COURSE EVALUATION

 Please take 5 minutes and complete the course evaluation for History of Psychology! We will discuss the results next week.





History of Psychology

Session 10: Decision science

Loreen Tisdall, Center for Cognitive and Decision Sciences December 1, 2025

Session information

Sessions take place Mondays, 8.15-9.45, Chemie, Organische, Grosser Hörsaal OC.

#	Date	Topic	Instructor
1	22.09.2025	Session 1: What kind of science is psychology?	Mata
2	29.09.2025	Session 2: The birth of psychology	Mata
3	13.10.2025	Session 3: Psychoanalysis	Mata
4	20.10.2025	Session 4: Behaviorism	Mata
5	27.10.2025	Session 5: Gestalt psychology (cancelled)	Mata
6	03.11.2025	Session 6: Cognitive psychology	Mata
7	10.11.2025	Session 7: Psychology today	Tisdall
8	17.11.2025	Session 8: Psychotherapy research	Tisdall
9	24.11.2025	Session 9: Psychological testing	Tisdall
10	01.12.2025	Session 10: Decision science	Tisdall
11	08.12.2025	Session 11: What kind of science is psychology? (revisited)	Tisdall
12	15.12.2025	Session 12: Exam	

Information regarding (mock) exam

- → Mock exam (without solutions) will be released via ADAM until the end of today
- → Solutions to the mock exam will be posted on ADAM on Friday
- → We will open up an **ADAM forum for questions regarding the mock exam** (1.12. 10.12.)
 - -> send us your questions on the forum until 10.12. and we will respond

→ Exam venues:

- Surnames A-N: Chemie, Organische, Grosser Hörsaal OC, St. Johanns-Ring, 4056 Basel
 − First family-name starts with "A" up to and including "N"
- Surnames 0-Z: Vesalianum Seiteneingang, Grosser Hörsaal (EO.16), Vesalgasse 1, 4051 Basel
 First family-name starts with "N" up to and including "Z"
- Please check ADAM for further information!



RECAP S9 - Psychological Testing



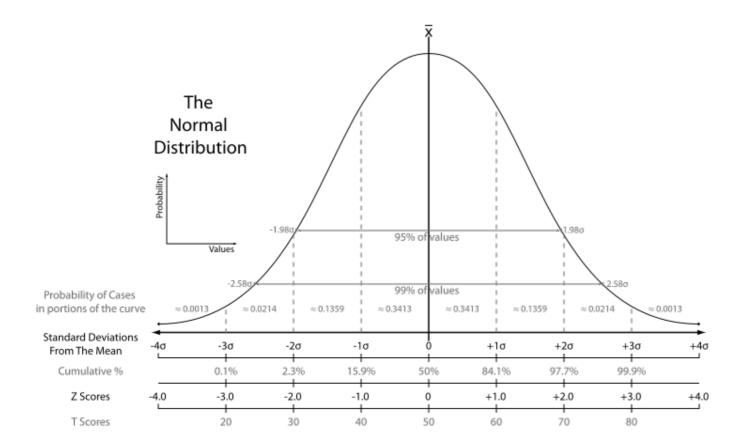
Consensus: Definition and testing of intelligence

25-point consensus on intelligence and testing

"1. Intelligence is a very general mental capability that, among other things, involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience. It is not merely book learning, a narrow academic skill, or test-taking smarts. Rather, it reflects a broader and deeper capability for comprehending our surroundings—"catching on," "making sense" of things, or "figuring out" what to do."

Wechsler Intelligence Scales

- The Wechsler scales were not revolutionary in the tests used (a lot of them were copied from other extant scales, as we have seen already)! The main innovation was the use of the point scale (rather than a chronological age scale as in Stanford-Binet scales)
- This allowed assigning points to each item and thus items to be grouped according to content. The scale thus also allowed testers
 to obtain multiple scores for each individual.
- The point scale transformed how intelligence was measured and interpreted, providing a multidimensional perspective on cognitive abilities.



Standard Deviation

Modern IQ (e.g., from Wechsler scales) is a deviation metric:

- Normal distribution with a mean of 100, and a standard deviation of 15
- → 68.2% of the population have an IQ between 85 and 115
- → About 0.1% of the population have an IQ above 145
- → Test your understanding: Which IQ score lies 2SD below the mean?

