THE BRUNSWIK SOCIETY NEWSLETTER

VOLUME 38 DECEMBER 2023

ISSN 2296-9926

ABOUT

The Brunswik Society is an international association of researchers who are interested in understanding and improving human judgment and decision making. Founded in 1985 by Kenneth Hammond, members of the Society share an appreciation for the work of psychologist Egon Brunswik.

STAY CONNECTED

Visit the Brunswik Society website at https://brunswiksociety.org/.

To receive information about the Society's annual meeting and newsletter, email info@brunswiksociety.org.

Follow us on Twitter! @BrunswikThe

TABLE OF CONTENTS

Foreword

Adaryukov, J., Collsiöö, A., Hamm, R. M., Kaufmann, E., & Molinaro, K.A	5
In Memoriam	
John W. Rohrbaugh	6
Agenda	
29th International (Virtual) Meeting of the Brunswik Society Agenda	9
Contributions	
<i>Grüning, D.J., Lechner, C.M., Le Mens, G., Bluemke, M., & Fiedler, K.</i> Asymmetric Sampling of Personality (ASP): Understanding Validity Limits of Personality Assessment with Brunswik's Lens Model	11
Körner, R., Overbeck, J.R., Körner, E., & Schütz, A. Interpersonal Perceptions of Power, Dominance, and Prestige Based on Short Written Self-Descriptions	17
<i>Mastrella, S.J.</i> How Does Anxious Nonverbal Behavior Affect Interview Performance Ratings?	19
<i>Millroth, P.</i> A Brunswikian Inspired Taxonomical Approach to Risky Decision Making	22
Sommer, J., Musolino, J., and Hemmer, P. Updating, Evidence Evaluation, and Operator Availability: A Theoretical Framework for Understanding Belief	26
<i>Utesch, K., Hecht, V., Utesch, T., Bläsing, B., & Back, M.D.</i> An Application of Brunswik's Lens Model to the Judgment of Dance	30
<i>Wang, X. & Navarro-Martinez, D.</i> Representative Experimental Design and the External Validity of Social Preference Games	33

Wittman, W.W.	
Brunswik Symmetry: A Golden Key to Success in Psychological Sciences	36

Commentary

Doherty, M.E., Holzworth, R.R., & Stewart, T.R.	
Extending Cognitive Continuum Theory	37

FOREWORD

We are very pleased to present the 2023 Brunswik Society Newsletter! We would like to thank all the readers and especially the authors and co-authors for their valuable contributions.

This year, we are again unfortunately mourning the passing of another friend, John W. Rohrbaugh. He will be remembered not only for his many contributions to Brunswikian psychology and social judgment theory, but also for his warm, funny, and caring personality and commitment to his community.

Started in 1986, the Brunswik Society Newsletter has been published for more than 37 years. This years' contributions show the current state of ongoing Brunswik-Hammond related efforts. The contributions span a wide range of psychological sub-disciplines ranging from sports (Utesch et al.), beliefs (Sommer et al.), social perception (Körner et al.), social preferences (Wang et al.), decision-making (Millroth), nonverbal behavior (Mastrella), and personality (Grüning et al.). It is also great to see the variety of author experience levels represented across these contributions (Doherty et al., Wittmann).

In previous years, often research on judgment and decision-making (JDM) was covered by the newsletter. It was Hammond who transferred Brunswik's research to JDM, so it was not surprising that the newsletter consisted mostly of JDM contributions. Recently, there has been a shift back in attention to Brunswik's methodological approach, at least in the current Brunswik Society Newsletter (see Doherty or Wittmann's contribution). We hope to see this trend continue in future newsletters. We invite authors to start planning their contributions for the 2024 Brunswik Society Newsletter and welcome a wide variety of topics such as recent Brunswik-Hammond-related trends, research projects, comments on the contributions in the current Brunswik Society Newsletter, etc.

As always, the newsletter contains the agenda for the upcoming 2023 Brunswik meeting. We're also looking forward to the upcoming meeting in 2024 where we will celebrate its 30th year. This provides a great opportunity to look into the crystal ball and make forecasts about the future of Brunswik-Hammond related research. Any comments are welcomed either in the upcoming 30th meeting in 2024 or in the 2024 newsletter.

Thank you all for your ideas, comments, and for further developing the field.

Sincerely,

James Adaryukov, August Collsiöö, Robert M. Hamm, Esther Kaufmann, and Kylie A. Molinaro

IN MEMORIAM

John W. Rohrbaugh



The Brunswik Society mourns the loss of John W. Rohrbaugh, who died on Thursday, June 22, 2023, in Cambria, California, where he had retired with his wife Kris Fox. John's contributions to Brunswikian psychology were numerous and substantial, focused primarily on group decision making and on the use of Social Judgment Theory (SJT) in decision conferencing. He was among the first scholars to apply Brunswikian and SJT ideas and procedures to group processes (see Rohrbaugh, 2001, for a summary).

John received his PhD in Social Psychology in 1976 from the University of Colorado at Boulder. His dissertation chair was Ken Hammond. To the best of our knowledge, his dissertation (Rohrbaugh, 1976) was the first formal laboratory research in social psychology to extend the study of cognitive conflict tasks beyond the dyad. He later showed that cognitive conflict tasks could be positioned on a continuum of "intentional depth," depending (at least in part) upon the

number of relevant cues in the task environment and the degree of equivalence between the ecological validity and utilization of each (Rohrbaugh, 1979). Building on this knowledge of the group task environment, John and his students used interactive, policy capturing and social judgment analysis in decision conferences to represent participants' cognitive models and, thereby, enhance interpersonal learning and reduce cognitive conflict (McCartt & Rohrbaugh, 1995; Rohrbaugh, 1992).

John was always eager to explore ways to extend his research into new areas and applications. While at the University at Albany, he established the Decision Group to provide decision conferencing services to state government agencies, the University itself, and other public entities. This more applied work helped to inform his more theoretical research on negotiation and mediation. In a 1996 paper, John wrote, "Brunswik argued that no coherent theory or model of human behavior could be developed that did not also include a theory or model of the environmental system (the task) with which the person interacted. In short, he argued that people's behaviors could not be understood independently of the environmental task. We believe the same holds true for negotiation" (Mumpower & Rohrbaugh, 1996).

Working with colleagues from the field of System Dynamics, he was instrumental in developing the Group Model Building approach, a process for helping stakeholder groups explore the potential implications of policies by collaborating to construct system dynamics models that represent complex policy environments and using policy capturing to represent tradeoffs among competing values (Richardson et al., 1989, 1992).

John published more than 60 articles and book chapters, as well as two books (Rohrbaugh, 2009; Rohrbaugh & McCartt, 1986). In addition to his judgment and decision research, he made substantial influential contributions in organizational theory and behavior, small group dynamics, and public administration. For example, his two papers with Robert Quinn introducing the Competing Values model of organizational effectiveness have been cited approximately 8,000 times (Quinn & Rohrbaugh, 1981; 1983). Not surprisingly, references to Brunswikian concepts show up even in this work, which might initially seem to be intellectually distant. For example, John argued that SJT might offer a means to unpack what scholars mean by the concept of effectiveness in organizations.

John spent virtually his entire career at the Rockefeller College of Public Affairs, University at Albany, State University of New York, joining the faculty in 1977 and retiring in 2015. He also held visiting appointments at Syracuse University, the London School of Economics and Political Science and the International Institute for Applied Systems Analysis. Much of his work involved international collaborations, particularly with Hungarian colleagues.

In addition to his scholarly achievements, John had a well-deserved reputation as an accomplished teacher and mentor – rigorous and demanding but highly supportive of and invested in his students' success. He also held significant administrative responsibilities during his career at Albany, including serving as Chair of the Department of Public Administration and Policy, Associate Dean of Rockefeller College, and Director of the Office of International Education.

After retirement he moved to Cambria where he became actively involved with that community, including starting a weekly newspaper:

John Rohrbaugh passed away on Thursday, June 22. He was a leader in the community and in 2021, took initiative to develop a newspaper for Cambria after the demise of the local paper. He served on the Policy Committee from January 17, 2019, through November 22, 2019, and was committed to his ideals of transparency in public service. He was loved by so many and was a guiding light in Cambria. He has left an indelible mark on our community; he will be missed. (https://www.cambriacsd.org/6-24-2023-letter-from-thegeneral-manager)

John was a perfectionist and a stickler for doing high-quality work. Unlike many perfectionists, he was also warm, funny, and caring. He will be remembered by those who were fortunate enough to know him not only for his contributions to Brunswikian psychology and SJT, which are many, but for those personal qualities as well.

— Jeryl L. Mumpower & Thomas R. Stewart

References

Group Process and Conflict

- McCartt, A. T., & Rohrbaugh, J. (1995). Managerial openness to change and the introduction of GDSS: Explaining initial success and failure in decision conferencing. *Organization Science*, *6*(5), 569–584.
- Mumpower, J. L., & Rohrbaugh, J. (1996). Negotiation and design: Allocation decisions through analytical mediation. *Group Decision and Negotiation*, *5*, 385–409.
- Rohrbaugh, J. (1976). Conflict management in decision-making groups: A comparison of social judgment analysis and the delphi technique. Boulder: University of Colorado, Department of Psychology. Unpublished doctoral dissertation.
- Rohrbaugh, J. (1979). Improving the quality of group judgment: Social judgment analysis and the delphi technique. *Organizational Behavior and Human Performance*, 24(1), 73–92.
- Rohrbaugh, J. (1992). Cognitive challenges and collective accomplishments. In R. P. Bostrom, R. Watson, & S. T. Kinney (Eds.), *Computer augmented teamwork: A guided tour* (pp. 299–324). New York: Van Nostrand Reinhold.
- Rohrbaugh, J. (2001). The relationship between strategy and achievement as the basic unit of group functioning. In K. R. Hammond & T. R. Stewart (Eds.), *The essential Brunswik: Beginnings, explications, applications* (pp. 384–387). New York: Oxford University Press.

Group Model Building

- Richardson, G. P., Vennix, J. A. M., Anderson, D. M., Rohrbaugh, J., & Wallace, W. A. (1989). Eliciting group knowledge for model-building, *The* 7th *International Conference of the System Dynamics Society*, Stuttgart, Germany.
- Richardson, G. P., Andersen, D. F., Rohrbaugh, J., & Steinhurst, W. (1992). Group model building, *The* 10th International Conference of the System Dynamics Society, Utrecht, Netherlands.

Competing Values Model of Organizational Effectiveness

- Quinn, R. E., & Rohrbaugh, J. (1981). A competing values approach to organizational effectiveness. *Public Productivity Review*, *5*, 122–140.
- Quinn, R. E., & Rohrbaugh, J. (1983). A spatial model of effectiveness criteria: Towards a competing values approach to organizational analysis. *Management Science*, *29*(3), 363–377.

Books

- Rohrbaugh, J. (2009). *The application of statistics to policy analysis and management: An introduction.* Albany: Executive Decision Services.
- Rohrbaugh, J., & McCartt, A. T. (1986). New directions for institutional research: Applying decision support systems in higher education. San Francisco: Jossey-Bass.



29th International (Virtual) Meeting of the Brunswik Society

Free event – for Zoom link register your name, affiliation, and email address with esther.kaufmann@gmx.ch

7th December 2023, 1200–1400 EST (1700–1900 GMT) via Zoom

Opening Remarks – Mandeep Dhami (Middlesex University, London, UK)

Title: News from the Brunswik Society **Presenter:** Esther Kaufmann (University of Konstanz, GER)

Title: A Role for Probabilistic Functionalism in Differential Diagnosis

Presenter/Authors: Frank Papa (Texas College of Osteopathic Medicine, US) & Robert M. Hamm (University of Oklahoma Health Sciences Center, US)

Abstract: Our research suggests that physicians experience their patient care environment, in part, in terms of gradually abstracted estimates of the frequency with which a given disease's characteristic features are likely to occur in patients suffering from each disease encountered. Over time, physicians gradually develop cognitive processes enabling the use of their knowledge of disease by feature frequency estimates as a means of diagnosing, quasi-probabilistically, which disease is the most likely cause of a given patient's clinical features (signs and symptoms). We suggest that a deeper understanding of the mathematical nature of the cognitive processes that transform disease by feature frequency estimates into quasi-probabilistic diagnostic decisions can lead to training which can improve the probabilistic functionalism of future health care professionals.

Title: Is Numerical Information Always Beneficial? Verbal and Numerical Cue-Integration in Additive and Non-Additive Tasks

Presenter/Authors: August Collsiöö, Peter Juslin, & Anders Winman (Uppsala University, SWE) **Abstract:** Individuals tend to default to linear additive cue-integration when relying on rule-based integration to make multiple-cue judgments. However, this may hamper learning in non-additive tasks. We hypothesize that this effect is partly driven by the use of numeric formats, through expectations about a simple numerical solution. We predict that while numeric formats will benefit learning in an additive environment, verbal formats will be beneficial in a non-additive environment and find support for this across two experiments. Cognitive modelling shows that when verbal information is presented, exemplar memory dominates across task environments, whereas cue-abstraction is prevalent in additive environments when numerical information is presented. Application of the Precise/Not Precise model – on a Brunswikian conceptualization of intuitive and analytic thought – reveals primarily analytic instantiations of the strategies used by individuals.

Title: Congruence-Incongruence Effect – How Different Cue-Saliencies Shape the Dynamics of Multiple-Cue Probability Learning

Presenter/Authors: Florian Scholten (Tübingen University, GER) & Arndt Bröder (Mannheim University, GER)

Abstract: We used the weather prediction task (Knowlton et al., 1994) in two experiments (N = 257) to examine the influence of cue saliency in multiple-cue probability learning. We examined whether the hierarchy of a face's trustworthiness was either congruent or incongruent to the face's forecasting validity for a positively valenced outcome. Notably, the incongruence group yielded lower accuracy rates than their congruent counterparts, displaying unique learning trajectories – evidenced by distinct cue utilization curves detected by a rolling regression method from Lagnado et al. (2006). Differentiating through two different scenarios, we explored the true nature of the effect, asking whether it reflects a socially relevant dimension affecting a social judgment criterion, or is merely based on the association of similarly valenced cues/outcomes (positive vs. negative).

