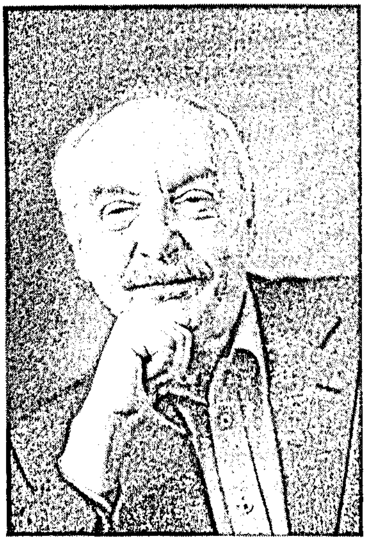
4.1 Gerd Gigerenzer（吉仁泽）

The Science of Heuristics: Decision Making in an Uncertain World



吉仁泽(Gerd Gigerenzer)近年来一直是最有影响力的德国心理学家。自从他于1995年领导德国马普人类发展研究所适应行为和认知中心之后，组织着来自心理学、经济学、生物学、数学、计算机科学等领域的研究者对人类的认知与适应性行为进行了系统的研究，并出版了多种专著，其中《简捷启发式》和《有限理性：适应性工具箱》等在中国也有译著出版。

吉仁泽的主要的研究方向是人类思考和决策的模型，研究着重在有限理性、生态理性和社会理性的理论探讨以及实验考证，决策与判断的启发式以及社会科学的历史和方法学。几十年来发表了很多引用率极高的学术文章，并出版了不少畅销的科学书籍。吉仁泽用清楚简练的语言把复杂的算法讲解的简明易懂，在非专业的读者中口碑很好，这是很多学术作者难以企及的。

吉仁泽1947年9月出生，1974年获得慕尼黑大学心理学学位，1977年获慕尼黑大学心理系博士学位。1977—1982任慕尼黑大学心理系助理教授；1982—1984任教慕尼黑大学Privat-Doze心理系（Privat-Dozent Department of Psychology）；1984—1990任康斯坦茨大学心理学教授；1990—1992任澳大利亚萨尔斯堡大学心理系教授；1992—1995任美国芝加哥大学科技概念基金委员会委员（Committee for the Conceptual Foundations of Science）以及心理系教授；1995—1997任慕尼黑心理学研究所Max Planck Institute主任；1998年至今任德国柏林马普人类发展研究所适应行为和认知中心主任。

吉仁泽1985年在最佳德国社会科学期刊文章的评比中获Fritz Thyssen基金会奖。他在《心理学综述》上发表的论文“从工具到理论”（From tools to theories: A heuristic of discovery in cognitive psychology, *Psychological Review*, *98*,

254—267）于1991年获AAAS（美国科学促进会）行为科学研究奖。他写的《估算过的风险》（*Calculated Risks: How to Know When Numbers Deceive You*）一书，德文翻译版获得到了2002年度科学书籍奖。

吉仁泽与2002年诺贝尔经济学奖获得者心理学家卡尼曼（Daniel Kahneman）和特沃茨基（Amos Tversky）有过一场著名的争论（见Kahneman & Tversky 1996；Gigerenzer, 1996）。争论的焦点在于决策偏差的本质在于认知的错误还是在于任务信息与认知机制的不匹配。吉仁泽认为许多卡尼曼等人揭示的决策偏差不是由于人们的认知缺陷造成，而是由于研究者忽略了决策的有限理性和生态理性，以至于提供的信息与认知的机制不协调。就像是给一个十进制的计算器输入二进制的数字，算出得结果自然是垃圾。比如，概率的判断在人类进化的生态环境中应该是以事件发生的频数为计算单位的（比如，7人中有3人得过疾病A）而不是转换成某个单一事件的发生概率作为运算单位的（比如，每个人有0.429的概率患疾病A）。吉仁泽等人的实验证明，在改用事件发生的自然频数表述之后，概率判断的偏差消失了。

