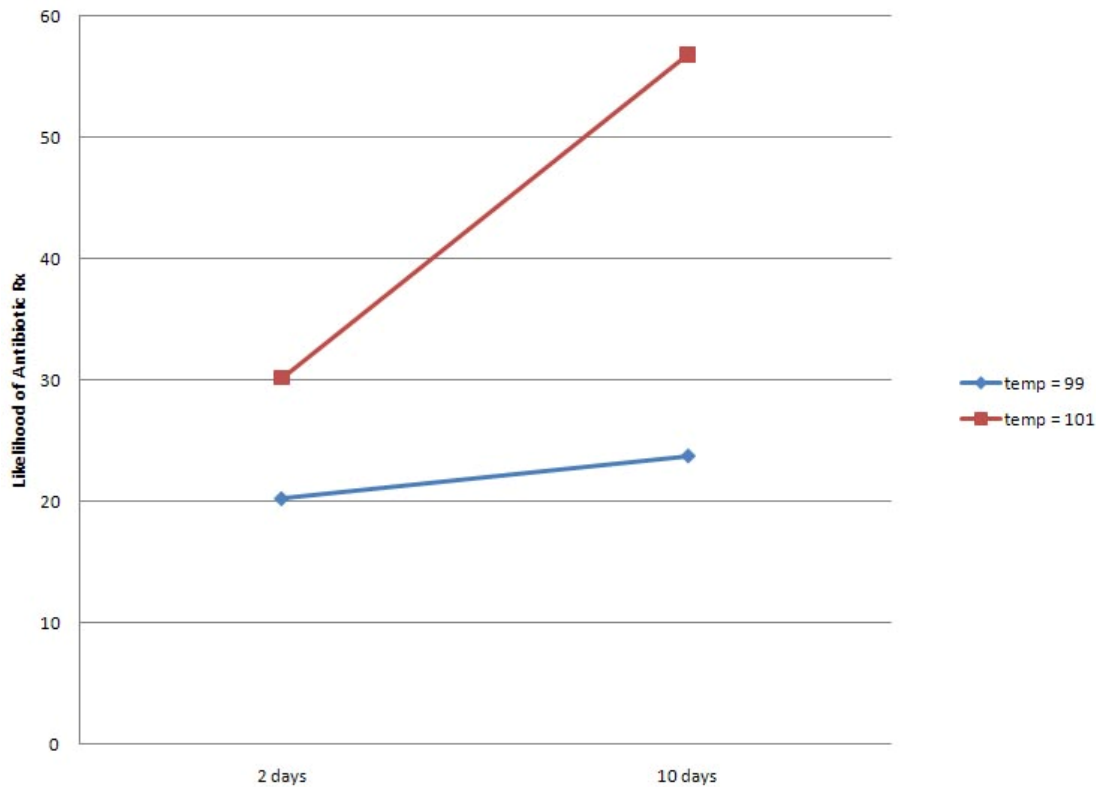
In analyzing the results originally, I had noticed that some of the interaction terms had very high relative weights, some exceeding the weights of the main effects. In past studies I had not paid much attention to cue interactions, but decided to re-analyze the complete results with attention to the first order interactions.

101 community practitioners had estimated how likely they were to prescribe antibiotics in response to each of 20 paper cases of patients presenting with ARI. They also judged the likelihood that the patient had each of 4 clinical diagnoses (viral ARI, pneumonia, bronchitis, strep throat). Values of clinical findings were expressed at 2 levels, using a fractional factorial design. We used judgment analysis to calculate the weight of each clinical finding on the decision to prescribe antibiotics for each individual practitioner. In addition, I identified for each subject the most highly weighted cues in order to characterize groups with similar policies.

In the decision to prescribe antibiotics, cue interactions outweighed all main effects for 41% of the 101 practitioners. The two most highly weighted interactions were temperature x duration (positively weighted) and temperature x runny nose (negatively weighted). In diagnosing the cause of the illness, interactions outweighed the main effects for 50-60% of the participants, depending on the diagnosis.



Interaction of Temperature and Duration of Illness



Thus, the interactions between clinical findings were often more important than main effects in predicting practitioners' decisions about whether to give antibiotics in ARI. One important interaction was runny nose x temperature, which reduced the likelihood of prescribing antibiotics – a logical effect since runny nose is a feature of viral ARI (though not in the case of influenza). Also, Temperature x long duration had a positive effect on prescribing antibiotics, consistent with bacterial pneumonia and sinusitis, but not influenza.