Title: Extending Cognitive Continuum Theory

Presenter/Authors: Michael E. Doherty (Bowling Green State University, US), R. James Holzworth (University of Connecticut, US), & Thomas R. Stewart (University at Albany, US) **Abstract:** We present an expanded version of Hammond's Cognitive Continuum Theory (CCT), which we call Cognitive Continuum Theory II (CCTII). It includes Hammond's CCT with two new premises. The *intuition-analysis* continuum is taken directly from CCT. In addition, we propose as continua the truth criteria of coherence and correspondence, and also Brunswik's representative design. We describe all four continua — coherence, correspondence, representative design and *intuition-analysis* — as psychological continua that influence the thinking of Social Judgment Theory (SJT) scientists at every stage of research and theory. We believe these continua represent what occurs in the minds of researchers, consistent with Hammond's general conceptual approach. Consideration of our proposed CCTII may help SJT researchers think about design and evaluation of research.

Closing Remarks – Jeryl Mumpower (Texas A&M University, US)

Virtual Social/Networking Hour!

7th December 2023, starts 1415 EST (1915 GMT) Free event – invites will be sent to meeting delegates

The organization team looks forward to seeing you: Mandeep Dhami, Gjis Holleman, Esther Kaufmann, & Karolin Salmen

CONTRIBUTIONS

Asymmetric Sampling of Personality (ASP): Understanding Validity Limits of Personality Assessment with Brunswik's Lens Model

David J. Grüning^{1, 2}, Clemens M. Lechner², Gaël Le Mens³, Matthias Bluemke², & Klaus Fiedler¹

¹Heidelberg University, Germany, ²GESIS – Leibniz Institute for the Social Sciences, Germany, ³Universitat Pompeu Fabra, Barcelona School of Economics, and UPF-Barcelona School of Management, Spain

\boxtimes david.gruening@geis.org

Personality assessment faces several unresolved challenges associated with the self-report method. First, statistical associations between self-reports and actual behaviors in various life domains are weak (e.g., decision-making, Frey et al., 2017; emotions, Joseph & Newman, 2010; Murphy & Lilienfeld, 2019; sexual activity, Jaccard et al., 2002; creativity, Park et al., 2016; and social cognition, Eisenberg et al., 2019; Saunders et al., 2018), especially when behaviors are highly contextualized and specific (Wittmann, 1986; 1988; 1990; 1999; 2002). Second, self and third-party observer reports often suffer from substantial discrepancies (Luft & Ingham, 1955; Fiedler et al., 2004; Vazire & Mehl, 2008). Third, similar discrepancies affect the reports of multiple third-party observers (Atkins & Wood, 2006; Fleenor et al., 1996; Lyness et al., 2021; Nawka & Konerding, 2012). We use Brunswik's (1952) lens model to provide a unified explanation for these three problems.

We propose that self and third-party reports of personality suffer from systematic biases that arise from unequal exposure of individuals to different life situations. We refer to this perspective as "asymmetric sampling of personality" (ASP). ASP focuses on the mechanism by which individuals obtain information relevant to their own personality assessment from their daily lives and information relevant to the personality assessment of others from their interactions with them. Our perspective builds on the sampling approach to human judgment: Judgment patterns and biases (e.g., illusory correlations and negativity biases) can be explained by invoking properties of the samples of information people obtain as they navigate the social world. The information samples people use to form their judgments suffer from systematic biases. For example, people tend to more frequently sample positive experiences than negative experiences, because they aim to repeat positive experiences whereas they avoid negative experiences. More generally, samples of experiences are shaped by people's personal preferences for certain situations (Allport, 1954; Asch, 1946; Denrell & Le Mens, 2011; Denrell & March, 2001; Fiske & Taylor, 1991; Hilton & von Hippel, 1996; Ickes et al., 2015; Rauthmann et al., 2015; Rosenthal & Jacobsen, 1968; Snyder & Stukas, 1999; Snyder & Swann, 1978; Tajfel et al, 1971; Word et al., 1974) and external constraints (Bronfenbrenner, 1979; Denrell & Le Mens, 2007; Fiedler & Juslin, 2006; Merçon-Vargas et al., 2020). We apply these ideas to the domain of personality assessment: when

responding to personality questionnaires, people draw on the samples of past experiences that took place in a variety of situations.

We use Brunswik's lens model to capture the effect of situation sampling on personality assessment (Figure 1). In this model, the probability that a situation, s_x (here s_{1-5}), is sampled by an actor depends on the actor's situation selection mechanism, sm, which consists of the actor's personal preferences, p, and external constraints, e, expressed as $p(s_x|sm)$. Different probabilities of different situations being selected and experienced by an actor lead to different sampling frequencies for these different situations. In Figure 1, frequencies of different magnitudes are represented by arrows of different strengths pointing to the situations. At the limit, due to personal preferences or external constraints, some relevant situations may never be sampled at all (i.e., situation 5). Each situation interacts with the actor's personality, τ , and results in observable behavior, b_{1-4} , that provides a signal about the actor's personality. The interaction can be expressed as the probability of the behavior given the situation and an actor's personality, $p(b_x|s_x, \tau)$. The behavior is observed by the actor themselves and by third-party observers that are present. The observed behaviors from all available (i.e., experienced) situations form a judge's individual mental representation, m, of their personality (if the judge is the actor) or the target person's personality (if the judge is a third-party observer).



Figure 1. Brunswik's lens model of ASP.

Notably, we focus here on how Brunswikian sampling can explain biases in personality assessment. We recognize that there are other influences on an individual's personality impression, such as experiencing mental states in a situation (Prager & Fiedler, 2021), experiencing imagined situations (Honeycutt, 2008; Honeycutt et al., 2013), and mentally sampling situations (Berry et al., 2012; Nunes et al., 2015).

The utility of the ASP lens model for personality assessment lies in its ability to provide a unified explanation for the three central problems outlined in the introduction (for other approaches to problem subsets, see; Funder, 1995; Vazire, 2010; Tourangeau et al., 2000). Specifically, all three problems can be explained by differences between the samples of situations used for personality assessment. First, an actor's mental representation of a particular personality trait is informed by

their asymmetric sampling of situations relevant to the assessment of that trait. If the sample of situations is not representative of the set of situations in which the personality trait is meant to have predictive validity, the predictive validity of the self-assessment will suffer. This effect becomes more pronounced as behavior becomes increasingly contextualized. Thus, the predictive validity of self-report personality assessments will be particularly low for contextualized behavior that is *atypical* for an actor. Second, a third-person rater has access to only a subset of the situations experienced by the target. This sample is unlikely to be a representative sample of the experienced situations relevant to the focal personality trait. If the sample is biased, self-report and third person-report will differ. Moreover, multiple third-person raters will generally have different patterns of interaction with the target, and thus their sampled distributions of situations relevant to the personality trait will differ. The personality assessments provided by these third-person raters are thus bound to differ.

In conclusion, ASP introduces a novel perspective to personality assessment. By leveraging the Brunswik lens model, ASP can formalize the assessment biases that result from people's unequal exposure to different experiences relevant to personality assessment; an inequality which may ultimately aid its quantification. This perspective deepens our understanding of the limited predictive validity of personality assessments and inter-rater discrepancies. It encourages a more nuanced approach to self-reporting.

References

- Allport, G. (1954). The nature of prejudice. Cambridge, MA: Addison-Wesley.
- Asch, S. E. (1946). Forming impressions of personality. *Journal of Abnormal and Social Psychology*, 41(3), 258–290. https://doi.org/10.1037/h0055756
- Atkins, P. W., & Wood, R. E. (2002). Self- versus others' ratings as predictors of assessment center ratings: Validation evidence for 360-degree feedback programs. *Personnel Psychology*, 55(4), 871–904. https://doi.org/10.1111/j.1744-6570.2002.tb00133.x
- Berry, C. J., Shanks, D. R., Speekenbrink, M., & Henson, R. N. A. (2012). Models of recognition, repetition priming, and fluency: Exploring a new framework. *Psychological Review*, 119(1), 40–79. https://doi.org/10.1037/a0025464
- Bronfenbrenner, U. (1979). *The ecology of human development: Experiments in nature and design*. Harvard University Press.
- Brunswik, E. (1952). *The conceptual framework of psychology*. (Int. Encycl. Unified Sci., v. 1, no. 10.). The University of Chicago Press.
- Denrell, J., & Le Mens, G. (2007). Interdependent sampling and social influence. *Psychological Review*, 114(2), 398–422. https://doi.org/10.1037/0033-295X.114.2.398
- Denrell, J., & Le Mens, G. (2011). Seeking positive experiences can produce illusory correlations. *Cognition*, 119(3), 313–324. https://doi.org/10.1016/j.cognition.2011.01.007
- Denrell, J., & March, J. G. (2001). Adaptation as information restriction: The hot stove effect. *Organization Science*, *12*(5), 523–538. https://doi.org/10.1287/orsc.12.5.523.10092
- Eisenberg, I. W., Bissett, P. G., Zeynep Enkavi, A., Li, J., MacKinnon, D. P., Marsch, L. A., & Poldrack, R. A. (2019). Uncovering the structure of self-regulation through data-driven ontology discovery. *Nature Communications*, 10(1), 2319. https://doi.org/10.1038/s41467-019-10301-1

- Fiedler, K., & Juslin, P. (2006). Taking the Interface between Mind and Environment Seriously. In K. Fiedler & P. Juslin (Eds.), *Information sampling and adaptive cognition* (pp. 3–29). Cambridge University Press.
- Fiedler, E. R., Oltmanns, T. F., & Turkheimer, E. (2004). Traits associated with personality disorders and adjustment to military life: Predictive validity of self and peer reports. *Military Medicine*, 169(3), 207– 211. https://doi.org/10.7205/milmed.169.3.207
- Fiske, S. T., & Taylor, S. E. (1991). Social cognition (2nd ed.). New York: McGraw-Hill.
- Fleenor, J. W., Fleenor, J. B., & Grossnickle, W. F. (1996). Interrater reliability and agreement of performance ratings: A methodological comparison. *Journal of Business and Psychology*, 10(3), 367– 380. https://doi.org/10.1007/BF02249609
- Frey, R., Pedroni, A., Mata, R., Rieskamp, J., & Hertwig, R. (2017). Risk preference shares the psychometric structure of major psychological traits. *Science Advances*, 3(10), e1701381. https://doi.org/10.1126/sciadv.170138
- Funder, D. C. (1995). On the accuracy of personality judgment: A realistic approach. *Psychological Review*, *102*(4), 652–670. https://doi.org/10.1037/0033-295X.102.4.652
- Hilton, J. L., & von Hippel, W. (1996). Stereotypes. Annual Review of Psychology, 47, 237-271.
- Honeycutt, J. M. (2008). Imagined interaction theory. In L. A. Baxter & D. O. Braithewaite (Eds.), *Engaging theories in interpersonal communication: Multiple perspectives* (pp. 77–87). Sage Publications, Inc. https://doi.org/10.4135/9781483329529.n6
- Honeycutt, J. M., Pence, M. E., & Gearhart, C. C. (2013). Associations between imagined interactions and the "Big Five" personality traits. *Imagination, Cognition and Personality*, 32(3), 273–289. https://doi.org/10.2190/IC.32.3.d
- Ickes, W., Snyder, M., & Garcia, S. (1997). Personality influences on the choice of situations. In R. Hogan, J. Johnson, & S. Briggs (Eds.), *Handbook of personality psychology* (pp. 165–195). New York, NY: Academic Press.
- Jaccard, J., McDonald, R., Wan, C. K., Dittus, P. J., & Quinlan, S. (2002). The accuracy of self-reports of condom use and sexual behavior. *Journal of Applied Social Psychology*, 32(9), 1863–1905. https://doi.org/10.1111/j.1559-1816.2002.tb00263.x
- Joseph, D. L., & Newman, D. A. (2010). Emotional intelligence: An integrative meta-analysis and cascading model. *Journal of Applied Psychology*, 95(1), 54–78. https://doi.org/10.1037/a0017286
- Luft, J., & Ingham, H. (1955). The Johari window, a graphic model of interpersonal awareness. In *Proceedings of the Western Training Lab- oratory in Group Development*. Los Angeles, CA: UCLA.
- Lyness, S. A., Peterson, K., & Yates, K. (2021). Low inter-rater reliability of a high stakes performance assessment of teacher candidates. *Education Sciences*, 11(10), 648. https://doi.org/10.3390/educsci11100648
- Merçon-Vargas, E. A., Lima, R. F. F., Rosa, E. M., & Tudge, J. (2020). Processing proximal processes: What Bronfenbrenner meant, what he didn't mean, and what he should have meant. *Journal of Family Theory & Review*, 12(3), 321–334. https://doi.org/10.1111/jftr.12373
- Murphy, B. A., & Lilienfeld, S. O. (2019). Are self-report cognitive empathy ratings valid proxies for cognitive empathy ability? Negligible meta-analytic relations with behavioral task performance. *Psychological Assessment*, 31(8), 1062. https://doi.org/10.1521/pedi.2019.33.5.577
- Nawka, T., & Konerding, U. (2012). The interrater reliability of stroboscopy evaluations. *Journal of Voice*, 26(6), 812.e1–812.e10. https://doi.org/10.1016/j.jvoice.2011.09.009