RECAP S9 - Psychological Testing



Consensus: Definition and testing of intelligence

Consensus: Predictive validity of intelligence tests

More consensus on intelligence and testing

Table 1
Predictive Validity for Overall Job Performance of General Mental Ability (GMA) Scores
Combined With a Second Predictor Using (Standardized) Multiple Regression

	Validity (r)	Multiple R	Gain in validity from adding supplement	% increase in validity	Standardized regression weights	
Personnel measures					GMA	Supplement
GMA tests ^a	.51					
Work sample tests ^b	.54	.63	.12	24%	.36	.41
Integrity tests ^c	.41	.65	.14	27%	.51	.41
Conscientiousness tests ^d	.31	.60	.09	18%	.51	.31
Employment interviews (structured) ^e	.51	.63	.12	24%	.39	.39
Employment interviews (unstructured) ^f	.38	.55	.04	8%	.43	.22
Job knowledge tests ^g	.48	.58	.07	14%	.36	.31
Job tryout procedureh	.44	.58	.07	14%	.40	.20
Peer ratings ⁱ	.49	.58	.07	14%	.35	.31
T & E behavioral consistency method ^j	.45	.58	.07	14%	.39	.31
Reference checksk	.26	.57	.06	12%	.51	.26
Job experience (years) ¹	.18	.54	.03	6%	.51	.18
Biographical data measures ^m	.35	.52	.01	2%	.45	.13
Assessment centers ⁿ	.37	.53	.02	4%	.43	.15
T & E point method ^o	.11	.52	.01	2%	.39	.29
Years of education ^p	.10	.52	.01	2%	.51	.10
Interests ^q	.10	.52	.01	2%	.51	.10
Graphology ^r	.02	.51	.00	0%	.51	.02
Age ^s	01	.51	.00	0%	.51	01

→ Meta-analyses provide evidence that general intelligence tests (i.e., general mental ability) have predictive validity in the real world, such as in predicting job performance (also other outcomes like job-related learning)!

Learning Objectives for Today

- Identify utility as an important concept in Psychology and Economics
- Understand key commonalities and differences between models of choice under uncertainty

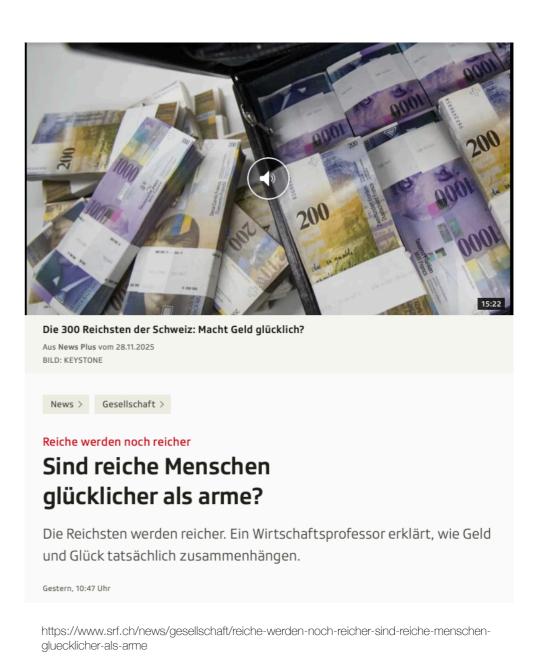
Your turn!



Does money make you happier?

Your turn!





How do humans make choices?

Decision science: general idea & motivation



Decision science: useful terminology

- Field of study into how decisions 1) should optimally (rationally) be made (normative), 2) are made (descriptive), and 3) how to bridge the two (prescriptive)
- Multi / interdisciplinary field that includes psychologists, engineers, economists, mathematicians, philosophers, statistics, marketing, amongst others
- A key aspect in decision science is trying to understand decision-making under uncertainty (uncertainty regarding outcome magnitudes, probabilities, directions, temporal aspects)
 - → Distinction between **risk** (outcomes and their probabilities are given or can be ascertained; e.g., roll of a die) versus **Knightian uncertainty** (ambiguity; outcomes and their probabilities are not given and cannot be ascertained, e.g., impact of Artificial General Intelligence)
 - → Addresses **deviations from rational models** when navigating uncertainty (e.g., how cognitive limitations, heuristics, and biases influence decision-making when faced with incomplete or ambiguous information)

Normative, descriptive, and prescriptive models

NORMATIVE: How should ultra-intelligent, super-rational people make decisions?

