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Keith Stanovich: What Intelligence Tests Miss

What Cost for Irrationality?

This is the first part in a mini-sequence presenting content from Keith E. Stanovich's excellent book What Intelligence Tests Miss: The psychology of rational thought. It will culminate in a review of the book itself.

People who care a lot about rationality may frequently be asked why they do so. There are various answers, but I think that many of ones discussed here won't be very persuasive to people who don't already have an interest in the issue. But in real life, most people don't try to stay healthy because of various far-mode arguments for the virtue of health: instead, they try to stay healthy in order to avoid various forms of illness. In the same spirit, I present you with a list of real-world events that have been caused by failures of rationality.

What happens if you, or the people around you, are not rational? Well, in order from least serious to worst, you may...

Have a worse quality of living. *Status Quo bias* is a general human tendency to prefer the default state, regardless of whether the default is actually good or not. In the 1980's, Pacific Gas and Electric conducted a survey of their customers. Because the company was serving a lot of people in a variety of regions, some of their customers suffered from more outages than others. Pacific Gas asked customers with unreliable service whether they'd be willing to pay extra for more reliable service, and customers with reliable service whether they'd be willing to accept a less reliable service in exchange for a discount. The customers were presented with increases and decreases of various percentages, and asked which ones they'd be willing to accept. The percentages were same for both groups, only with the other having increases instead of decreases. Even though both groups had the same income, customers of both groups overwhelmingly wanted to stay with their status quo. Yet the service difference between the groups was large: the unreliable service group suffered 15 outages per year of 4 hours' average duration and the reliable service group suffered 3 outages per year of 2 hours' average duration! (Though note caveats.)

A study by Philips Electronics found that one half of their products had nothing wrong in them, but the consumers couldn't figure out how to use the devices. This can be partially explained by egocentric bias on behalf of the engineers. Cognitive scientist Chip Heath notes that he has "a DVD remote control with 52 buttons on it, and every one of them is there because some engineer along the line knew how to use that button and believed I would want to use it, too. People who design products are experts... and they can't imagine what it's like to be as ignorant as the rest of us."

Suffer financial harm. John Allen Paulos is a professor of mathematics at Temple University. Yet he fell prey to serious irrationality which began when he purchased WorldCom stock at $47 per share in early 2000. As bad news about the industry began mounting, WorldCom's stock price started falling - and as it did so, Paulos kept buying, regardless of accumulating evidence that he should be selling. Later on, he admitted that his "purchases were not completely rational" and that "I bought shares even though I knew better". He was still buying - partially on borrowed money - when the stock price was $5. When it momentarily rose to $7, he finally decided to sell. Unfortunately, he didn't get off from work until the market closed, and on the next

market day the stock had lost a third of its value. Paulos finally sold everything, at a huge loss.

Stock market losses due to irrationality are not atypical. From the beginning of 1998 to the end of 2001, the Firsthand Technology Value mutual fund had an average gain of 16 percent per year. Yet the average investor who invested in the fund *lost* 31.6 percent of her money over the same period. Investors actually lost a total of $1.9 *billion* by investing in a fund which was producing 16 percent of a profit per year. That happened because the fund was very volatile, causing people to invest and cash out at exactly the wrong times. When it gained, it gained a lot, and when it lost, it lost a lot. When people saw that it had been making losses, they sold, and when they saw it had been making gains, they bought. In other words, they bought when high and sold when low - exactly the opposite of what you're supposed to do if you want to make a profit. Reporting on a study of 700 mutual funds during 1998-2001, finanical reporter Jason Zweig noted that "to a remarkable degree, investors underperformed their funds' reported returns - sometimes by as much as 75 percentage points per year."