- Nunes, J. C., Ordanini, A., & Valsesia, F. (2015). The power of repetition: Repetitive lyrics in a song increase processing fluency and drive market success. *Journal of Consumer Psychology*, 25(2), 187– 199. https://doi.org/10.1016/j.jcps.2014.12.004
- Park, N. K., Chun, M. Y., & Lee, J. (2016). Revisiting individual creativity assessment: Triangulation in subjective and objective assessment methods. *Creativity Research Journal*, 28(1), 1–10. https://doi.org/10.1080/10400419.2016.1125259
- Prager, J., & Fiedler, K. (2021). Forming impressions from self-truncated samples of traits-interplay of Thurstonian and Brunswikian sampling effects. *Journal of Personality and Social Psychology*, 121(3), 474–497. https://doi.org/10.1037/pspa0000274
- Rauthmann, J. F., Sherman, R. A., Nave, C. S., & Funder, D. C. (2015). Personality-driven situation experience, contact, and construal: How people's personality traits predict characteristics of their situations in daily life. *Journal of Research in Personality*, 55, 98–111. https://doi.org/10.1016/j.jrp.2015.02.003
- Rosenthal, R., & Jacobsen, L. (1968). *Pygmalion in the classroom: Teacher expectations and children's intellectual development*. New York: Holt, Rinehart & Winston.
- Saunders, B., Milyavskaya, M., Etz, A., Randles, D., & Inzlicht, M. (2018). Reported self-control is not meaningfully associated with inhibition-related executive function: A Bayesian analysis. *Collabra: Psychology*, 4(1), 39. https://doi.org/10.1525/collabra.134
- Snyder, M., & Stukas, A. A. (1999). Interpersonal processes: The interplay of cognitive, motivational, and behavioral activities in social interaction. *Annual Review of Psychology*, 50(1), 273–303. https://doi.org/10.1146/annurev.psych.50.1.273
- Snyder, M., & Swann, W. B. (1978). Hypothesis-testing processes in social interaction. Journal of Personality and Social Psychology, 36(11), 1202–1212. https://doi.org/10.1037/0022-3514.36.11.1202
- Tajfel, H., Flament, C., Billig, K., & Bundy, R. (1971). Social categorization and intergroup behavior. *European Journal of Social Psychology*, 1(2), 149–178. https://doi.org/10.1002/ejsp.2420010202
- Tourangeau, R., Rips, L. J., & Rasinski, K. (Eds.). (2000). *The psychology of survey response*. Cambridge University Press. https://doi.org/10.1017/CBO9780511819322
- Vazire, S. (2010). Who knows what about a person? The self-other knowledge asymmetry (SOKA) model. *Journal of Personality and Social Psychology*, *98*(2), 281–300. https://doi.org/10.1037/a0017908
- Vazire, S., & Mehl, M. R. (2008). Knowing me, knowing you: The accuracy and unique predictive validity of self-ratings and other-ratings of daily behavior. *Journal of Personality and Social Psychology*, 95(5), 1202–1216. https://doi.org/10.1037/a0013314
- Wittmann, W. W. (1986). The synthesis of Cattell's BDRM, Cronbach et al. generalisability theory and Brunswik's lens model. A framework for improving construct and predictive validity. AERA Annual Meeting, New Developments in Generalizability Theory. International Perspectives. https://www.researchgate.net/profile/Werner-Wittmann/publication/260980320_The_synthesis_of_Cattell's_BDRM_Cronbach_et_al_generalizabil ity_theory_and_Brunswik's_lens_model_A_framework_for_improving_construct_and_predictive_val idity/links/0a85e532caa44a0e56000000/The-synthesis-of-Cattells-BDRM-Cronbach-et-algeneralizability-theory-and-Brunswiks-lens-model-A-framework-for-improving-construct-andpredictive-validity.pdf
- Wittmann, W. W. (1988). Brunswik-symmetry and successfully predicting human behavior. XXIVth Intention Congress of Psychology. https://www.researchgate.net/profile/Werner-Wittmann/publication/261250877_Brunswik-

Symmetry_and_Successfully_Predicting_Human_Behavior/links/0a85e533af49a8ef57000000/Brunsw ik-Symmetry-and-Successfully-Predicting-Human-Behavior.pdf

- Wittmann, W. W. (1990). Brunswik-Symmetrie und die Konzeption der Fünf-Datenboxen—Ein Rahmenkonzept für umfassende Evaluationsforschung [Brunswik-Symmetry and the five-data-box conceptualization: A framework for comprehensive evaluation research]. Zeitschrift für Pädagogische Psychologie / German Journal of Educational Psychology, 4(4), 241–251.
- Wittmann, W. W., & Süß, H.-M. (1999). Investigating the paths between working memory, intelligence, knowledge, and complex problem-solving performances via Brunswik symmetry. In P. L. Ackerman, P. C. Kyllonen, & R. D. Roberts (Eds.), *Learning and individual differences: Process, trait, and content determinants* (pp. 77–108). American Psychological Association. https://doi.org/10.1037/10315-004
- Wittmann, W. W. (2002). Brunswik-Symmetrie: Ein Schlüsselkonzept für erfolgreiche psychologische Forschung [Brunswik-Symmetry: A key concept for successful psychological research]. In M. Myrten (Hrsg.), Die Person im biologischen und sozialen Kontext (S. 163–186).
- Word, C. O., Zanna, M. P., & Cooper, J. (1974). The non-verbal mediation of self-fulfilling prophecies in interactial interaction. *Journal of Experimental Social Psychology*, 10(2), 109–120. https://doi.org/10.1016/0022-1031(74)90059-6

Interpersonal Perceptions of Power, Dominance, and Prestige Based on Short Written Self-Descriptions

Robert Körner¹, Jennifer R. Overbeck², Erik Körner³, & Astrid Schütz¹

¹Otto-Friedrich-University of Bamberg, Germany, ²Melbourne Business School, Australia, ³Saxon Academy of Sciences and Humanities in Leipzig, Germany

⊠ robert.koerner@uni-bamberg.de

In almost every type of relationship, whether romantic, professional, or friendly, hierarchies occur (Agnew & Harman, 2019). The most intensively studied hierarchy variables are power, dominance, and to some degree prestige. Sense of *power* is the perceived capacity to influence others and make decisions in social interactions (Anderson et al., 2012). It has often been reported to be more predictive of behavioral outcomes than objective power. Dominance and prestige are two routes how social rank can be achieved and maintained. *Dominance* describes the use of fear, threat, and coercion to intimidate others and overcome their will (Cheng & Tracy, 2014; Henrich & Gil-White, 2001). By contrast, *prestige* is a positively valued strategy whereby rank is granted willingly to someone with superior knowledge, expertise, and abilities. Both dominance and prestige show high temporal stability and have unique and stable patterns of associations with personality traits, emotions, and behavior, which suggests that they represent stable tendencies for navigating social hierarchies (Körner et al., 2023).

In our work (Körner et al., in press), we studied the *interpersonal perception of another person's sense of power, prestige, and dominance* using linguistic cues. We sought evidence of accuracy (and consensus), relying on Brunswik's lens model (Brunswik, 1956). We conceptualized *self-other agreement* (SOA) as the similarity of targets' self-ratings to judges' ratings of the target, that is, how accurately judges use cues (cue utilization) that were provided by targets (cue validity) to perceive the targets as the targets see themselves (Back et al., 2008). *Consensus* describes whether judges use correct cues to assess speakers' qualities. Whereas an immense literature addresses the interpersonal perception of broad personality traits such as the Big Five using Brunswik's lens model, such research is scarce regarding hierarchy concepts—especially with textual information as cues.

In two studies, German-speaking targets (400 in total) provided self-descriptions (around 5 sentences) and completed the Personal Sense of Power Scale (e.g., "In my relationships with others my ideas and opinions are often ignored") as well as the Dominance-Prestige Scales (e.g., "Some people are afraid of me" for dominance, "My unique talents and abilities are recognized by others" for prestige). Judges (307 in total) read the self-descriptions and assessed targets' power, dominance, and prestige (each target was rated by 5 judges). We relied on a zero-acquaintance setting, that is, judges had only thin slices of information on the speakers' standing. Judgments in everyday life often arise from scarce information, and quick and accurate assessment of where strangers stand, and how they may behave, with regard to hierarchy is necessary for appropriate navigation through hierarchies and behavior toward others.

We found medium to high accuracies for power (SOA = .44), dominance (SOA = .35), and prestige (SOA = .37). Further, judges' assessments converged strongly (ICC(2, 5) = .72/.67/.60 for power, dominance, prestige). Finally, the cues used by targets and judges correlated strongly for power (r = .50) and prestige (r = .44). By contrast, the correspondence between cue validity and cue utilization correlations was lower for dominance (r = .30). We also observed several linguistic correlates for the hierarchy variables in self- and peer-reports, which can be found in the article (Körner et al., in press).

Overall, we found that social hierarchy concepts can be accurately inferred from minimal textual information. The cues used by speakers and judges clearly corresponded above chance. We observed striking social consensus: Judges converged to a high degree when they assess others' sense of power, dominance, and prestige, suggesting that social hierarchy concepts can readily be observed in everyday life. It is important to perceive another person's standing in a hierarchy. For example, people often want to learn and copy the skills and expertise of people high in prestige (Henrich & Gil-White, 2001) and thus need to perceive others' prestige accurately. Because hierarchies are an important aspect of virtually every social interaction, it seems plausible that people develop skill at judging others on this dimension. High accuracy is adaptive, to avoid coercion by dominant others or to effectively communicate and navigate hierarchies (e.g., making requests toward powerful and not powerless persons). These findings may have important downstream consequences: For example, if observers judge a speaker to be high in sense of power, they may also judge this person to be an effective negotiator or leader.

References

Agnew, C. R., & Harman, J. J. (Eds.). (2019). Power in close relationships. Cambridge University Press.

- Anderson, C., John, O. P., & Keltner, D. (2012). The personal sense of power. *Journal of Personality*, 80(2), 313–344. https://doi.org/10.1111/j.1467-6494.2011.00734.x
- Back, M. D., Schmukle, S. C., & Egloff, B. (2008). How extraverted is honey.bunny77@hotmail.de? Inferring personality from e-mail addresses. *Journal of Research in Personality*, 42(4), 1116–1122. https://doi.org/10.1016/j.jrp.2008.02.001
- Brunswik, E. (1956). *Perception and the representative design of psychological experiments*. University of California Press.
- Cheng, J. T., Tracy, J. L., & Henrich, J. (2010). Pride, personality, and the evolutionary foundations of human social status. *Evolution and Human Behavior*, 31(5), 334–347. https://doi.org/10.1016/j.evolhumbehav.2010.02.004
- Henrich, J., & Gil-White, F. J. (2001). The evolution of prestige: Freely conferred deference as a mechanism for enhancing the benefits of cultural transmission. *Evolution and Human Behavior*, 22(3), 165–196. https://doi.org/10.1016/S1090-5138(00)00071-4
- Körner, R., Heydasch, T., & Schütz, A. (2023). Dominance and prestige as self-concept facets. *Journal of Personality Assessment*, 105(5), 590–609. https://doi.org/10.1080/00223891.2022.2137028
- Körner, R., Overbeck, J. R., Körner, E., & Schütz, A. (in press). The language of power: Interpersonal perceptions of sense of power, dominance, and prestige based on word usage. *European Journal of Personality*.

How Does Anxious Nonverbal Behavior Affect Interview Performance Ratings?

Simonne J. Mastrella

University of Guelph, Canada

 \boxtimes smastrel@uoguelph.ca

Job interviews are high-stakes situations that involve being evaluated by a stranger—conditions that are anxiety-provoking for many job candidates. Not only can interview anxiety be unpleasant to experience, but it may also have negative effects on how the candidate is rated by the interviewer. Although anxious interviewees tend to receive lower ratings of interview performance (Powell et al., 2018), there is no evidence to suggest that they would go on to be poor job performers (Schneider et al., 2019; Zhang et al., 2021). This means that anxiety may cause strong candidates to perform poorly in an interview, which can have negative consequences for both the candidate and the organization, who may go on to hire someone who is less suitable. We wanted to know *why* anxiety may cause interviewees to be rated poorly, as this is a crucial first step to helping anxious interviewees receive better interview performance ratings.

Theoretically, there are several ways anxiety can negatively affect interview performance ratings. Anxious interviewees may have difficulty forming a coherent response to an interview question or may struggle to recall relevant examples that demonstrate their skills. However, anxious interviewees may also appear anxious through their body language (i.e., nonverbal behavior), by fidgeting or making poor eye contact with the interviewer. Understanding the particular mechanism can have important implications for training interviewees and interviewers alike. If anxious interviewees struggle with their responses, they can be taught techniques to help them prepare for and answer interview questions. But if anxious interviewees do demonstrate their qualifications in their responses and simply *look* anxious in the interview, then lower performance ratings may reflect interviewer biases regarding anxiety. In other words, interviewers may pick up on the interviewee's anxiety and evaluate them negatively because of it. In our study, we tested the nonverbal behavior mechanism (for details, see Mastrella et al., 2023).

The Brunswik (1956) lens model can help us understand how an interviewer would use anxious nonverbal behavior when forming judgments about the interviewee (see Figure 1). Cues, such as those denoting anxious nonverbal behaviors, are available to the interviewer but may or may not be detected by them. If the cues are detected, the interviewer can use them to accurately infer anxiety, as well as (accurately or inaccurately) form judgments about the interviewee's traits and their overall qualifications. For example, an anxious interviewee may avoid making eye contact with the interviewer and may fidget often. The interviewer may detect these nonverbal cues and, if so, infer that the interviewee is anxious and therefore less qualified.



Figure 1. Brunswik's (1956) lens model applied to interview anxiety.

For our study (Mastrella et al., 2023), we recruited American residents with management experience (N = 823) from an online research platform. The participants watched a brief interview and rated the interviewee's performance. The interviewees were actors (one man and one woman) who recited scripted responses but differed in their nonverbal behavior. Specifically, the high anxiety interviewee averted their gaze, toughed their neck, and shifted their legs more than the low anxiety interviewee. We also manipulated the job the interviewee was applying for, with a job that was more interpersonal in nature (i.e., a bank consumer representative) and one that was more independent (i.e., a bank data clerk). We wanted to know the effect of the anxious cues on the interview performance ratings, and if that effect differed based on the interviewee's gender and the job they were applying for.

We found that the high anxiety interviewee did indeed receive a lower interview performance rating than the low anxiety interviewee. On a scale out of 5, the high anxious interviewee scored a mean of 3.48 (SD = 0.80) and the low anxiety interviewee scored a mean of 4.13 (SD = 0.61)—given how competitive jobs are, this can be a meaningful difference! The high anxiety interviewee was also rated as less competent than the low anxiety interviewee. This difference in performance ratings across anxiety conditions occurred regardless of whether the interviewee was a man or a woman, or whether they were applying for a consumer representative or data clerk position. In sum, these results suggest that when interviewees display anxious nonverbal behavior, interviewers detect those cues and use them to infer that the interviewee is less competent, which has a negative effect on their interview performance ratings.

Overall, we found that looking anxious in an interview can lead to lower interview performance ratings—even when the interviewee is qualified for the job and provides strong answers. This insight can be used to help both interviewees and interviewers. Interviewees can be trained to demonstrate a confident outwardly appearance, and interviewers can be informed to not let anxious nonverbal behavior factor into their ratings, given that anxiety does not seem to be relevant to an interviewee's qualifications. We hope that this research can add to our understanding of interview anxiety in selection.