- Sets out how to make optimal (instead of actual) decisions
- The profession of economists

DESCRIPTIVE: How do people actually make decisions?

- Account for and explain decisions
- The profession of psychologists

PRESCRIPTIVE: How can better decisions be made?

- Integration of descriptive and normative perspectives (creating a bridge!)
- The profession of practitioners and engineers

From normative to descriptive models

Expected Value Theory (EVT)

Normative Origins and Rational Foundations

- **1654:** Attempting to solve the "problem of points", Blaise Pascal and Pierre de Fermat propose EVT as one of the earliest mathematical approaches to decision-making under uncertainty (birth of probability theory!)
- Includes the notion of expected value, EV: a choice was thought rational if it maximized EV
- EV = "the product of the probability of an outcome and the value of that outcome" (sum of products for multiple outcomes)

Expected Utility Theory (EUT)

Expected Utility and Risk Preferences

Prospect Theory (PT)

Behavioral Insights and Real-World Choices

Integration of value and probability

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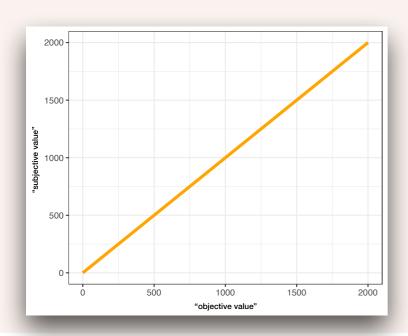
Behavioral Insights and Real-World Choices

Example for 2 options

$$EV = p_1^*x_1 + p_2^*x_2$$

 $EV = 0.5^*100 + 0.5^*0 = 50$

Value function x is linear



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Expected Utility Theory (EUT)

Expected Utility and Risk Preferences

 1738: Daniel Bernoulli publishes Exposition of a New Theory on the Measurement of Risk, the foundation for EUT, but originally received little attention

Prospect Theory (PT)

Behavioral Insights and Real-World Choices

Daniel Bernoulli





Bernoulli Network for the Behavioral Sciences

About

Bernoulli Lectures

Bernoulli Workshops

Symposium on Risk



Welcome to the Bernoulli Network for the Behavioral Sciences!

The Bernoulli Network for the Behavioral Sciences is a joint initiative of the **Faculty of Psychology** and the **Faculty of Business and Economics** of the University of Basel, with the aim of fostering interdisciplinary dialogue in the behavioral sciences. The initiative honours the polymath Daniel Bernoulli (1700-1782) who contributed greatly to conceptions of utility and risk that are central to Psychology, Economics, and related disciplines.

The Bernoulli Network organises the > Bernoulli Lectures for the Behavioral Sciences, annually honouring a researcher who has contributed significantly to the development of the behavioural sciences, and the > Bernoulli Workshops, a set of yearly workshops allowing researchers in the behavioural sciences at the University of Basel to present and discuss their work and establish interdisciplinary collaborations. In addition, the Bernoulli Network organizes other special interest events related to the behavioural sciences, such as the > Bernoulli Symposium on Risk (2017) or > WIDS Basel (Women in Data Science Basel Conference, 2019).

The Bernoulli Network was initiated by Prof Dr. > Ralph Hertwig in 2010 (now Director of the Center for Adaptive Rationality, Max Planck Institute for Human Development, Berlin) and currently involves Prof. Dr. > Jörg Rieskamp, Prof. Dr. > Rainer Greifeneder, Prof. Dr. > Rui Mata, at the Faculty of Psychology, and Prof. Dr. > Georg Nöldeke, Prof. Dr. > Alois Stutzer, and Prof. Dr. > Miguel Brendl at the Faculty of Business and Economics, University of Basel.

To receive information about upcoming events, please contact the administrative assistant, Laura Wiles: >laura.wiles@unibas.ch.