Be manipulated and robbed of personal autonomy. Subjects were asked to divide 100 usable livers to 200 children awaiting a transplant. With two groups of children, group A with 100 children and group B with 100 children, the overwhelming response was to allocate 50 livers to each, which seems reasonable. But when group A had 100 children, each with an 80 percent chance of surviving when transplanted, and group B had 100 children, each with a 20 percent chance of surviving when transplanted, people still chose the equal allocation method even if this caused the unnecessary deaths of 30 children. Well, that's just a question of values and not rationality, right? Turns out that if the patients were ranked from 1 to 200 in terms of prognosis, people were relatively comfortable with distributing organs to the top 100 patients. It was only when the question was framed as "group A versus group B" that people suddenly felt they didn't want to abandon group B entirely. Of course, these are exactly the same dilemma. One could almost say that the person who got to choose which framing to use was *getting to decide on behalf of the people being asked the question.*

Two groups of subjects were given information about eliminating affirmative action and adopting a race-neutral policy at several universities. One group was told that under race-neutral conditions, the probability of a black student being admitted would decline from 42 percent to 13 percent and the probability of a white student being admitted would rise from 25 percent to 27 percent. The other group was told that under race-neutral admissions, the number of black students being admitted would decrease by 725 and the number of white students would increase by 725. These two framings were both saying the same thing, but you can probably guess the outcome: support for affirmative action was much higher in the percentage group.

In a hypothetical country, a family with no children and an income of $35,000 pays $4,000 in tax, while a family with no children and an income of $100,000 pays $26,000 in tax. Now suppose that there's a $500 tax reduction for having a child for a family with an income of $35,000. Should the family with an income of $100,000 be given a larger reduction because of their higher income? Here, most people would say no. But suppose that instead, the baseline is that a family of two children with an income of $35,000 pays $3,000 in tax and that a family of two children with an income of $100,000 pays $25,000 in tax. We propose to make the families with no children pay more tax - that is, have a "childless penalty". Say that the family with the

income of $100,000 and one child has their taxes set at $26,000 and the same family with no children has their taxes set at $27,000 - there's a childless penalty of $1,000 per child. Should the poorer family which makes $35,000 and has no children also pay the same $2,000 childless penalty as the richer family? Here, most people would also say no - they'd want the "bonus" for children to be equal for low- and high-income families, but they do not want the "penalty" for lacking children to be the high for same and low income.

End up falsely accused or imprisoned. In 2003, an attorney was released from prison in England when her conviction of murdering her two infants was overturned. Five months later, another person was released from prison when her charge of having murdered her children was also overturned. In both cases, the evidence presented against them had been ambiguous. What had convinced the jury was that in both cases, a pediatrician had testified that the odds of two children in the same family dying of infant death syndrome was 73 million to 1. Unfortunately, he had arrived to this figure by squaring the odds of a single death. Squaring the odds of a single event to arrive at the odds for it happening twice only works if the two events are independent. But that assumption is likely to be false in the case of multiple deaths in the same family, where numerous environmental and genetic factors may have affected both deaths.

In the late 1980s and early 1990s, many parents were excited and overjoyed to hear of a technique coming out of Australia that enabled previously totally non-verbal autistic children to communicate. It was uncritically promoted in highly visible media such as *60 Minutes, Parade* magazine and the *Washington Post*. The claim was that autistic individuals and other children with developmental disabilities who'd previously been nonverbal had typed highly literate messages on a keyboard when their hands and arms had been supported over by the typewriter by a sympathetic "facilitator". As Stanovich describes: "Throughout the early 1990s, behavioral science researchers the world over watched in horrified anticipation, almost as if observing cars crash in slow motion, while a predictable tragedy unfolded before their eyes." The hopes of countless parents were dashed when it was shown that the "facilitators" had been - consciously or unconsciously - directing the children's hands on the right keys. It *should* have been obvious that spreading such news before the technique had been properly scientifically examined was dangerously irresponsible - and it gets worse. During some "faciliation" sessions, children "reported" having been sexually abused by their parents, and were removed from their homes as a result. (Though they were eventually returned.)

End up dead. After 9/11, people became afraid of flying and started doing so less. Instead, they began driving more. Unfortunately, car travel has a much higher chance of death than air travel. Researchers have estimated that over 300 more people died in the last months of 2001 because they drove instead of flying. Another group calculated that for flying to be as dangerous as driving, there would have to be an incident on the scale of 9/11 once a month!