References

- Brunswik, E. (1956). Perception and the representative design of psychological experiments (2nd ed.). University of California Press.
- Mastrella, S. J., Powell, D. M., Bonaccio, S., & McMurtry, C. M. (2023). The impact of interviewees' anxious nonverbal behavior on interview performance ratings. *Journal of Personnel Psychology*, 22(2), 99–110. https://doi.org/10.1027/1866-5888/a000319
- Powell, D. M., Stanley, D. J., & Brown, K. N. (2018). Meta-analysis of the relation between interview anxiety and interview performance. *Canadian Journal of Behavioral Science*, 50(4), 195–207. https://doi.org/10.1037/cbs0000108
- Schneider, L., Powell, D. M., & Bonaccio, S. (2019). Does interview anxiety predict job performance and does it influence the predictive validity of interviews? *International Journal of Selection and Assessment*, 27(4), 328–336. https://doi.org/10.1111/ijsa.12263
- Zhang, I. Y., Powell, D. M., & Bonaccio, S. (2021). The role of negative evaluation in interview anxiety and social-evaluative workplace anxiety. *International Journal of Selection and Assessment*, 1(9), 1–9. https://doi.org/10.1111/ijsa.12365

A Brunswikian Inspired Taxonomical Approach to Risky Decision Making

Philip Millroth

Department of Psychology, Uppsala University, Sweden

⊠ philip.millroth@psyk.uu.se

Risky decision-making has perennially occupied a focal position in cognitive and behavioral research, with its implications stretching across disciplines such as finance, health, and interpersonal relationships. Despite the considerable body of research on risky decision-making, an overarching synthesis that integrates diverse findings within a framework that mirrors real-world scenarios remains elusive. This state of affairs is surprising given that cognitive scientists have repeatedly stressed the importance of understanding the structure of the environment (Brunswik, 1955; Simon, 1956; Todd & Gigerenzer, 2003). Notwithstanding calls in the last decades to resolve this issue (Fox et al., 2015; Schonberg et al., 2011), the current literature offers no vital signs that progress has been made in this regard.

If we as researchers want to increase the external validity of our lab-based research, and with that the predictive power, we need to fulfill the principle of representative design as proposed by Brunswik: We need to ground experimental conditions so that they closely resemble those found in naturalistic environments. This approach is especially pertinent to the study of risky decisionmaking, where the complexity and variability of real-life scenarios are paramount, ranging from simple choices such as choosing traffic routes to life-changing decisions such as relocating to a new city.

One route for pursuing this goal is through a taxonomical approach, a humble effort to uncover how cognitive strategies and processes emerge as functions of the naturalistic environments much like how Linnaeus systematized plants (Millroth et al., 2021). Of course, given the vast terrain of possible risky decisions spread across diverse life domains (e.g., financial, social, medical), synthesizing findings without a structured approach would be a Herculean task. Here, I outline a sketch for a Brunswikian inspired research program that aim to offer a structured approach, and thus be useful for taxonomical development and for informing future experimental designs. The focus here is on outlining the general theoretical approach, fully aware that it comes with vast methodological challenges that ultimately need resolution, such as identifying the inherent properties of a decision.

The initial phase (Figure 1, Panel A) involves developing a thorough understanding of natural "risky" environments, which includes identifying a comprehensive sample pool of real-world risky decisions and cataloging their inherent properties. The identification of decision-making situations involving risk is not a novel question; for example, it has received considerable attention in the development of generalizable risk-attitude scales. One popular scale for measuring potential engagement with behaviors considered "risky" is the Domain-Specific Risk Taking Scale (DOSPERT; Weber et al., 2002), which describes 50 situations considered potentially risky across five domains (e.g., financial). Another example is the psychometric study of risk perception pioneered by Paul Slovic, where the aim is to examine the judgments people make when asked to

characterize and evaluate hazardous activities and technologies (Slovic, 1987, identified 81 different "hazards").

However, there is reason to suspect that a much larger pool of risky situations is warranted, especially if we do not constrain "risk" to one simple definition and include less extreme situations. For example, for the purposes of this article, I employed ChatGPT 4.0 to identify everyday decisions involving risk. Risk was defined according to four different and commonly used definitions (Hansson, 2023): (i) the cause of an unwanted event that may or may not occur, (ii) an unwanted event that may or may not occur, (iii) the probability of an unwanted event that may or may not occur, After several conversation iterations, over 1,000 decisions were identified. Following redundancy reduction actions (vectorization, word-embedding techniques, and manual review), over 350 situations remained¹. Further prompting, and real-life survey work, is warranted and may ultimately produce an even larger and more generalizable sample pool.

What properties are inherent to these decisions? From decades of judgment and decision-making research, a rich repertoire of possible properties exists. These range from environmental factors (e.g., uncertainty, threat of loss, time pressure, number of attributes) to internal ones (e.g., risk tolerance, past outcomes, personal values and goals, confidence in abilities to achieve goals) and social/interpersonal ones (e.g., social norms, media influence, peer pressure, advice from trusted individuals, influence of authority figures). Yet, mapping properties across a wide range of decisions has yet to be done. Are there properties more universally prevalent than others are? Which types of properties matter the most: external (e.g., type of risk, time pressure), internal (e.g., task-specific knowledge), or social (e.g., norms, authority)? How do they interact? Arguably, this will be the most difficult part of the project.

With decisions and properties mapped, the second phase of the project involves sampling decisions and examining them in a manner similar to the lens-model framework (Figure 1, Panel B). Empirical investigations will aim to explore how various inherent properties serve as cues that influence not only the choice to engage in risky behavior but also the subsequent satisfaction derived from it. More specifically, the idea is that for each decision, there are properties (e.g., risk typology) that trigger specific cognitive strategies and processes. On one end, these properties can correlate with the binary decision to engage (or not) in risky behavior. For instance, the perceived likelihood of a negative outcome might deter someone from investing in a volatile stock. On the other end, these cues could be mapped to an individual's subsequent satisfaction or regret postdecision. A decision steered by a cue based on societal norms might lead to satisfaction if congruent with personal values but induce regret if contrary.

Finally (Figure 1, Panel C), the analysis explores the cognitive strategies invoked by these cue configurations. These strategies may be well-established paradigms (e.g., fast and frugal heuristics, exemplar-based memory strategies) or may require the development of novel frameworks.

The exploration and mapping strategies and cognitive processes uncovered through this program will be useful developing more accurate predictive models, thereby significantly increasing our capacity to anticipate and influence decision-making behaviors in various risk-related contexts.

¹ The list can be accessed here: <u>https://osf.io/preprints/psyarxiv/hs2n7</u>

Ultimately, it may pave the way for more effective, evidence-based interventions and policies that can adeptly navigate the complexities of human decision-making in the face of uncertainty and risk.



A. Choosing a naturalistic decision and identify its inherent properties.





C. Finding strategies and processes that facilitate the above configuration.



COGNITIVE STRATEGIES AND PROCESSES

Figure 1. Schematic representation of the Brunswikian taxonomical approach to decision making under risk.

References

- Brunswik, E. (1955). Representative design and probabilistic theory in a functional psychology. *Psychological Review*, 62(3), 193–217. https://doi.org/10.1037/h0047470
- Fox, C. R., Erner, C., & Walters, D. J. (2015). Decision under risk: From the field to the laboratory and back. In G. Keren & G. Wu (Eds.), *The Wiley Blackwell handbook of judgment and decision making* (pp. 41–88). https://doi.org/10.1002/9781118468333.ch2
- Hansson, S. O. (2023). Risk. In E. N. Zalta & U. Nodelman (Eds.), *The Stanford encyclopedia of philosophy* (Summer 2023 Edition). Metaphysics Research Lab, Stanford University. https://plato.stanford.edu/archives/sum2023/entries/risk/
- Millroth, P., Collsiöö, A., & Juslin, P. (2021). Cognitiva speciebus: Towards a Linnaean approach to cognition. *Trends in Cognitive Sciences*, 25(3), 173–176. https://doi.org/10.1016/j.tics.2020.12.005
- Schonberg, T., Fox, C. R., & Poldrack, R. A. (2011). Mind the gap: Bridging economic and naturalistic risk-taking with cognitive neuroscience. *Trends in Cognitive Sciences*, 15(1), 11–19. https://doi.org/10.1016/j.tics.2010.10.002
- Simon, H. A. (1956). Rational choice and the structure of the environment. *Psychological Review*, 63(2), 129–138. https://doi.org/10.1037/h0042769
- Slovic, P. (1987). Perception of risk. *Science*, 236 (4799), 280–285. https://doi.org/10.1126/science.3563507
- Todd, P. M., & Gigerenzer, G. (2003). Bounding rationality to the world. *Journal of Economic Psychology*, 24(2), 143–165. https://doi.org/10.1016/S0167-4870(02)00200-3
- Weber, E. U., Blais, A. R., & Betz, N. E. (2002). A domain-specific risk-attitude scale: Measuring risk perceptions and risk behaviors. *Journal of Behavioral Decision Making*, 15(4), 263–290. https://doi.org/10.1002/bdm.414

Updating, Evidence Evaluation, and Operator Availability: A Theoretical Framework for Understanding Belief

Joseph Sommer, Julien Musolino, & Pernille Hemmer

Rutgers University, United States

⊠ joseph.sommer@rutgers.edu

What explains irrational beliefs?

Many laypeople and psychologists alike assume that irrational beliefs result from problematic psychological mechanisms. Perhaps people believe things that they desire to be true or form beliefs that make them feel good. Alternatively, irrational beliefs might be produced by a lazy reliance on heuristics, where thoughtful analysis would lead to better beliefs. These views attribute irrationality solely to cognitive processes. In our recent paper (Sommer, Musolino, & Hemmer, 2023), we suggest that cognitive processes involved in belief may be more rational than they are often given credit for. At the same time, we propose that much of the responsibility for irrational beliefs may be due to evidence in the world, rather than inappropriate processing in the mind. Understanding irrational beliefs requires an appreciation of the interplay between mental processes and the external world (cf. Brunswik, 1943).

In support of some rationality in belief, note that the effects of motivation on belief are strongly constrained: Try to form the belief that you have just won the lottery. No matter how desirable this might be, it is not possible to believe at will. We argue that belief *updating*, narrowly construed, appears to be *cognitively impenetrable* (Pylyshyn, 1999) to desires, as it cannot be directly swayed by motivation. However, belief is not entirely impenetrable–it is perfectly possible for motivation to guide evidence search or to influence reasoning.

In light of this distinction, we propose a framework which divides the cognitive processes involved in belief into two qualitative types (Figure 1, Box A). At Level 1, *belief updating* is approximately Bayesian and impenetrable. However, before updating can occur, additional cognitive processes mediate between information in the world and subjectively compelling evidence. These Level 2 processes evaluate evidence and, critically, *are* penetrable to desires. For example, the desire to support a prior belief can indeed influence where people look for evidence. We further suggest that Level 2 processes face computationally intractable problems, which means these processes must be heuristic and fallible.

For example, *evidence search* must be heuristic and incomplete–it is impossible to exhaustively examine all the information related to any belief. Search must rely on stopping rules that halt well in advance of completely surveying the evidence (Gigerenzer, 2002). While search is necessarily heuristic, it is also penetrable to desires and incentives. If someone wants to win an argument more than they care about truth, they can direct their search accordingly. Other Level 2 processes have similar features. *Acceptance* refers to attending to a particular focal hypothesis for updating. Because data may bear on many hypotheses, people may fail to notice the implications of new evidence or may update differently on the same evidence. For example, a claim in a newspaper

might be evidence that the claim is true to one person, but evidence that the paper is biased to another. Similarly, *hypothesis specification*, a Level 2 process that proposes alternative explanations of evidence, cannot consider all possible explanations. Nonetheless, motivated partisans can deliberately construct alternative hypotheses to explain away inconvenient evidence. Our fourth Level 2 process, *recall of relevant information*, must also be incomplete. The frame problem (Pylyshyn, 1987) expresses the impossibility of considering all relevant information when forming a belief, though one can still try to recall supportive anecdotes. Finally, *reasoning* about evidence is constrained by limits on time and effort, while motivated reasoning remains possible.

Beyond taxonomizing belief processes, our framework proposes that individual differences in people's beliefs are due to the availability of different *operators* (Newell & Simon, 1972)–or micro-processes of information processing–to evidence evaluation processes. That is, Level 2 processes can be achieved by different algorithms, or operators. For example, evidence search can be conducted in different ways, including searching for confirmatory information, searching randomly, or asking an authority. Which operators someone uses will affect their evidence evaluation and will thereby impact their belief updating. We discuss five lines of research in cognitive psychology–referred to as *Relatively Invariant Characteristics of Persons or Environments*–which describe factors that alter the availability of Level 2 operators (Figure 1, Box B).

First, how information is represented can alter the operators used in reasoning (Simon, 1990). Second, research on emotions and goals suggests that these states can affect cognitive operators (Anderson, 1983; Vohs et al., 2007). Third, individual differences in *thinking dispositions*, such as *need for cognition* (Cacioppo & Petty, 1982), are associated with better reasoning and reduced susceptibility to cognitive biases. Fourth, differences in prior beliefs and reasoning strategies account for apparently motivated reasoning (Tappin et al., 2020) and affect argumentative skills (Kuhn, 1991), suggesting that different operators may be used by partisans and trained debaters. Finally, the external environment itself may constrain operators (Tolman & Brunswik, 1935). For example, direct perceptual evidence is less subject to counterarguments than testimony because the former cannot be dismissed as the result of an untrustworthy source. We argue that the unifying theme underlying these factors is their influence on the operators people use to evaluate evidence.

Consider an example of the nested influence implied by our framework. A political partisan who wants to form a certain belief cannot do so directly, because belief updating is impenetrable. However, they can manipulate processes at Level 2, choosing how they search for evidence or how long they spend explaining away evidence they disagree with. If they have a biased set of operators available which permits them to search only for confirmatory evidence or to dismiss any counterevidence with fallacious arguments, they will update on a carefully curated subset of evidence, resulting in false beliefs.

In sum, our framework suggests that irrational beliefs are the result of the interaction of fallible Level 2 processes and inappropriate or biased operators with evidence in the world, but not from irrational updating. The framework unites disparate literatures, proposes a nuanced and holistic account of belief, and may inform ongoing debates in the literature, including whether belief is rational or irrational.



Figure 1. Framework for understanding belief.

References

Anderson, J. R. (1983). The architecture of cognition. Lawrence Erlbaum.