Daniel Bernoulli

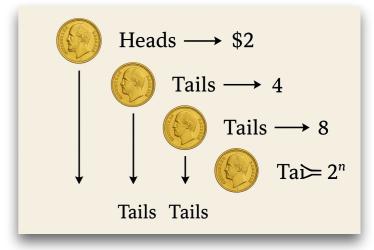


- 1700 (born in Groningen, NL) 1782 (died in Basel, CH)
- Swiss mathematician and physicist, born into prominent Bernoulli family that included several mathematicians and scientists
- Studied medicine at University of Basel, PhD in anatomy and botany
- Pioneering work in probability and statistics, held professorships in St. Petersburg and University of Basel
- St. Petersburg lottery: How much would you pay to play this game of chance in a casino?

A fair 2-sided coin You start with \$2

Throwing heads stops the game and you get whatever you accumulated

Throwing tails doubles your payoff



Daniel Bernoulli



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$$E = \frac{1}{2} \cdot 2 + \frac{1}{4} \cdot 4 + \frac{1}{8} \cdot 8 + \frac{1}{16} \cdot 16 + \cdots$$

= 1 + 1 + 1 + 1 + \cdots
= \infty.

PARADOX

- In theory, an individual should pay any price to enter this lottery!
- In practice, individuals paid very little to enter this lottery!
- Bernoulli asked "WHY?"

From normative to descriptive models

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Prospect Theory (PT)

Behavioral Insights and Real-World Choices

Integration of value and probability

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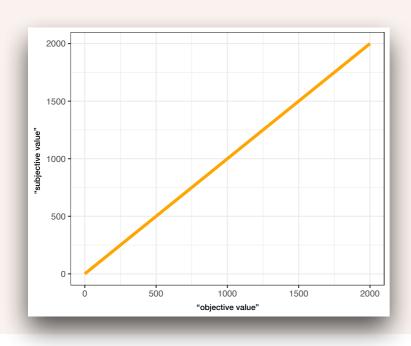
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Value function x is linear

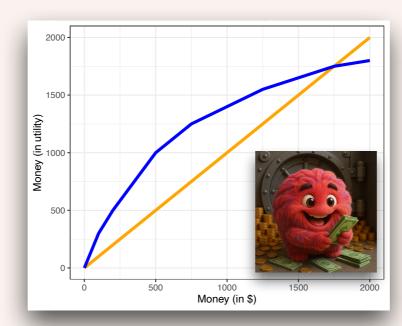


Example for 2 options

EU =
$$p_1^*u(x_1) + p_2^*u(x_2)$$

EU = $0.5^*80 + 0.5^*0 = 40$

Value function u(x) is concave



How do we find the 'U' in EU?
What experimental approach would be suitable?

Repeated choices in lotteries



0 CHF

50 CHF

VS.



100 CHF

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- Four axioms of EUT that define a rational decision maker: completeness; transitivity; independence of irrelevant alternatives; and continuity

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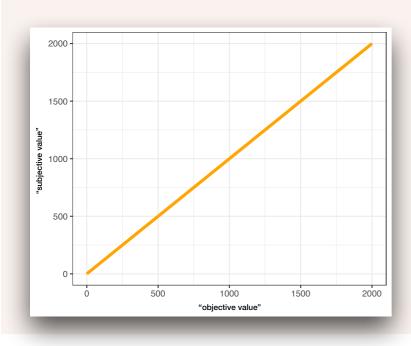
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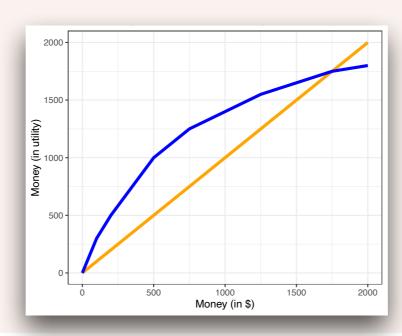


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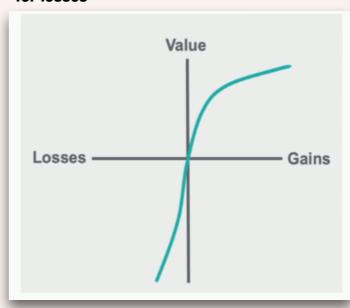
Value function u(x) is concave