Thus, interactions may amplify or attenuate the effect of the clinical finding on clinical judgment, as duration of illness here amplifies the effect of temperature. Since we do not know how practitioners process clinical findings (e.g., pattern recognition, analytical, narrative, cue weighting), understanding the role of interactions will need further study. Interactions may also be important in teaching medical professionals how clinical findings relate to diagnosis and management.

Reference:

Wigton R. S., Darr C. A., Corbett K. K., Nickol, D. R., & Gonzales, R. (2008). How do community practitioners decide whether to prescribe antibiotics for acute respiratory tract infections? *J Gen Intern Med*, 23(10),1615-20.

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**Brunswik Symmetry, Break-Even Effect Sizes and  
Return On Investments (ROI)**

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**Werner W. Wittmann**

*Otto-Selz-Institute for Applied Psychology,  
University of Mannheim,  
Germany*

*Contact: Wittmann@tnt.psychologie.uni-mannheim.de*

After retirement in 2009 (yes, we still have compulsory retirement at 65 in Germany) I still work voluntarily at my university, to finalize some longitudinal research projects and I am happy that many of my former students capitalize on and develop Brunswikian ideas. Last year I concentrated mainly on the economic impacts of psychological interventions. Using Tucker's lens model equation enriched with psychometric parameters similar to Hunter and Schmidt's psychometric meta-analysis and relating it to the Brogden/Cronbach/Gleser cost-benefit equation, I proposed to compute the effect size at the break-even point, where the economic costs and benefits are on par. Using the symmetry principles of the psychometric lens model equation the odds of underestimating true effects are substantially larger than overestimating them. I also found that the effect sizes at the break-even point are often very small ones. Capitalizing on evidence from meta-analysis or empirical program evaluations allows us to estimate the ROI of interventions. These results bolster the impression that the economic benefits of many psychological interventions are heavily underestimated as well. These ideas still have to find their way into peer-reviewed journals and into the tool kits of decision makers. However, a conference presentation demonstrating how a non-evidence based health-related political decision in Germany in 1996 produced roughly a quarter billion Euros as opportunity costs. This can be found on the homepage of the German Evaluation Society. [www.degeval.de](http://www.degeval.de).

Reference:

Wittmann, W. W., & Steffanowski, A. (2010). Meta-analysis of stationary psychotherapy (MESTA) for psychosomatic patients: How to fool yourself in not considering opportunity costs. Retrieved November 29, 2010 from: <http://www.degeval.de/calimero/tools/proxy.php?id=23481>

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# *New books*

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**Human-Tech:  
Ethical and Scientific Foundations**

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**Kim J. Vicente**  
*Cognitive Engineering Laboratory,  
University of Toronto,  
Canada*

*Contact: vicente@mie.utoronto.ca*

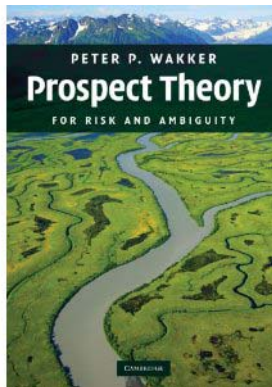
In *The Human Factor*, Kim Vicente coined the term 'Human-tech' to describe a more encompassing and ambitious approach to the study of Human-Technology Interaction (HTI) than is now evident in any of its participating disciplines, such as human factors, human-computer interaction, cognitive science and engineering, industrial design, informatics or applied psychology. Observing that the way forward is 'not by widgets alone,' Vicente's Human-tech approach addresses every level - physical, psychological, team, organizational, and political - at which technology impacts quality of life, identifies a human or societal need, and then tailors technology to what we know about human nature at that level. *The Human Factor* was written for a broad audience, in part to educate general readers beyond the HTI community about the need to think seriously about the tremendous impact that poorly designed technology can have, ranging from user frustration to the tragic loss of human life. The articles collected in this book provide much of the technical material behind the work that was presented in *The Human Factor*, and the commentaries by Alex Kirlik situate these articles in their broader historical, scientific and ethical context. This collection of articles and commentaries forms a set of recommendations for how HTI research ought to broaden both its perspective and its practical, even ethical, aspirations to meet the increasingly complicated challenges of designing technology to support human work, to improve quality of life, and to design the way we will live with technology. As the first book both to integrate the theory and research underlying Human-tech, and to clearly delineate the scientific challenges and ethical responsibilities that await those who either design technology for human use, or design technology that influences or even structures the working or daily lives of others, *Human-tech: Ethical and Scientific Foundations* will appeal to the broad range of students and scholars in all of the HTI disciplines.