- Brunswik, E. (1943). Organismic achievement and environmental probability. *Psychological Review*, 50(3), 255–272. https://doi.org/10.1037/h0060889
- Cacioppo, J. T., & Petty, R. E. (1982). The need for cognition. *Journal of Personality and Social Psychology*, 42(1), 116–131. https://doi.org/10.1037/0022-3514.42.1.116
- Gigerenzer, G. (2002). The adaptive toolbox. In G. Gigerenzer & R. Selten (Eds.), *Bounded rationality: The adaptive toolbox* (pp. 37–50). MIT Press.
- Kuhn, D. (1991). The skills of argument. Cambridge University Press.
- Newell, A., & Simon, H. A. (1972). Human problem solving. Prentice-Hall.
- Pylyshyn, Z. W. (1987). The robot's dilemma: The frame problem in artificial intelligence. Ablex Publishing.
- Pylyshyn, Z. W. (1999). Is vision continuous with cognition?: The case for cognitive impenetrability of visual perception. *Behavioral and Brain Sciences*, 22(3), 341–365. https://doi.org/10.1017/S0140525X99002022
- Simon, H. A. (1990). Invariants of human behavior. Annual Review of Psychology, 41(1), 1–19. 10.1146/annurev.ps.41.020190.000245
- Sommer, J., Musolino, J., & Hemmer, P. (2023). Updating, evidence evaluation, and operator availability: A theoretical framework for understanding belief. *Psychological Review*. Advance online publication. https://doi.org/10.1037/rev0000444
- Tappin, B. M., Pennycook, G., & Rand, D. G. (2020). Thinking clearly about causal inferences of politically motivated reasoning: Why paradigmatic study designs often undermine causal inference. *Current Opinion in Behavioral Sciences*, 34, 81–87. https://doi.org/10.1016/j.cobeha.2020.01.003

- Tolman, E. C., & Brunswik, E. (1935). The organism and the causal texture of the environment. *Psychological Review*, 42(1), 43–77. https://doi.org/10.1037/h0062156
- Vohs, K. D., Baumeister, R. F., & Loewenstein, G. (Eds.). (2007). Do emotions help or hurt decisionmaking?: A hedgefoxian perspective. Russell Sage Foundation.

An Application of Brunswik's Lens Model to the Judgment of Dance

Katharina Utesch¹, Vivien Hecht¹, Till Utesch¹, Bettina Bläsing², & Mitja D. Back¹

¹University of Münster, Germany, ²Technical University Dortmund, Germany

katharina.utesch@uni-muenster.de

[Please note that Katharina Utesch published under Katharina Geukes before October 2023.]

Success as a dancer depends on positive dance judgments—whether of professional judges in competitive sports and auditions or of audience members in stage performances. To examine judgments of dance and to complement and extend the extant knowledge on dance judgments, we applied the lens model (Brunswik, 1956) to the context of dance.

In striving for experimental control, but at the cost of ecological validity and representativeness, previous studies on dance judgments have mostly focused on edited or somewhat artificial stimulus material (e.g., point-light displays, stick figures) with the aim to identify dance-specific attributes that lead to positive judgments. These studies identified attributes, such as: expansiveness in space, variability and amplitude of movements, movement fluency, turning velocity, straight legs, elevated arms, flexibility, long balance times, large, fluent, and complex jumps, speed, symmetry, difficulty, familiarity, and spectacularism (cf. Bronner & Shippen, 2015; Calvo-Merino et al., 2008; Christensen et al., 2014; Torrents et al., 2013, 2015). Given, however, that dance is usually evaluated in rich real-life contexts—both by experts and by novices—we, in a recent study (Geukes et al., 2023), chose to focus on representative video stimuli that remained unedited and close to real-world dance performances and, thus, involved attributes related to the dance itself (technique and expression) as well as to the person who dances (physical appearance).

To do so, we produced 70 video-records of solo dance performances. On that basis, we asked (1) a total of six trained raters to evaluate the targets and their dance regarding their physical appearance, technique, and expression (i.e., cue ratings) and (2) 33 perceivers (11 experts and 22 novices) to provide overall judgements of the targets' dance. As physical appearance-related cues, we considered *facial and bodily attractiveness* as well as cues related to *styling* and *dressing*. Within the technique domain, we considered cues related to the dance execution and related to the correctness given the original choreography and musicality. Within the expression domain, we considered cues related to role play (e.g., convey a story, convey emotions, remain in role) and related to sovereignty (e.g., confident, awake). While making use of the natural variation in cue scores, we kept decisive aspects of our stimulus material constant to ensure comparability across targets: This regarded the length of the video clip (30sec), the music to which the targets danced (Morris, 2007), as well as the contemporary, modern, lyric dance choreography. Overall, we were interested in whether physical appearance-related attributes are a relevant cue domain in addition to dance- (i.e., technique- and expression-) related cue domains, and in the potentially moderating role of perceivers' expertise when it comes to the formation of real-life dance judgments (see Figure 1). For more information on that study, please refer to osf.io/ycz7e/.



Sensitivity

Figure 1. Schematic display of the considered lens model (Brunswik, 1956) [considered judgement side in black, unconsidered aspects in grey]. Adapted from "Mirror, mirror on the wall, who is the fairest dancer of them all? A naturalistic lens model study on the judgment of dance performance" by Geukes et al., 2023.

Results of cross-classified mixed-effects models revealed that attributes of all three domains were significantly related to dance judgements. Targets who were rated as more (facially) attractive and wearing unflashy outfits, who were rated as showing better dance execution and correctness as well as showing greater role-play and sovereignty, received better dance judgments. When we considered the cues of all domains simultaneously, however, only dance-specific attributes contributed to the prediction of dance judgments, that is, the technique-related cue *execution* as well as the expression-related cues *role play* and *sovereignty*. Additional moderation analyses underscored the importance of perceivers' expertise in judging dance; experts were found to judge the execution of dance in a stricter fashion than did novices.

The purpose of this study was to complement the previously accumulated knowledge on the formation of dance judgments by findings based on the lens model (Brunswik, 1956) and based on unedited, more representative stimulus material. Findings of this approach revealed that cues of all three cue domains were related to dance judgments, but this picture drastically changed when the cue domains were considered simultaneously. Physical appearance-related cues lost their predictive potential when considered simultaneously with dance-related cues. Despite these valuable insights, this study came with some limitations that outline future research avenues: All dancers serving as targets and also most of the perceivers and coders were female (and white and western, with normative bodies, being heterosexual etc.). Second, our results pertain to just a single choreography within just one dance style (i.e., Contemporary). As such, generalizability of our findings is naturally limited, warranting (conceptual) replication with more diverse samples (related to targets, coders, and perceivers) as well as more diverse choreographies and dance styles.

With this study, we showcased the usefulness of the lens model in the context of dance judgments. We hope that this study may serve as a complementary perspective to study "the whole thing' (i.e., the dance)" (Christensen & Calvo-Merino, 2013, p. 4) and to gain increasingly representative and ecologically valid insights into the formation of judgments of real-life dance (across target groups, choreographies, and dance styles), other types of artistic movement (e.g., gymnastics, figure skating), and sports performances (e.g., refereeing) more generally.

References

- Bronner, S., & Shippen, J. (2015). Biomechanical metrics of aesthetic perception in dance. *Experimental Brain Research*, 233(12), 3565–3581. https://doi.org/10.1007/s00221-015-4424-4
- Brunswik, E. (1956). *Perception and the representative design of psychological experiments* (2nd ed.). University of California Press.
- Calvo-Merino, B., Jola, C., Glaser, D. E., & Haggard, P. (2008). Towards a sensorimotor aesthetics of performing art. *Consciousness and Cognition: An International Journal*, 17(3), 911–922. https://doi.org/10.1016/j.concog.2007.11.003
- Christensen, J. F., & Calvo-Merino, B. (2013). Dance as a subject for empirical aesthetics. *Psychology of Aesthetics, Creativity, and the Arts*, 7(1), 76–88. https://doi.org/10.1037/a0031827
- Christensen, J. F., Nadal, M., Cela-Conde, C. J., & Gomila, A. (2014). A norming study and library of 203 dance movements. *Perception*, 43(2-3), 178–206. https://doi.org/10.1068/p7581
- Geukes, K., Hecht, V., Utesch, T., Bläsing, B., & Back, M. D. (2023). Mirror, mirror on the wall, who is the fairest dancer of them all? A naturalistic lens model study on the judgment of dance performance. *Psychology of Sport and Exercise*, 67, 102436. https://doi.org/10.1016/j.psychsport.2023.102436
- Morris, T. (2007). A historic love. On The Tudors. Varese Sarabande Records.
- Torrents, C., Castañer, M., Jofre, T., Morey, G., & Reverter, F. (2013). Kinematic parameters that influence the aesthetic perception of beauty in contemporary dance. *Perception*, 42(4), 447–458. https://doi.org/10.1068/p7117
- Torrents, C., Castañer, M., Reverter, F., Morey, G., & Jofre, T. (2015). Dance teachers' aesthetic perception of kinematic parameters. *Psychology of Aesthetics, Creativity, and the Arts*, 9(4), 442–450. https://doi.org/10.1037/a0039757

Representative Experimental Design and the External Validity of Social Preference Games

Xinghua Wang

Dongbei University of Finance and Economics, Institute for Advanced Economic Research, China

 \boxtimes xinghua.wang@dufe.edu.cn

Daniel Navarro-Martinez

Pompeu Fabra University, Department of Economics and Business, Spain

Barcelona School of Economics, Spain

Barcelona School of Management, Spain

 \boxtimes daniel.navarro@upf.edu

Research on what has been called "social preferences" has attracted great interest in the last decades. As part of this line of research, a variety of economic games have been developed to study different aspects of social behavior, such as altruism, cooperation, inequity aversion, reciprocity, trust, etc. Examples of these games include the dictator game, ultimatum game, trust game, and public good game, among others (see Camerer, 2003 for a review). These social preference games typically share some common features: they are closely based on game-theoretic structures and have clear game-theoretic equilibria; they are deliberately as context-free as possible, in the sense of not incorporating elements that resemble particular real-world contexts; and their outcomes consist in monetary payoffs for the players involved. This approach to social behaviors has been hugely influential and has become one of the benchmarks for the study of human interaction in economics, judgment and decision making and beyond.

However, an increasing number of studies suggest that social preference games have low external validity. For example, in a meta-analysis of the literature, Galizzi and Navarro-Martinez (2019) concluded that only 39.7% of the lab-field correlations reported in the papers they analyzed were statistically significant, and the average lab-field correlation obtained was 0.14. The authors also conducted a systematic experiment comparing various lab games against several field behaviors and found no significant correlation between them.

Why is the external validity of social preference games so low? One possible reason is that context plays a crucial role in economic behavior (see, e.g., Levitt & List, 2007, Lichtenstein & Slovic, 2006) but social preference games have a context-free nature. If this is true, it might be possible to increase the external validity of social preference research by introducing more realistic contextual elements in the lab games.

In our recent paper (Wang & Navarro-Martinez, 2023), we tested this by focusing on the dictator game and its predictive power in relation to naturalistic donation behavior in the field. The dictator game is one of the most influential games in social preference research (Kahneman et al., 1986). In the standard version of this game, two players are randomly and anonymously matched together.

One of them must decide how to allocate a certain amount of money provided by the experimenter. The other player passively accepts the allocation. This game is often conceptually linked to a donation situation. Many previous studies, however, have found that this game does not predict well real-life donation behavior (see, e.g., Galizzi & Navarro-Martinez, 2019). We used charitable giving as our main field situation. Specifically, our participants were approached on campus by a solicitor and asked for a donation to a charity.

Three important elements of this field context (among others) are missing in the standard dictator game: a recipient in real need (as opposed to another student), a monetary endowment that was earned by the participant (as opposed to assigned by the experimenter), and face-to-face interaction (as opposed to anonymous giving). Starting from the standard dictator game, we designed four different versions of the game to incorporate these elements step-by-step. We then ran three interconnected experiments in which the same participants faced different versions of the game and also the naturalistic donation situation in the field.

We found a dramatic increase in the correlation between the lab games and the field situation as more contextual elements were incorporated. Specifically, the Pearson correlation between the game decision and the field behavior increased from 0.21 (in the standard dictator game) to 0.65 (in the final game).

This result has wide-ranging implications for social preference research and behavioral science more generally. Our interpretation is that this type of research should seriously consider using more naturalistic contexts in laboratory experiments and be more explicit about the types of field behaviors it aims to address (if any). This conclusion is in line with the long-standing proposals to increase the representativeness of experimental designs in other areas of behavioral research (e.g., Brunswik, 1955, 1956; Dhami et al., 2004; Hammond, 1966, 1990; Hogarth, 2005).

References

- Brunswik, E. (1955). Representative design and probabilistic theory in a functional Psychology. *Psychological Review*, 62(3), 193–217. https://doi.org/10.1037/h0047470
- Brunswik, E. (1956). *Perception and the representative design of psychological experiments* (2nd ed.). University of California Press.
- Camerer, C. (2003). *Behavioral game theory: Experiments in strategic interaction*. Princeton: Princeton University Press.
- Dhami, M. K., Hertwig, R., & Hoffrage, U. (2004). The role of representative design in an ecological approach to cognition. *Psychological Bulletin*, 130(6), 959–988. https://doi.org/10.1037/0033-2909.130.6.959
- Galizzi, M., & Navarro-Martinez, D. (2019). On the external validity of social preference Games: A systematic lab-field study. *Management Science*, 65(3), 976–1002. https://doi.org/10.1287/mnsc.2017.2908
- Hammond, K. R. (1966). Probabilistic Functionalism: Egon Brunswik's integration of the history, theory, and method of psychology. In K. R. Hammond (Ed.), *The psychology of Egon Brunswik* (p. 15–80). New York: Holt, Rinehart and Winston.
- Hammond, K. R. (1990). Functionalism and illusionism: Can integration be usefully achieved? In R.M. Hogarth (Ed.), *Insights in decision making* (p. 227–261). Chicago: University of Chicago Press.