Have your society collapse. Possibly even more horrifying is the tale of Albania, which had previously been a communist dictatorship but had made considerable financial progress from 1992 to 1997. In 1997, however, *one half of the adult population* had fallen victim to Ponzi schemes. In a Ponzi scheme, the investment itself isn't actually making any money, but rather early investors are paid off with the money from late investors, and eventually the system has to collapse when no new investors can be recruited. But when schemes offering a 30 percent *monthly* return began to become popular in Albania, competitors offering a 50-60 or even a 100

percent monthly return soon showed up, and people couldn't resist the temptation. Eventually both the government and economy of Albania collapsed. Stanovich describes:

> People took out mortgages on their homes in order to participate. Others sold their homes. Many put their entire life savings into the schemes. At their height, an amount equal to 50 percent of the country's GDP was invested in Ponzi schemes. Before the schemes collapsed, they actually began to compete with wage income and distort the economy. For example, one business owner saw his workforce quickly slip from 130 employees to 70 because people began to think they could invest in the Ponzi schemes instead of actually working for their income.

The estimated death toll was between 1,700 and 2,000.

A Taxonomy of Bias: The Cognitive Miser

This is the second part in a mini-sequence presenting content from Keith E. Stanovich's excellent book What Intelligence Tests Miss: The psychology of rational thought. It will culminate in a review of the book itself.

Noting that there are many different kinds of bias, Keith Stanovich proposes a classification scheme for bias that has two primary categories: the Cognitive Miser, and Mindware Problems. Today, I will discuss the Cognitive Miser category, which has the subcategories of Default to the Autonomous Mind, Serial Associative Cognition with a Focal Bias, and Override Failure.

The Cognitive Miser

Cognitive science suggests that our brains use two different kinds of systems for reasoning: Type 1 and Type 2. Type 1 is quick, dirty and parallel, and requires little energy. Type 2 is energy-consuming, slow and serial. Because Type 2 processing is expensive and can only work on one or at most a couple of things at a time, humans have evolved to default to Type 1 processing whenever possible. We are "cognitive misers" - we avoid unnecessarily spending Type 2 cognitive resources and prefer to use Type 1 heuristics, even though this might be harmful in a modern-day environment.

Stanovich further subdivides Type 2 processing into what he calls the *algorithmic mind* and the *reflective mind*. He argues that the reason why high-IQ people can fall prey to bias almost as easily as low-IQ people is that intelligence tests measure the effectiveness of the algorithmic mind, whereas many reasons for bias can be found in the reflective mind. An important function of the algorithmic mind is to carry out *cognitive decoupling* - to create copies of our mental representations about things, so that the copies can be used in simulations without affecting the original representations. For instance, a person wondering how to get a fruit down from a high tree will imagine various ways of getting to the fruit, and by doing so he operates on a mental concept that has been copied and decoupled from the concept of the actual fruit. Even when he imagines the things he might do to the fruit, he never confuses the fruit he has imagined in his mind with the fruit that's still hanging in the tree (the two concepts are decoupled). If he did, he might end up believing that he could get the fruit down by simply imagining himself taking it down. High performance on IQ tests indicates an advanced ability for cognitive decoupling.

In contrast, the reflective mind embodies various higher-level goals as well as *thinking dispositions*. Various psychological tests of thinking dispositions measure things such as the tendency to collect information before making up one's mind, the tendency to seek various points of view before coming to a conclusion, the disposition to think extensively about a problem before responding, the tendency to calibrate the degree of strength of one's opinion to the degree of evidence available, the tendency to think about future consequences before taking action, the tendency to explicitly weigh pluses and minuses of situations before making a decision, and the tendency to seek nuance and avoid absolutism. All things being equal, a high-IQ person would have a better chance of avoiding bias if they stopped to think things through, but a higher algorithmic efficiency doesn't help them if it's not in their nature to ever bother doing

so. In tests of rational thinking where the subjects are explicitly instructed to consider the issue in a detached and objective manner, there's a correlation of .3 - .4 between IQ and test performance. But if such instructions are not given, and people are free to reason in a biased or unbiased way as they wish (like in real life), the correlation between IQ and rationality falls to nearly zero!