Example for 2 options

$$V = V(x_1)^*W(p_1) + V(x_2)^*W(p_2)$$

Value function v(x) is concave for gains and convex for losses



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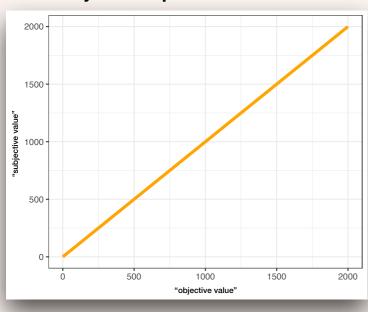
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Value function x is linear Probability function p is linear



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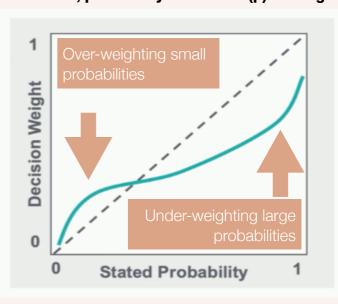
Value function u(x) is concave Probability function p is linear



Example for 2 options

$$V = V(x_1)^*W(p_1) + V(x_2)^*W(p_2)$$

Value function v(x) is concave for gains and convex for losses, probability function w(p) is weighted



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- Behavioral choice patterns that are in violation of EUT but are in line with PT:
 - · Certainty effect
 - · Reflection effect
 - · Framing effect

Summary

- Utility is a central concept in decision science that represents a subjective quantity of value or worth; first formalized in 18th century by Daniel Bernoulli, it has since been a central concept in both economics and psychology (as the causal principle underlying choices) and is central to concepts such as motivation, happiness and well-being
- Amongst other factors, models of choice under uncertainty differ in how outcomes and probabilities are treated:
 - * Expected Value Theory evaluates choices using objective monetary values and linear probabilities ("Choose based on the average payoff")
 - * Expected Utility Theory incorporates subjective utility to reflect risk preferences while maintaining linear probabilities ("Choose as if you have a utility function and you maximize its expectation")
 - * Prospect Theory accounts for psychological biases by both a value and a probability weighting function ("Choose as if you're loss averse and distort probabilities")
- The history of decision science is characterized by transitions from purely normative to more descriptive models of choice —> fruitful marriage between empirical research and theoretical work!

Key reading

Newell, B. R., Lagnado, D. A., & Shanks, D. R. (2022). Decision quality and a historical context. In *Straight choices* (3rd ed., pp. 12). Psychology Press. https://doi.org/ 10.4324/9781003289890 (download via ADAM:

https://adam.unibas.ch/ilias.php? baseClass=ilrepositorygui&cmdNode=yh:ni&cmdClass=ilObjFileGUl&cmd=sendfile&ref_id=20_80371

Additional reading (optional)

Ruggeri, K., Alí, S., Berge, M. L., Bertoldo, G., Bjørndal, L. D., Cortijos-Bernabeu, A., ... & Folke, T. (2020). Replicating patterns of prospect theory for decision under risk. *Nature human behaviour*, *4*(6), 622-633. https://www.nature.com/articles/s41562-020-0886-x.pdf

Comment by Kellen (2020). The Limited Value of Replicating Classic Patterns of Prospect Theory. https://communities.springernature.com/posts/the-limited-value-of-replicating-classic-patterns-of-prospect-theory

Participants wanted for research study at the Faculty of Psychology



Uni-Stress? Nimm teil an unserer Online-Intervention!



Du...

- ... leidest unter akademischem Stress?
- ... studierst an einer Schweizer Universität?
- ... würdest dir Unterstützung wünschen?
- ... und möchtest gleichzeitig einen Beitrag zur Forschung leisten?

Wir...

... wissen aus vorherigen Studien, dass bereits kurze Online-Interventionen wirksam zur Verbesserung der mentalen Gesundheit beitragen können.



QR-Code scannen, um mehr über die Studie & die Intervention zu erfahren!

Studienleitung: PD Dr. Dorothée Bentz, Universität Basel

Teilnahmekriterien

- Immatrikuliert an einer Schweizer Universität
- 18 65 Jahre
- Derzeit nicht in psychologischer oder psychiatrischer Behandlung
- Gute Deutschkenntnisse

Entschädigung:

Teilnahme an einem Gewinnspiel (Büchergutscheine im Wert von 50.-)

No conflict of interest!