- Hogarth, R. (2005). The challenge of representative design in psychology and economics. *Journal of Economic Methodology*, 12(2), 253-263. https://doi.org/10.1080/13501780500086172
- Kahneman, D., Knetsch, J., & Thaler, R. (1986). Fairness and the assumptions of economics. *The Journal of Business*, 59(4), S285–S300. https://www.jstor.org/stable/2352761
- Levitt, S., & List, J. A. (2007). What do laboratory experiments measuring social preferences reveal about the real world. *Journal of Economic Perspectives*, 21(2), 153–174. https://doi.org/10.1257/jep.21.2.153
- Lichtenstein, S., & Slovic, P. (2006). *The Construction of Preference*. Cambridge: Cambridge University Press.
- Wang, X., & Navarro-Martinez, D. (2023). Bridging the gap between the economics lab and the field: Dictator games and donations. *Judgment and Decision Making*, 18, e18. https://doi.org/10.1017/jdm.2023.19

Brunswik Symmetry: A Golden Key to Success in Psychological Sciences

Werner W. Wittmann

University of Mannheim, Germany

wittmann@xi.psychologie.uni-mannheim.de

Many psychologists, me included, envy the natural sciences with regard to their successes in prediction and explanation. Egon Brunswik's peers saw these successes as a function of using randomized systematic experiments and rejected his ideas of representative designs using correlations. "Correlations are the method of the devil" shouted Ernest Hilgard (1955) criticizing Brunswik's ideas. It is amazing that many psychologists did not notice that not only do randomized systematic designs lead to success in science but principles of symmetry as well. There is a long list of physicists who got fame applying them, starting with Michael Faraday and continued with Nobel prize winners like Eugene Wigner, Richard Feynman, Murray Gell-Mann among many others. Brunswik's lens model brought symmetry to psychology. I first learned about it in Jerry Wiggins (1973) excellent book personality and prediction and later by Ken Hammond how Ledyard Tucker gave it a mathematical equation. I started using it in my dissertation and applied it since then in many publications and presentations and labeled it Brunswik symmetry. Despite getting a lot of praise from Ray Cattell, Lee Cronbach, Hans Eysenck, Ken Hammond or Jack and Patricia Cohen it took a long time for the virtues of Brunswik symmetry to catch interest of my peers. Brunswik symmetry is a golden key to success in psychological sciences. I hope to finalize a paper titled: "The two most important equations of psychology. How they help in dealing with prediction, explanation, replication and the scientific and the practical importance of psychology." The first one is the lens model equation and the second one is the Cronbach, Gleser, Brogden costbenefit equation. Be assured that the Brunswik Society will be the first one to review it.

In the meantime, I refer to my previous research (see <u>Wittmann, 1988</u>; <u>Wittmann & Klumb, 2006</u> – newly linked on the Brunswik Society website under *Resources*).

References

- Hilgard, E. R. (1955). Discussion of probabilistic functionalism. *Psychological Review*, 62(3), 226–228. https://doi.org/10.1037/h0040825
- Wiggins, J. S. (1973). *Personality and prediction: Principles of personality assessment*. Reading, Mass, Addison-Wesley.
- Wittmann, W. W. (1988). Brunswik-Symmetry and Successfully Predicting Human Behavior. Symposium: The Predictability of Human Behavior, the XXIVth International Congress of Psychology, Sydney, Australia, August 28-September 2. See: <u>https://brunswiksociety.org/wpcontent/uploads/2023/11/WWW Sydney 1988.pdf</u>
- Wittmann, W. W., & Klumb, P. L. (2006). How to fool yourself with experiments in testing psychological theories. In R. R. Bootzin & P. E. McKnight (Eds.), *Strengthening Research Methodology: Psychological Measurement and Evaluation*. Washington, D.C.: American Psychological Association. https://brunswiksociety.org/wp-content/uploads/2023/11/festschrift-sechrest_chap._wittmann_final2-1.pdf

COMMENTARY

Extending Cognitive Continuum Theory

Michael E. Doherty

Bowling Green State University, United States

R. James Holzworth

University of Connecticut, United States

⊠ jimholzworth@gmail.com

Thomas R. Stewart

University at Albany, United States

⊠ t.stewart@albany.edu

This extension of Kenneth Hammond's Cognitive Continuum Theory (CCT) brings together into a single theory some of the methodological, theoretical and philosophical contributions of Egon Brunswik and Kenneth Hammond. We do so by conceptualizing these apparently disparate contributions as they are understood by social judgment theory (SJT) scientists who are planning or evaluating an investigation. That is, this extension of CCT, which we will call Cognitive Continuum Theory II (CCT II) is a theory of the behavior of SJT researchers, not of the subjects (judges) in SJT research. A major attribute of CCT II is that the methodological, theoretical and philosophical contributions of Brunswik and Hammond are not viewed as dichotomous concepts but as cognitive continua, similar in many ways to a key concept in CCT, the *intuitive-analytic* continuum. A version of the intuitive-analytic continuum is a core premise in CCT II. The other four premises of CCT are assumed to be part of CCT II. These four premises deal with the continua of quasirationality, the role of task structure, dynamic cognition and pattern relations and functional relations. Two other premises are added, each of which plays a critical role in CCT II. One is that coherence and correspondence are continua. The other is that representative design is a continuum. Implications for how we think about research and for graduate education are discussed.

Our objective is to unite two metatheories of truth (coherence and correspondence) with Ken Hammond's original cognitive continuum theory (CCT) and Egon Brunswik's principle of representative design of scientific research. We add two premises to the original five CCT premises and reinterpret several key concepts as continua. The *intuitive-analytic* continuum, of course, is the foundation of CCT. We propose that the coherence and correspondence truth criteria are also best conceptualized as continua. Furthermore, we argue that representative design in research should also be conceptualized as a continuum. The three proposed continua are similar to

Hammond's *intuitive-analytic* continuum in that they are continua, but there are fundamental differences. One difference is that the *intuitive-analytic* continuum may have on it a virtually infinite variety of objects, from images to hunches to ideas about research. Another difference is that Hammond's *intuitive-analytic* continuum has two positive poles, whereas the proposed continua will range from a negative pole to a positive one. The proposed continua are each devoted to the evaluation of potential research studies.

Our domain of interest in this paper is the design and evaluation of research within the framework of social judgment theory (SJT), although our argument applies to some other judgment and decision making (JDM) research. The *intuitive-analytic* continuum has just been characterized as potentially representing a great variety of psychological phenomena. The proposed continua are special purpose in that they represent possible SJT investigations. We describe all four continua — coherence, correspondence, representative design and *intuitive-analytic* — as psychological continua that influence the thinking of SJT scientists at every stage of research and theory. We believe that consideration of our proposed CCT II may help SJT researchers think about design and evaluation of research.

Cognitive Continuum Theory

Cognitive Continuum Theory (CCT) evolved through the 1980s and 1990s (Hammond, 1980, 1981, 1986, 1987, 1988, 1990a,b) and is detailed in a book by Hammond (1996) that was chosen by the awards committee of Division I of the American Educational Research Association (AERA) "for Outstanding Research Publication of 1996 focusing on education for the professions" (AERA, 1997, p. 39).

The essence of Hammond's original CCT is its five basic premises, listed below (also see Hammond, 2000). Page references are from Hammond (1996). Our proposed extension of CCT, which we call CCT II, consists of the five premises of CCT plus two additional premises. We believe the additional premises are fully consistent with the spirit of Hammond's approach to theory. Hammond's insights into the development of SJT and CCT were profound, and we believe it will be useful to reexamine and build upon those insights.

Premise 1: A Cognitive Continuum.

Various modes, or forms, of cognition can be ordered in relation to one another on a continuum that is identified by intuitive cognition at one pole and analytical cognition at the other. (p. 147)

Premise l rejects the dichotomous view of analysis and intuition (also known as dual systems theory). According to Hammond (1996, p. 149), "The idea of a cognitive continuum challenges the age-old tradition of a dichotomy between intuition and analysis; in fact, it denies the validity of that dichotomy." Acknowledgment of a continuum between analysis and cognition permits discussion of modes of cognition lying between the two poles.

The *intuitive-analytic* continuum is a core concept in CCT. Our proposed coherence, correspondence, and representative design continua will be discussed with respect to the *intuitive-analytic* continuum.

We noted above the centrality of the *intuitive-analytic* continuum to CCT. Given the complexities introduced by conceptualizing coherence, correspondence, and representative design, we believe that it is incumbent on us to expand on the conception of the *intuitive-analytic* continuum. The basic expansion that we propose focuses on application of the *intuitive-analytic* continuum to potential investigations in various stages of conceptualization.

We have one more necessary comment about the expansion of *intuitive-analytic* continuum. The potential investigations must be multifaceted so that the principles and knowledge in the three proposed continua can be used to modify the planned investigation. We note that the principle of quasirationality implies that the representations on the *intuitive-analytic* continuum and the other continua involved are in essence multifaceted. In order for the scheme to work, the representations of the proposed study are assumed to be multifaceted, or better, to have multiple components. Such proposals can be more easily modified and improved by reference to the continua introduced in CCT II. Note also that the various components of the proposed studies may be differentially intuitive or analytic, as seems likely in proposals that would qualify as quasirational.

Premise 2: Common Sense

The forms of cognition that lie on the continuum between intuition and analysis include elements of both intuition and analysis and are included under the term quasirationality. This form of cognition is known to the layperson as "common sense." (p. 150)

Quasirationality (common sense) is cognition incorporating elements of both intuition and analysis. The term quasirationality was used by Brunswik (1952, pp. 23–24) in discussing the system which a person uses to perceive the environment. In the context of CCT, quasirationality is a blend of intuitive and analytical cognition, having neither greater nor lesser importance than pure analytical or intuitive cognition. The issue of importance or status among modes of cognition is a major consideration within CCT. For those who would claim superiority of analytical cognition over intuition, we agree with Cooksey (1996, p. 16) who says that "analytical cognition and that in order to completely understand human cognition, we must understand the relationships between cognition and the task ecology within which it must operate."

Premise 3: Theory of Task Structure

Cognitive tasks can also be ordered on a continuum with regard to their capacity to induce intuition, quasirationality, or analytical cognition. (p. 180)

Serious consideration of the structure of the environment or ecology in which organisms' function is a major tradition within the area of research on perceptual and social judgment processes known as lens model functionalism or SJT (see *The essential Brunswik: Beginnings, explications, applications* by Hammond & Stewart, 2001). This tradition began with Brunswik (1952, 1956) when he insisted that ecological systems be studied in parallel with cognitive systems, using a research methodology called representative design. The idea that cognitive tasks can be ordered on a continuum with regard to their capacity to induce intuitions, quasirationality, or analytical cognition is an outgrowth of Hammond's earlier work within the Brunswikian tradition and has serious implications for research efforts in the entire field of judgment and decision processes.

Premise 4: Dynamic Cognition

Cognitive activities may move along the intuitive-analytic continuum over time; as they do so, the relative contributions of intuitive and analytical components to quasirationality will change. Successful cognition maintains constancy with the task environment and inhibits movement; failure and loss of constancy stimulate movement. (p. 192)

People oscillate along the cognitive continuum over time, with the relative contributions of analysis and intuition shifting according to changing circumstances and tasks. Failure to solve a cognitive problem stimulates a shift toward either the analytical or intuitive pole of the continuum. According to Cooksey (1996, p. 21), Premise 4 moves "in direct opposition to the traditional view of intuition and analytical cognition as relatively stable cognitive styles." According to Hammond (1996, p. 196), "Although the empirical basis for oscillation is almost nonexistent, the rationale for its presence is intuitively compelling." In the discussion of CCT II Premise 6, we note that the truth criteria of coherence and correspondence share the property of dynamic cognition.

In a thorough treatment of Hammond's CCT, Hogarth (2001, p. 261) adds:

my amendment to the Hammond model would be to stress the role of learning. The fact that a task induces intuitive (i.e., tacit) processing does not mean that this will necessarily be more effective than deliberate thought. For example, many stimuli or tasks can induce stereotypic reactions. But it takes active thought to question whether stereotypes are justified and to correct initial impressions if these are misguided. (p. 261)

Learning influences oscillation along the *intuitive-analytic* continuum as well as pattern recognition and use of functional relations.

Premise 5: Pattern Recognition and Functional Relations

Human cognition is capable of pattern recognition and the use of functional relations. (p. 196)

The ability to learn and utilize functional relations among indicators has long been studied and recognized as essential to correspondence competence. Hammond describes the seldom recognized relation between pattern recognition and coherence competence:

Pattern recognition has barely been touched by judgment and decision-making researchers. The present theory, however, asserts that cognition alternates between coherence-seeking (pattern-seeking) and correspondence-seeking explanations—that is, seeking functional relations between indicators and targets. (p.201)

Pattern seeking and pattern recognition are useful cognitive activities when employed in appropriate circumstances—that is, on tasks that offer coherence either through our natural capacities or through our training capacities to do so. (p. 198)

Premise 6 (proposed): Coherence and correspondence are psychological continua.

Coherence and correspondence criteria for truth are psychological continua that affect research design and interpretation.

Coherence refers to principles. Correspondence refers to observations. Coherence is defined by the agreement among principles that govern the investigation at hand and with those principles that constitute the received view in the field. Correspondence is defined by the agreement between predicted observations and actual observations. Hammond brought these metatheories to the attention of JDM scientists in *Human Judgment and Social Policy: Irreducible Uncertainty Inevitable Error, Unavoidable Injustice* (Hammond, 1996). He wrote that "*Two grand metatheories have been persistent rivals in the history of science in general and in the history of research in judgment and decision making*" (p. 95). He argued that tasks used in JDM studies can be easily classified as those evaluating human performance according to coherence or correspondence principles, and that classification helps us understand their methods and results. We will quote extensively from Hammond's 1996 book.