Modeling the mind purely in terms of Type 1 and Type 2 systems would do a poor job of explaining the question of why intelligent people only do better at good thinking if you tell them in advance what "good thinking" is. It is much better explained by a three-level model where the reflective mind may choose to "make a function call" to the algorithmic mind, which in turn will attempt to override the autonomous Type 1 processes. A failure of rationality may happen either if the reflective mind fails to activate the algorithmic mind, or if the algorithmic mind fails to override the autonomous mind. This gives us a three-level classification of this kind of bias.

Default to the Autonomous Mind

Defaulting to the autonomous mind is the most shallow kind of thought, where no Type 2 processing is done at all. The reflective mind fails to react and activate the algorithmic mind. Stanovich considers biases such as impulsively associative thinking and affect substitution (evaluating something primarily based on its affect) to be caused by this one.

Serial Associative Cognition with a Focal Bias

In this mode of thinking, Type 2 processes are engaged, but they are too conservative in their use of resources. For instance, consider the following problem (answer in rot13 below):

Jack is looking at Anne but Anne is looking at George. Jack is married but George is not. Is a married person looking at an unmarried person? A) Yes B) No C) Cannot be determined.

Gur pbeerpg nafjre, juvpu yrff guna 20 creprag bs crbcyr trg, vf N. Vs Naar vf zneevrq, gura gur nafjre vf "Lrf", orpnhfr fur'f ybbxvat ng Trbetr jub'f hazneevrq. Vs Naar vf hazneevrq, gura gur nafjre vf "Lrf" orpnhfr fur'f orvat ybbxrq ng ol Wnpx, jub'f zneevrq.

In this example, people frequently concentrate too much on a single detail and get the answer wrong. There are numerous biases of similar kind. For instance, when asked to guess the amount of murders in Detroit (which is located in Michigan) they give a higher number than when asked to guess the number of murders in Michigan. This is because people are using crude affect-laden images of the locations in question to generate their guess. Vividness, salience and accessibility of various pieces of information have an overly strong effect to our thinking, becoming the main focal point of our evaluation. Focal bias is also involved biases such as framing effects (the presented frame is taken as focal), the Wason selection task, motivated cognition, and confirmation bias.

Override Failure

In an override failure, Type 2 processes notice that Type 1 systems are attempting to apply rules or heuristics that are not applicable to the situation at hand. As a result, the Type 2 processes attempt to initiate an override and take the Type 1 systems

offline, but for whatever reason they fail to do so. Override failures can be divided into two categories: "cold" and "hot" ones.

- Premise: All living things need water
- Premise: Roses need water
- Conclusion: Roses are living things

The above reasoning is invalid ("Living things" implies "need water", but "need water" does not imply "living thing"), but many people will instinctively accept it, because the conclusion is a true one. It's an example of a cold override, where you need to override a natural response with a rule-based one. In another example, test subjects were presented with two cans of jelly beans. One of the cans had nine white jelly beans and one red jelly bean. The other had eight red jelly beans and ninety-two white jelly beans. The subjects were told to pick one of the cans and then draw a jelly bean at random from their chosen can: if they got a red one, they'd win a dollar. Most picked the can with one red jelly bean (a 10% chance) but 30 to 40 percent of the subjects picked the one with the worse (8%) odds. Many of them knew that they were doing a mistake, but having a higher absolute amount of beans was too enticing to them. One commented afterwards: "I picked the one with more red jelly beans because it looked like there were more ways to get a winner, even though I knew there were also more whites, and that the percents were against me."