在《聪明的启发式：下意识的适应智慧》（*Smart Heuristics: the Adaptive Intelligence of the Unconscious*）等书中吉仁泽和合作者感兴趣的是人类如何应对不确定性。在科学革命之前，决定论是一种强势的思潮。宗教信仰对不确定性进行了否定，很多人都觉得自己的家族或肤色是受上帝青睐的。人是什么时候才开始跳出这种思维而开始意识到世界有着一种基础性的不确定性呢？我们如何避免对确定性的幻觉，而理解到不确定性是所有事物的基础元素。

以往许多有关于决策的畅销书都告诉我们要考虑所有信息，仔细权衡，计算出最佳的选择，如果能有个统计软件的帮助那是再好不过了。在经济领域上，诺贝尔奖所授予的成果一般都是假设个人能够得到充分信息，能够计算出问题的最佳解决方法。然而，真实世界中的人在时间很少而信息稀缺的情况下如何能作出那么好的决策？人忽略信息的这一事实经常被误认为是某种形式的非理性。不少书籍在讨论人是如何总是犯下认知错误。Gigerenzer对于头脑让认知最佳化的想法提供了另一种选择。经过多年的研究之后，Gigerenzer与其团队找出了他们认为可行的新方法，也就是关于运用快速而简洁的启发式地做决策的研究。为了在不确定的世界里作出好的决定，一个人有时候必须忽略信息。知道一个人不需要知道什么东西，这是一种基于生态理性决策的艺术。这些快速而节俭的策略，包括冠心病监护病房的决定、人事挑选以及股票选择。

在如下的章节中，吉仁泽介绍了他和他的团队对生态理性的实验研究，探讨了人类的认知与其生存环境的契合。

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The Science of Heuristics: Decision Making in an Uncertain World

Gerd Gigerenzer[①]

An evolutionary approach to human behavior should emphasize two questions. (1) What are the proximal mechanisms underlying decisions? (2) How does behavior result from both proximal mechanisms and environment? The object of natural selection is proximal mechanisms, also called Darwinian algorithms by Leda Cosmides and John Tooby. I argue that these algorithms are typically fast-and-frugal heuristics, that is, strategies that use only few pieces of information and ignore the rest. As far as we know, both animals and humans have always relied on heuristics to solve adaptive problems.

To choose a mate, a peahen investigates only three or four of the peacocks posing and displaying in a lek to capture her attention, and selects the one with the largest number of eyespots. Note that this heuristic is strikingly different from classical decision theory, which would promote investigating all males and weighting and adding all their relevant features to choose the one with the highest expected utility. Many evolved rules of thumb are amazingly simple and efficient (see Gigerenzer, 2008, chap. 3). The same holds for human decision making. Consider how experienced managers predict which customers are active or not, in order to reduce the costs of sending catalogues to customers who will not make any further purchases and to avoid excluding customers who would. While management science recommend complex statistical models, real managers in fact rely on the *hiatus heuristic* that uses one good reason only: "If the customer has made a purchase within the last 9 months, classify as active, otherwise as inactive." Note that the hiatus heuristic ignores all other information, such as how much and how often customers bought. Yet

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when tested, it actually made, on average, better predictions of future purchases than the Pareto/NBD model and similar complex "rational" models (Gigerenzer et al., 2011, chap. 36). These examples illustrate that heuristics are neither irrational nor always second-best, and there may be good reason why humans and other animals often ignore part of the information.

The first question the science of heuristics poses is descriptive: What heuristics does an individual or species have at its disposal? This is called the study of the "adaptive toolbox." The second question is normative: Given a real-world problem, which of several heuristics (or complex strategies) is the most successful? The investigation of the second question is called the study of "ecological rationality." It entails identifying the structures of environments that a heuristic can exploit. For instance, relying on one reason only (as in the case of the peahen and the managers) tends to be more successful than weighting and adding of all reasons when redundancy is high and predictability low, that is, when the reasons are highly intercorrelated and the criterion is difficult to predict.