Correspondence theory focuses on the empirical accuracy of judgments, irrespective of whether the cognitive activity of the judge can be justified or even described. Although correspondence researchers may be interested in describing the processes that produce the judgments, they rarely inquire into the question of whether these processes are rational, that is, conform to some normative, or prescribed, model of how a judgment ought to be reached. (p. 106)

Coherence theorists have opposite interests; they examine the question of whether an individual's judgment processes meet the test of rationality -- internal consistency -- irrespective of whether the judgment is empirically accurate. Indeed, no test of empirical accuracy may be available in principle or fact. (p. 106)

In short, correspondence theorists are interested in the way the mind works in relation to the way the world works, while coherence theorists are interested in the way the mind works in relation to the way it ought to. (p. 106)

Hammond clearly sees coherence and correspondence as a dichotomy, that is, research programs and studies can be classified as one or the other, but not both. However, he also stresses the importance of complementarity. For example:

The tension between coherence and correspondence, however, cannot be resolved by compromise; one replaces the other in entirety. But these two meta theories can enjoy peaceful coexistence, and that coexistence can be, and should be, constructive. Each may compete for our attention and our energy even our treasure (as they have), but given the successful history of each, there is no need for researchers or policymakers to deny the value of one or the other and although compromise cannot be achieved, there is always the grand goal of <u>complementarity</u> but that would require that the researcher and policymaker alike be able to comprehend which meta theory is being proposed on which occasion. (p. 218, emphasis in original)

We disagree with Hammond's view that studies can use one or the other, but not both. Scientists are capable of using both coherence and correspondence in their research, and often do. Furthermore, complementarity can only be achieved using both. Complementarity is a complex concept, and we will not attempt to address it fully here, but we will reject his "one or the other" view and replace it with the recognition that correspondence and coherence should both play important roles in any study, and usually do. Furthermore, we argue below that each can be present to a degree and therefore must be considered continua.

There are discussions of coherence and correspondence in philosophical and scientific literature (e.g., Dawson & Gregory, 2009; Dunwoody, 2009; Polonioli, 2015). There is considerable consensus in the literature that coherence and correspondence are fundamental concepts, that both are important in the science of JDM, and that coherence is often crucial in achieving correspondence. According to Collins et al. (2023, p. 2), recent findings "show that coherence and correspondence may, in fact, be strongly related. More importantly, decision makers can exploit knowledge of the former to improve the latter."

Mosier (2009) considers both coherence and correspondence as goals of cognition and also as strategies used to achieve both of these goals. She writes:

The goal of correspondence is empirical, objective accuracy in human judgment. A correspondence strategy entails the use of multiple fallible indicators to make judgments about the natural world. A pilot, for example, uses a correspondence strategy when checking cues outside the cockpit to figure out where he or she is, or judging height and distance from an obstacle or a runway. Correspondence competence refers to an individual's ability to correctly judge and respond to multiple fallible indicators in the environment (e.g., Brunswik, 1956; Hammond, 1996, 2000, 2007), and the empirical accuracy of these judgments is the standard by which correspondence is evaluated. (p. 154)

The goal of coherence, in contrast, is rationality and consistency in judgment and decision making. Using a coherence strategy, a pilot might evaluate the information displayed inside the cockpit to ensure that system parameters, flight modes, and navigational displays are consistent with each other and with what should be present in a given situation. Coherence competence refers to the ability to maintain logical consistency in judgments and decisions. Coherence is not evaluated by empirical accuracy relative to the real world; what is important is the logical consistency of the process and resultant judgment (Hammond, 1996, 2000, 2007). (pp. 154-155)

We propose reconceptualizing the two philosophical theories of truth in psychological terms and adding them to CCT II as two psychological continua. We label two poles of the coherence continuum *Chaos* and *Coherence*. The two poles of the correspondence continuum we label *Irrelevance* and *Correspondence*. We believe this is well within the spirit of Hammond's conception. We add here that tasks may elicit activation on truth (coherence and correspondence) continua in different ways.

If you assume that the metatheory of coherence is all or none, how can you explain how often you have felt "*I'm almost there*" when working on understanding something about reality? How often have you thought "*That's it I have it*" – only to realize an hour, day, or later that you never did

have it? How often have you been convinced that you had understood something until you started to put it on paper and found that you just couldn't do it? These behavioral phenomena implicate movement on the coherence continuum even as they trigger movement on the *intuitive-analytic* continuum. They describe a thinker who understands a conception to be true and then realizes that it may be or is incorrect. That means that the scientist's criterion for truth in this case has changed. It means that his or her metatheory of truth in this case is not fixed and immutable. It is a continuum.

There is a technical argument supporting the idea that the two theories of truth as they relate to judgment and decision research are continua. It is that the criteria used by judgment researchers to evaluate research results are themselves continua. Ward Edwards conducted decades of elegant decision analysis and research, both theoretical and applied (see Weiss & Weiss, 2009). A basic theoretical underpinning of decision analysis, and model of study design, is Bayes' theorem, which is intrinsically continuous. SJT investigators typically employ correlation coefficients to measure coherence and correspondence (using R_s and r_a to assess coherence and correspondence of a study participant). Of course, correlation coefficients are intrinsically a continuous variable.

We make one final point on this issue. Perfect coherence, for example, is impossible. But conceptualizing the truth criteria as continua rather than as all or none allows us to see an investigation with less than a perfect level of coherence or correspondence as pragmatically useful rather than as having a fatal flaw.

We don't claim that working scientists explicitly consider coherence and correspondence when they design studies and interpret results. Rather, we consider them psychological continua that implicitly or explicitly influence how SJT scientists do their work. We have limited (and mostly introspective) access to the way scientists think (see Tweney et al., 1981), our evidence is limited to the research designs and interpretations of results produced by such thinking.

Premise 7 (proposed): Representative design is a continuum.

The representative design continuum refers to the ability of a design to support generalizations to a specific environment of interest by representing important characteristics of that environment. It is based on a central tenet of Brunswik's probabilistic functionalism.

The two poles of the continuum are *Environment Ignored* and *Environment Represented*. At one pole (end) of this continuum (environment ignored), scientists specify a phenomenon with no attention to the environment. At the other pole (environment represented), scientists specify the environment and include all the important features of that environment in their study. Representation means that the study is a model of the environment. At one end, there is no model. At the other, the model is a "good" match to the environment. "Good" is a judgment about whether the properties of the environment that influence the phenomenon being studied (judgment, in our case) are included.

For a thorough review of representative design, see Dhami, Hertwig, and Hoffrage (2004; Dhami, 2011), see also Katsikopoulos (2009), Kirlik (2010, 2012, 2018), and Mosier (2009) for details concerning pros and cons of representative design. We will summarize two examples below.

An invited editorial in Simulation in Healthcare by Alex Kirlik concerns a research paper by Nadler et al (2010) about clinicians' abilities to accurately and reliably make judgments of Apgar scores (clinical conditions of newborns). The article was the first to introduce readers of Simulation in Healthcare to Egon Brunswik's theory of probabilistic functionalism and methodology of representative design (2010, p. 255). Authors of the research were meticulous in designing, producing, and validating 50 video recordings of neonatal resuscitation scenarios generated by a simulator (Laerdal SimNewB) and based upon computerized (representative) birth records of the five cues comprising an Apgar score (heart rate, breathing, blood saturation, muscle tone, and vocal sound). In each video, a neonate patient (mannequin) was provided treatment by a professional medical team. Each video recording lasted approximately 2 minutes (see Nadler et al., 2010, for details). Intended Apgar scores generated by the simulator were verified by judgments of expert clinicians before use in the research project. In the actual study, 17 clinicians (doctors and nurses) viewed and judged 30 of the original 50 scenario recordings, with rest breaks after sets of 10. Results were quite positive. Kirlik strongly endorsed the representative design of the Nadler et al. research and concluded that the "finding that increased levels of representativeness [emphasis added] allowed clinicians to demonstrate their competence adds another data point confirming Egon Brunswik's insights into the importance of representative design in psychological research" (Kirlik, 2010, p. 258). Kirlik appears to acknowledge that representative design is a continuous variable.

Importantly, representative design is not a silver bullet: it does not tell us how to design an experiment or simulation (i.e., it does not specify what aspects of a clinical situation are important to preserve in the research or training context). Instead, as a methodology, it is a process toward which a scientific community can collectively learn, from empirical evidence, to discover what those aspects are. In research, if findings relating to clinical judgment intended to generalize to some particular class of situations (e.g., making Apgar ratings) are found not to generalize to another situation in that class, then one has discovered information on the inadequacy of the original research and a need to refine the relevant situational aspects accordingly. In training, if learning does not effectively transfer from the training context to the target, clinical context of performance, one has similarly gained information on the inadequacy of the original training context and a need to refine the indequacy of the original training context and a need to refine the indequacy of the original training context and a need to refine the similarly gained information on the inadequacy of the original training context and a need to refine (typically enrich, but in some instances impoverish) the relevant situational aspects to improve training effectiveness. (Kirlik, 2010, p. 257)

Mosier (2009) traces the evolution of the aircraft cockpit as an example of the transformation of a probabilistic environment into an ecological hybrid. She defines ecological hybrid as an environment characterized by both probabilistic and deterministic features and elements. Mosier (2009) claims that:

As technology has changed the nature of cues and information available to the pilot, it has also changed the strategies and tactics pilots must use to make judgments successfully. I make the case that judgment and decision making in a hybrid ecology requires coherence as the primary strategy to achieve correspondence, and that this process requires a shift in tactics from intuition toward analysis. The recognition of these changes carries implications for research models in high-technology environments, as well as for the design of systems and decision aids. (p. 154) Because the hybrid ecology functions in and is subject to the constraints of the physical world, correspondence is still the ultimate goal of judgment and decision making. However, because the hybrid ecology is characterized by highly reliable deterministic systems, strategies and tactics to achieve correspondence will be different than those in a probabilistic ecology. (2009, p. 159)

If correspondence in judgment and decision making in the hybrid ecology is accomplished primarily through the achievement of coherence, then it is important to examine whether the features and properties of the environment elicit the type of cognition required. (2009, p. 160)

This is precisely why representative design of research is important for research, development, and training. According to Dhami et al. (2004 p. 963), "Brunswik (1944) himself proposed that it is 'generally possible' and 'practically often very desirable' (p. 42) to use a hybrid design in which the researcher introduces certain elements of systematic design into an experiment in which a representative design is used."

Implications for research design and evaluation

The coherence continuum. One useful function of the coherence continuum is to provide comparisons among possible proposals and research projects with examples of related research studies, especially examples that the scientist has judged as excellent and worth knowing. The rigorous processes of becoming a scientist and doing science leads to the development and internalization of a graduated and flexible set of criteria for good science. The coherence continuum is concerned with how research under consideration makes sense (coheres) both internally and externally with respect to the larger scientific enterprise.

An important question to be asked here is what is supposed to cohere with what? That question has answers at multiple levels. A good scientific theory or research contribution ought to cohere with all the received knowledge in the field and related fields. As Dunwoody (2009, p.117) put it "Theories must be coherent. That is, theories cannot be self-contradictory and generally, they must be consistent with other widely held beliefs within that scientific community." We certainly agree, but that statement was not meant as a measurable cognitive goal. Dunwoody's assertion that theories must be consistent with other widely held beliefs might be termed global coherence, which we believe is typically a desired characteristic of contemporary science. Scientific theory and research take advantage of millennia of progress not only in the sense of the vast amount of scientific knowledge accessible with current information technology, but also in the sense of the very modes of thought that we call scientific thinking, including the metatheories of truth. Much of today's science has global coherence largely because science is a set of social enterprises knit together by marvels of technology. What we are mainly concerned with in this paper might be called *local coherence*. The assumptions and principles defining a scientist's work must agree among themselves and with those of the received view in the area in which the scientist is working. Of course, the received view may be wrong. Scientific revolutions do occur (Kuhn, 1962).

Another level of local coherence involves the agreement among all the attributes of the research or theory at hand. As noted above, we assume that an individual scientist has internalized a set of principles defining or describing the principle of coherence as it applies in his or her field. Today's scientist does not start out at the chaos end of the truth continuum, even if the problem is new. In some fields a mathematical model may already be available to be adapted or exploited. It is not news to any reader of this paper that scientists often struggle for a considerable time to come up with coherent theories and good experiments. Efforts may be assessed by comparing possibilities on the coherence continuum. Easily dismissed are scientific claims that rest on propositions that are not coherent. The coherence continuum stretches all the way from chaos to formal mathematical or logical models.

The correspondence continuum. A useful function of the correspondence continuum is to serve as a standard of successful science, as with the correspondence continuum. Potential research projects on the *intuitive-analytic* continuum can be compared with projects that have demonstrated high correspondence. As with the coherence continuum, we attribute the development of this continuum to the rigorous processes of becoming a scientist and practicing one's craft. That is, a scientist has internalized a set of examples with acceptable outcomes that support the expectation that the proposed project may well be worth doing.

A proposed experiment may be based on theory, on similar experiments in the relevant literature, on pilot studies, etc. The conditions of the research and the hoped for results are then matched to the relevant study or studies. Possible studies that appear to fall near the extreme irrelevance end of the scientist's correspondence continuum are easily dismissed as not worth doing. The other extreme end of the continuum involves a situation in which the evidence of potentially important outcomes is overwhelmingly positive. Much interest in scientific thinking lies between the two ends of the continuum, nearer the upper end. It is there that most of the work of science is done and that science progresses.

We have quasirational mixes of analytic and intuition on the *intuitive-analytic* continuum, and we may also have quasirational mixes of analytic and intuitive cognition on the correspondence continuum. That is, we may have quasirational cognition on what is and on what makes science to start with and what makes a study worth doing.

We believe that it is almost self-evident that correspondence is a matter of degree. As we argued above, the statistical tools for analyzing JDM research yield continuous results. The very notion that science progresses means that at one time the scientific community holds that the criterion for truth has been met, but then new kinds of thinking or new information surfaced, and revision of understanding on the *intuitive-analytic* continuum begins. Movement on one or both of the truth continua (coherence and correspondence) may commence. The concept of continua leaves open the idea that a potential solution may be good or very good yet not perfect.

A widely accepted statement about the nature of science is that all scientific knowledge is tentative. Our truth continua are consistent with that maxim.