A "hot" override, on the other hand, is one where strong emotions are involved. In what's likely to be a somewhat controversial example around here, Stanovich discusses the trolley problem. He notes that most people would choose to flip the switch sending the trolley to the track where it kills one person instead of five, but that most people would also say "no" to pushing the fat man on the tracks. He notes that this kind of a scenario feels more "yucky". Brain scans of people being presented various variations of this dilemma show more emotional activity in the more personal variations. The people answering "yes" to the "fat man"-type dilemmas took a longer time to answer, and scans of their brain indicated activity in the regions associated with overriding the emotional brain. They were using Type 2 processing to override the effects of Type 1 emotions.

Stanovich identifies denominator neglect (the jelly bean problem), belief bias effects ("roses are living things"), self-control problems such as the inability to delay gratification, as well as moral judgement failures as being caused by an override failure.

A Taxonomy of Bias: Mindware Problems

This is the third part in a mini-sequence presenting content from Keith E. Stanovich's excellent book What Intelligence Tests Miss: The psychology of rational thought. It will culminate in a review of the book itself.

Noting that there are many different kinds of bias, Keith Stanovich proposes a classification scheme for bias that has two primary categories: the Cognitive Miser, and Mindware Gaps. Last time, I discussed the Cognitive Miser category. Today, I will discuss Mindware Problems, which has the subcategories of Mindware Gaps and Corrupted Mindware.

Mindware Problems

Stanovich defines "mindware" as "a generic label for the rules, knowledge, procedures, and strategies that a person can retrieve from memory in order to aid decision making and problem solving".

Mindware Gaps

Previously, I mentioned two tragic cases. In one, a pediatrician incorrectly testified the odds of a two children in the same family suffering infant death syndrome to be 73 million to 1. In the other, people bought into a story of "facilitated communication" helping previously non-verbal children to communicate, without looking at it in a critical manner. Stanovich uses these two as examples of a *mindware gap.* The people involved were lacking critical mindware: in one case, that of probabilistic reasoning, in the other, that of scientific thinking. One of the reasons why so many intelligent people can act in an irrational manner is that they're simply missing the mindware necessary for rational decision-making.

Much of the useful mindware is a matter of knowledge: knowledge of Bayes' theorem, taking into account alternative hypotheses and falsifiability, awareness of the conjunction fallacy, and so on. Stanovich also mentions something he calls *strategic mindware,* which refers to the disposition towards engaging the reflective mind in problem solving. These were previously mentioned as thinking dispositions, and some of them can be measured by performance-based tasks. For instance, in the Matching Familiar Figures Test (MFFT), participants are presented with a picture of an object, and told to find the correct match from an array of six other similar pictures. Reflective people have long response times and few errors, while impulsive people have short response times and numerous errors. These types of mindware are closer to strategies, tendencies, procedures, and dispositions than to knowledge structures.

Stanovich identifies mindware gaps to be involved in at least conjunction errors and ignoring base rates (missing probability knowledge), as well as the Wason selection task and confirmation bias (not considering alternate hypotheses). Incorrect lay psychological theories are identified as a combination of a mindware gap and contaminated mindware (see below). For instance, people are often blind to their own biases, because they incorrectly think that biased thinking on their part would be detectable by conscious introspection. In addition to bias blind spot, lay psychological theory is likely to be involved in errors of affective forecasting (the forecasting of one's future emotional state).

Contaminated Mindware

I previously also mentioned the case of Albania, where a full one half of the adult population fell victim to Ponzi schemes. As another example, in the 1980s psychotherapists thought they had found a way to uncover repressed memories of childhood sexual abuse. The ideas spread via professional association but without any evidence of them actually being correct. Even when the patients had no memories of abuse prior to entering therapy, and during therapy began to come up with elaborate memories of being abused in rituals with satanic overtones, nobody questioned their theories or sought any kind of independent evidence. The belief system of the therapists was basically "if the patient thinks she was abused then she was", and the mindware represented by this belief system required only the patient and the therapist to believe in the story. Several people were convicted of abuse charges because of this mindware.