One of our first discoveries was that take-the-best, a simple heuristic that relies only on one reason to make a decision, can predict better than multiple regression, neural networks, and other complex models (Gigerenzer & Brighton, 2009; Gigerenzer et al., 1999). Earlier research, such as in the heuristics-and-biases program by Daniel Kahneman, Amos Tversky, and their followers, had routinely interpreted the use of simple heuristics as *the* source of human error. Today we know that this interpretation is incorrect, and that in uncertain worlds, a successful strategy for making good decisions must ignore part of the relevant information. The mathematical reasons for the robustness of heuristics have been formulated using the "bias-variance dilemma" in statistics and the study of ecological rationality (Gigerenzer & Brighton, 2009).

The science of heuristics provides an alternative to the prevailing explanations of behavior by internal propensities only-traits, attitudes, preferences, or, most recently, neural processes. In contrast, I think of behavior as the result of internal and external features, as formalized in the study of ecological rationality. For instance, humans often rely on social heuristics such as "imitate the majority" and "tit-for-tat." The resulting behavior, however, is not determined by the heuristic, but jointly by the heuristic *and* the environment. If a teenager imitates the behavior of the majority to gain peer group acceptance and not be considered an oddball, whether the behavior is morally good or bad depends on the behavior of the peer group. The same holds when a person relies on tit-for-tat, which can lead to cooperative or uncooperative behavior, depending on the actions of the people interacted with. These examples also illustrate that social heuristics can underlie moral behavior, which explain moral inconsistencies within the same person (Gigerenzer, 2010). The phylogenetic development of the adaptive toolbox of species has not yet been studied; but it is noteworthy that other primates imitate less generally and precisely than humans, and tit-for-tat appears to be absent in almost all animal species.

An ecological approach also provides new solutions to old problems in statistical thinking and risk perception. For instance, consider the following situation that many doctors face (Gigerenzer et al., 2007):

Assume you conduct breast cancer screening using mammography in a certain region. You know the following information about the women in this region:

The probability that a woman has breast cancer is 1% (prevalence)

- If a woman has breast cancer, the probability that she tests positive is 90% (sensitivity)
- If a woman does not have breast cancer, the probability that she nevertheless tests positive is 9% (false-positive rate)

A woman tests positive. She wants to know from you whether that means that she has breast cancer for sure, or what her chances are. What is the best answer among the following 4 responses: 1%, 10%, 81%, 90%?

Out of 160 German gynecologists, only 21% understood that the best answer is a 10% probability of having breast cancer given the positive mammogram. Nineteen percent thought the answer is 1%, and most believed it to be 81% or 90%. One can image the unnecessary fear these doctors instill in the many women who test positive in screening. Most of the roughly 1,000 doctors I have trained in risk literacy are confused by sensitivities and other conditional probabilities. Training in medical schools worldwide has clearly failed to teach doctors statistical thinking. What to do? For decades, the response was resignation because, in the words of paleontologist Stephen J. Gould, our minds are not built (for whatever reasons) to work by the rules of probability. An ecological approach, in contrast, does not attribute failure to inner processes alone, but to their interaction with the external framing of information. Conditional probabilities are fairly new in human history; the way people learned individually about co-occurrences was in terms of "natural frequencies," that is, observed joint frequencies such as the number of people with disease *and* positive test. Here is the presentation of the same information in terms of natural frequencies:

- Ten out of every 1,000 women have breast cancer
- Of these 10 women with breast cancer, 9 test positive
- Of the 990 women without cancer, about 89 nevertheless test positive

When the same 160 gynecologists received the same information in terms of natural frequencies, 87% understood that the best answer is 1 out of 10, or 10% (Gigerenzer et al., 2007). Concepts such as "natural frequencies" have since become standard in evidence-based medicine, and medical schools have begun to teach it to their students. More generally, my research group and I study which external representations of information foster insight, and why. Other experts that profit from these techniques include judges, lawyers, and financial analysts; I myself have trained about 50 U. S. federal judges in using these psychological tools to better understand statistical evidence in court.