The representative design continuum. Every SJT researcher considers the degree of representativeness appropriate for his/her research design. With the objectives of coherence and correspondence in mind, hybrid designs mentioned above (Kirlik, 2010; Mosier, 2009) may enable us to address more complex research questions. Mosier and Fischer (2010) comment:

Because "good" decision making in hybrid ecologies must be both coherent (in the electronic world) and accurate (in the physical world), proficient decision making in these environments involves knowing which strategy is appropriate in a given situation. As yet, the optimal combinations of recognition and analysis, and of coherence and correspondence strategies, are not known. The proliferation of hybrid ecologies in decision domains (particularly those domains in which teams operate) offers perhaps the greatest future challenge in decision-making research. (p. 184)

Decision making in human factors must be studied in context. Laboratory studies, the traditional approach in early work, can give insights on specific microaspects of judgment and decision making, but they alone cannot provide viable predictions of how operators will perform in dynamic environments. Rather, as exemplified by the research cited in this chapter, a range of methodological tools for investigating decision making should be employed with the goal of converging results at varied levels of context fidelity. These include lab studies in which factors and variables replicate aspects of the environment, archival analyses of accidents and incidents, simulations of varying fidelity, synthetic environments, and field studies. At all levels, it is important to match the features of the tasks as closely as possible to the formal properties of the environment (Hammond, 1993). (Mosier and Fischer. 2010, p. 176)

A body of literature exists in the area of engineering design to aid decision making, including several chapters in Reviews of Human Factors and Ergonomics volumes ... Technological innovations to enhance decision making must be based on correct assumptions about human judgment processes and about how people think (Maule, 2009), and they should provide support for both coherence and correspondence as well as for requirements at the front and back ends of decision making. (p. 236)

Lynn Miller and colleagues (2019a) introduced a hybrid *systematic representative design* that takes advantage of virtual reality. Miller et al. (2019b), in a reply to commentaries to their earlier introduction suggest that, in virtual environments,

we might expect that top-down processes will play particularly significant roles in social interaction, but proximal cues could as well, especially if they are incompatible with topdown predictions. Imagine we had highly representative environments that allowed us to ascertain (e.g., via eye tracking) when people were considering what cues; we might begin to see patterns of a given participant's proximal cue attention, use (and weights) as predictive of "top down" and "bottom up" cue utilization following, for example, prediction surprise. (p. 252)

The Interaction Between Continua

The primary interactions between the *intuitive-analytic* continuum and the two truth continua have been mentioned in passing above. That interaction involves comparison of a proposed research study with one or more alternative studies on either or both truth continua. Comparison with the coherence continuum is done with the goal of deciding whether a proposed study on the *intuitive-analytic* continuum meets a key scientific standard of whether the study is properly designed and is both internally consistent and consistent with the larger body of knowledge to which it should

fit. Coherence is a *sine qua non* of acceptability. Local coherence should be a relatively straight forward achievement. Global coherence is harder to even conceptualize. It is hard enough to know one's own area of expertise, and so we see global coherence largely as an unattainable ideal for the JDM community. The incommensurability between the research agendas of several major investigators is only too well known. Psychology has yet to have its Newton, who showed that the same laws governed terrestrial and celestial motion.

Comparison of a proposed study with the correspondence continuum is a very different issue. We believe that there is widespread though not perfect agreement on what constitutes coherence but far less agreement on what the standard for correspondence is. Thinking of correspondence in terms of matching to reality is not enough; different investigators use different measures of reality.

Representative design should always be a consideration when doing research and developing training programs. We hypothesize that scoring high on representativeness (*environment represented*) promotes both coherence and correspondence.

Evaluation of CCT II

First, note that CCT II is a proposed theory based on our conception of how SJT scientists think. It also has implications for practice. Given that no experimental operations are involved, the otherwise ubiquitous call for operational operations is relevant to its evaluation. An important form of evaluation would involve methods rarely if ever used in SJT research, that is, think aloud protocols (Ericsson & Simon, 1980, 1993; also see Hamm, 1988). Such research is normally time and labor intensive, but in this case, it could well be part of students' master's and doctoral research, with the students as subjects. We speculate that explicitly thinking and verbalizing about the issues on coherence, correspondence and representative design may have a positive impact on research design. Interestingly, it is in this activity that the potentially symbiotic relation between description of research and prescription for research becomes most clear.

Summary and Conclusion

We opened this paper by saying that our objective is to unite two metatheories of truth (coherence and correspondence) with Ken Hammond's original cognitive continuum theory (CCT) and Egon Brunswik's principle of representative design of scientific research. We have done so by incorporating these key principles into a theory of investigators' thinking. In the above pages we present an expanded version of Hammond's cognitive continuum theory (CCT). We call this expanded version Cognitive Continuum Theory II (CCT II). It includes Hammond's CCT but has additional features. The additional features include two new premises. Importantly, CCT II redefines as psychological continua certain ideas that have traditionally been conceived as fixed. One continuum, the *intuitive-analytic* continuum, is taken directly from CCT and made the engine of creativity in CCT II. In addition, we propose as continua the truth criteria of coherence and correspondence, and also Brunswik's representative design as it functions in the minds of researchers. CCT II assigns the latter three continua the role of turning a creative idea into a plan for research. We believe these continua represent what goes go on in the minds of researchers better than terms representing fixed concepts. We also believe that these continua are consistent with Hammond's general conceptual approach as exemplified by his *intuitive-analysis* continuum. We believe it is clear that coherence and correspondence metatheories ought to be treated as continua and that they can (and do) complement one another. Coherence and correspondence competence develop continually (Mosier, 2009). Movement on coherence triggers movement on the intuitive analysis continuum, as does movement on correspondence (see Premise 4). Movement on one continuum is likely to trigger movement on one or more other continua.

We also believe that representative design should be thought of (treated) as a continuum and that focusing on it as such will improve research design and evaluation, and also training protocols. To reiterate Kirlik (2010, p. 257), "*it is a process toward which a scientific community can collectively learn, from empirical evidence,* …"

We have speculated about possible advantages of uniting these metatheories and representative design with CCT. Such advantages have prescriptive implications. Investigators can deliberately step back and think explicitly of the coherence, correspondence, and the representative design continua during the design process. Investigators in their teaching and mentoring activities should urge students to follow suit.

In this short note we have, at best, taken a small step toward an extended version of CCT that could improve our understanding of the research design process and suggest ways to improve it. We have added premises and proposed new continua. Premise 6 adds metatheories of coherence and correspondence as psychological continua in CCT II. Premise 7 adds representative design as a CCT II continuum. We have argued that dimensions of research that traditionally have been treated as unitary should instead be considered as continuous. We have also argued that those continua must interact somehow to produce good research. But much is left to do. Descriptions of the continua should be further developed and perhaps measures of them could be invented. Interactions among the continua apply differently to the different mental processes involved in conducting research. In designing research, scientists engage in a number of tasks while solving a number of problems, such as formulating the research topic, designing tasks for subjects, selecting measures, choosing subjects, collecting and analyzing data, Finally, we hope that our contribution will help clarify thinking about research design.

Acknowledgments

We dedicate this paper to the memory of Kenneth Hammond. We thank our friends and colleagues Leonard Adelman, Neal Dawson, Phillip Dunwoody, Rob Hamm, Alex Kirlik, and Kathleen Mosier for their helpful and insightful comments on an earlier draft of this paper.

References

AERA. (1997). Annual Report. Educational Researcher, 26(6), 28–40.

Brunswik, E. (1944). Distal focusing of perception: Size constancy in a representative sample of situations. *Psychological Monographs*, *56*(254), 1–49. https://doi.org/10.1037/h0093505

Brunswik, E. (1952). The conceptual framework of psychology. Chicago: University of Chicago Press.

Brunswik, E. (1956). *Perception and the representative design of psychological experiments*. Berkeley: University of California Press.

Cooksey, R. W. (1996). Judgment analysis: Theory, methods, and applications. San Diego: Academic Press

- Collins, R. N., Mandel, D. R., Karvetski, C. W., Wu, C. M., & Nelson, J. D. (2023, June 19). The wisdom of the coherent: Improving correspondence with coherence-weighted aggregation. *Decision*. Advance online publication. https://dx.doi.org/10.1037/dec0000211
- Dawson, N. V. & Gregory, F. (2009). Correspondence and coherence in science: A brief historical perspective. *Judgment and Decision Making*, 4(2), 126–133. https://doi.org/10.1017/S1930297500002552
- Dhami, M. K. (2011). Representative design: A challenge for scientific psychology. In K. O. Moore, & N. P. Gonzalez (Eds.), *Handbook on psychology of decision-making*. Nova Science Publishers, Inc.
- Dhami, M. K., Hertwig, R., & Hoffrage, U. (2004). The role of representative design in an ecological approach to cognition. *Psychological Bulletin*, 130(6), 959–988. https://doi.org/10.1037/0033-2909.130.6.959
- Dunwoody, P. T. (2009). Introduction to the special issue: Coherence and correspondence in judgment and decision making. *Judgment and Decision Making*, 4(2), 113–115. https://doi.org/10.1017/S1930297500002539
- Ericsson, K., & Simon, H. (1980). Verbal reports as data. *Psychological Review*, 87(3), 215–251. https://doi.org/10.1037/0033-295X.87.3.215.
- Ericsson, K., & Simon, H. (1993). Protocol Analysis: Verbal reports as data (2nd ed.). Boston: MIT Press. ISBN 0-262-05029-3.
- Hamm, R. M. (1988). Moment-by-moment variation in experts' analytic and intuitive cognitive activity. *IEEE Transactions on Systems Man and Cybernetics*, 18(5), 757–776. https://doi.org/10.1109/21.21602
- Hammond, K. R. (1980). *The integration of research in judgment and decision theory* (Report 226). Center for Research on Judgment and Policy, University of Colorado, Boulder, CO.
- Hammond, K. R. (1981). *Principles of organization in intuitive and analytical cognition* (Report 231). Center for Research on Judgment and Policy, University of Colorado, Boulder, CO.
- Hammond, K. R. (1986). A theoretically based review of theory and research in judgment and decision making (Report 260). Center for Research on Judgment and Policy, University of Colorado, Boulder, CO.
- Hammond, K. R. (1987). Toward a unified approach to the study of expert judgment. In J. Mumpower, L. Phillips, O. Renn, & R. Uppuluri (Eds.), *Expert judgment and expert systems* (pp. 1–16). Berlin: Springer-Verlag.
- Hammond, K. R. (1988). Judgment and decision making in dynamic tasks. *Information and Decision Technologies*, 14, 3–14.
- Hammond, K. R. (1990a). Functionalism and illusionism: Can integration be usefully achieved? In R. Hogarth (Ed.), *Insights in decision making: A tribute to Hillel J. Einhorn*. Chicago: University of Chicago Press.

- Hammond, K. R. (1990b). Intuitive and analytical cognition: Information models. In A. Sage (Ed.), Concise encyclopedia of information processing in systems and organizations (pp. 306–312). Oxford: Pergamon Press.
- Hammond, K. R. (1993). Naturalistic decision making from a Brunswikian viewpoint: Its past, present, future. In G. A. Klein, J. Orasanu, R. Calderwood, & C. E. Zsambok (Eds.), *Decision making in action: Models and methods* (pp. 205–227). Norwood, N. J.: Ablex.
- Hammond, K. R. (1996). *Human judgment and social policy: Irreducible uncertainty, inevitable error, unavoidable injustice.* New York: Oxford University Press.
- Hammond, K. R. (2000). Judgments under stress. New York: Oxford University Press.
- Hammond, K. R. (2007). *Beyond rationality: The search for wisdom in a troubled time*. New York: Oxford Press.
- Hammond, K. R., & Stewart, T. R. (Eds.). (2001). *The essential Brunswik: Beginnings, explications, applications*. New York: Oxford University Press.
- Hogarth, R. M. (2001). Educating Intuition. Chicago: University of Chicago Press.
- Katsikopoulos, K. V. (2009). Coherence and correspondence in engineering design: Informing the conversation and connecting with judgment and decision-making research. *Judgment and Decision Making*, 4(2), 147–153. https://doi.org/10.1017/S1930297500002588
- Kirlik, A. (2010). Editorial: Brunswikian theory and method as a foundation for simulation-based research on clinical judgment. (Invited). Simulation in Healthcare, 5(5), 255–259. https://doi.org/0.1097/SIH.0b013e3181f12f03
- Kirlik, A. (2012). An overview of human factors. In S. W. J. Kozlowski (Ed.), *The Oxford Handbook of Organizational Psychology*. New York: Oxford University Press.
- Kirlik, A. (2018). Automation and adaptive behavior. Journal of Cognitive Engineering and Decision Making, 12(1), 70–73.
- Kuhn, T. S. (1962). The Structure of Scientific Revolutions. Chicago: University of Chicago Press.
- Maule, J. (2009). Can computers help overcome limitations in human decision making? In Proceedings of NDM9, the 9th International Conference on Naturalistic Decision Making (pp. 10-17). London: British Computer Society.
- Miller, L. C., Jeong, D. C., Wang, L., Shaikh, S. J., Gillig, T. K., Godoy, C. G., Appleby, P. R., Corsbie-Massay, C. L., Marsella, S., Christensen, J. L., & Read, S. J. (2019b). Systematic representative design: A reply to commentaries. *Psychological Inquiry*, 30(4), 250–263.
- Miller, L. C., Shaikh, S. J., Jeong, D. C., Wang, L. G., Traci K., Godoy, C. G., Appleby, P. R., Corsbie-Massay, C. L., Marsella, S., Christensen, J. L., & Read, S. J. (2019a). Causal inference in generalizable environments: Systematic representative design. *Psychological Inquiry*, 30(4), 173–202.

- Mosier, K. L. (2009). Searching for coherence in a correspondence world. *Judgment and Decision Making*, 4(2), 154–163. https://doi.org/10.1017/S193029750000259X
- Mosier, K. L., & Fischer, U. M. (2010). Judgment and decision making by individuals and teams: Issues, models and applications. In D. Harris (Ed.), *Reviews of Human Factors, Volume 6* (pp. 198–256). Santa Monica, CA: Human Factors and Ergonomics Society. Reprinted in D. Harris & W. Li (Eds., 2015). *Decision making in aviation* (pp. 139–197). Burlington, VT: Ashgate.
- Nadler, I., Liley, H. G., & Sanderson, P. M. (2010). Clinicians can accurately assign Apgar scores to video recordings of simulated neonatal resuscitations. *Simulation in Healthcare*, 5, 204–212. https://doi.org/10.1097/SIH.0b013e3181dcfb22
- Polonioli, A. (2015). The uses and abuses of the coherence-correspondence distinction. *Frontiers in Psychology*, 6, Article 507. https://doi.org/10.3389/fpsyg.2015.00507
- Tweney, R. D., Doherty, M. E., & Mynatt, C. R. (Eds.). (1981). *On scientific thinking*. New York: Columbia University Press.
- Weiss, J. W., & Weiss, D. J. (Eds). (2009). A science of decision making: The legacy of Ward Edwards. New York: Oxford University Press.

THE BRUNSWIK SOCIETY

STAY CONNECTED

Visit the Brunswik Society website at https://brunswiksociety.org/.

To receive information about the Society's annual meeting and newsletter, email info@brunswiksociety.org.

Follow us on Twitter! @BrunswikThe