For more information, see: <http://www.amazon.com/Human-Tech-Scientific-Foundations-Technology-Interaction/dp/0199765146>

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**Prospect Theory:  
For Risk and Ambiguity**

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**Peter P. Wakker**  
*Econometric Institute,  
Erasmus University,  
Rotterdam,  
the Netherlands*

Contact: [Wakker@ese.eur.nl](mailto:Wakker@ese.eur.nl)

As emphasized by Egon Brunswik, we have to make our decisions in a risky environment. De Finetti gave a rationality foundation for the use of subjective probabilities to model risk and uncertainty. The probabilities are called subjective because they express a relation between our knowledge and our environment rather than describing the environment objectively. The economist Ellsberg (1961) showed that human beings haven't succeeded in rationally using subjective probabilities yet, and numerous empirical studies have confirmed his finding since. It has led to more general theories of "ambiguity." Kahneman and Tversky incorporated ambiguity into their prospect theory in 1992, and their theory was part of the economics Nobel prize in 2002.

My book combines theoretical tools from economics with the empirical insights from psychologists in analyzing risk and ambiguity, formalizing everything mathematically as did Brunswik. It has been organized in such a manner that different readers can skip and select different parts, so that psychologists and people from other fields can study it and use it for teaching.

Part I describes the traditional normative ideas of decision analysis of the 1960s and 1970s, starting with de Finetti in Chapter 1, von Neumann-Morgenstern expected utility in Chapters 2 and 3, and a continuous version of Savage's expected utility in Chapter 4. On informal occasions I describe this part of history as the overoptimistic (naïve) first stage of decision analysis. The next two parts introduce modern developments generated by the many descriptive deviations found since. Part II concerns risk (Brunswik, Kahneman and Tversky) and Part III the more



important ambiguity (Gilboa and Schmeidler's addition to Kahneman & Tversky's prospect theory). Parts II and III show what should be corrected for in realistic prescriptive applications of decision analysis (Ariely, Loewenstein, Sunstein, Thaler). The direct measurement of intangibles such as nonadditive subjective probabilities, utilities, and loss aversion, is central throughout the book.

For more information: <http://people.few.eur.nl/wakker/cv.htm>

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# ***Job Announcement***

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**Postdoctoral Fellowships and Graduate Student Fellowships  
in Cognition and Decision Making**

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The Center for Adaptive Behavior and Cognition at the Max Planck Institute for Human Development in Berlin, under the direction of Gerd Gigerenzer, seeks applicants for up to 2 two-year Postdoctoral Fellowships (with the possibility of a third year) and up to 2 two-years Graduate Student Fellowships (with the possibility of two six-months extensions). The positions are to begin on or after September 1, 2011. Please contact us for details about the eligibility requirements for the Graduate Student Fellowships.

Candidates should be interested in studying the cognitive mechanisms underlying bounded, social, and ecological rationality in real-world domains. Current and past researchers in our group have had training in psychology, cognitive science, economics, mathematics, biology, and computer science to name but a few. The Center provides excellent resources, including support staff and equipment for conducting experiments and computer simulations, travel support for conferences, and, most importantly, the time to think.

For more information about our group and other funding possibilities for graduate students please visit our homepage at [www.mpib-berlin.mpg.de/en/forschung/abc/](http://www.mpib-berlin.mpg.de/en/forschung/abc/). The working language of the center is English, and knowing German beforehand is not necessary. We strongly encourage applications from women, and members of minority groups. The Max Planck Society is committed to employing more disabled individuals and especially encourages them to apply.

Please submit applications (consisting of a cover letter describing research interests, curriculum vitae, up to five reprints, and 3 letters of recommendation) by January 7th, 2011 to ensure consideration. However, applications will be accepted until the positions are filled. The preferred method of submission is a single PDF file for the cover letter and CV, plus PDF copies of the reprints e-mailed to [fellowships2011@mpib-berlin.mpg.de](mailto:fellowships2011@mpib-berlin.mpg.de). Letters of recommendation and questions can be emailed to the same address. Under exceptional circumstances applications can be mailed to Ms. Sylvaine von Franqué, Center for Adaptive Behavior and Cognition, Max Planck Institute for Human Development, Lentzeallee 94, 14195 Berlin, Germany.

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# **The Brunswik Society**

*<http://www.brunswik.org/>*

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