Even though mindware gaps were definitely involved in both of these cases, they are also examples of *contaminated mindware* sweeping through a population. Stanovich defines contaminated mindware as mindware that leads to maladaptive actions and resists critical evaluation. Contaminated mindware is often somewhat complicated and may be just as enticing to high-IQ people than low-IQ people, if not more so. In a survey of paranormal beliefs conducted on members of a Mensa club in Canada, 44% believed in astrology, 51% believed in biorhytms, and 56% believed in extraterrestrial visitors.

To explain why we acquire mindware that is harmful to us, Stanovich draws upon memetic theory. In the same way that organisms are built to advance the interests of the genes rather than for the interest of the gene hosts themselves, beliefs may spread without being true or helping the human who holds the belief in any way. Chain letters such as "send me to five other people or experience misfortune" are passed on despite being both untrue and useless to the people passing them on, surviving because of their own "self-replicative" properties. Memetic theory shifts our perspective from "how do people acquire beliefs" to "how do beliefs acquire people". (Here, we're treating "memes" and "mindware" as rough synonyms, with the main difference being one of emphasis.)

Stanovich lists four reasons for why mindware might spread:

1. Mindware survives and spreads because it is helpful to the people that store it.
2. Certain mindware proliferates because it is a good fit to pre-existing genetic dispositions or domain-specific evolutionary modules.
3. Certain mindware spreads because it facilitates the replication of genes that make vehicles that are good hosts for that particular mindware (e.g. religious beliefs that urge people to have more children).
4. Mindware survives and spreads because of the self-perpetuating properties of the mindware itself.

Stanovich notes that reasons 1-3 are relatively uncontroversial, with 1 being a standard assumption in cultural anthropology, 2 being emphasized by evolutionary psychology, and 3 being meant to capture the types of effects emphasized by theorists stressing gene/culture co-evolution.

There are several subversive ways by which contaminated mindware might spread. It might mimick the properties of beneficial mindware and disguise itself as one, it might cause its bearers to want to kill anyone who speaks up against it, it might be

unfalsifiable and prevent us from replacing it, it might contain beliefs that actively prohibit evaluation ("blind faith is a virtue") or it might impose a prohibitively high cost on testing it (some groups practicing female genital mutilation believe that if a baby's head touches the clitoris during delivery, the baby will die).

Stanovich identifies contaminated mindware to be involved in at least self-centered biases (self and egocentric processing) and confirmation bias (evaluation-disabling strategies), as well combining with mindware gaps to cause problems in the form of lay psychological theory.

What Intelligence Tests Miss: The psychology of rational thought

This is the fourth and final part in a mini-sequence presenting Keith E. Stanovich's excellent book What Intelligence Tests Miss: The psychology of rational thought.

If you want to give people a single book to introduce people to the themes and ideas discussed on Less Wrong, *What Intelligence Tests Miss* is probably the best currenty existing book for doing so. It does have a somewhat different view on the study of bias than we on LW: while Eliezer concentrated on the idea of the map and the territory and aspiring to the ideal of a perfect decision-maker, Stanovich's perspective is more akin to bias as a thing that prevents people from taking full advantage of their intelligence. Regardless, for someone less easily persuaded by LW's somewhat abstract ideals, reading Stanovich's concrete examples first and then proceeding to the Sequences is likely to make the content presented in the sequences much more interesting. Even some of our terminology such as "carving reality at the joints" and the instrumental/epistemic rationality distinction will be more familiar to somebody who was first read *What Intelligence Tests Miss.*

Below is a chapter-by-chapter summary of the book.

Inside George W. Bush's Mind: Hints at What IQ Tests Miss is a brief introductory chapter. It starts with the example of president George W. Bush, mentioning that the president's opponents frequently argued against his intelligence, and even his supporters implicitly conceded the point by arguing that even though he didn't have "school smarts" he did have "street smarts". Both groups were purportedly surprised when it was revealed that the president's IQ was around 120, roughly the same as his 2004 presidential candidate opponent John Kerry. Stanovich then goes on to say that this should not be surprising, for IQ tests do not tap into the *tendency* to actually think in an analytical manner, and that IQ had been overvalued as a concept. For instance, university admissions frequently depend on tests such as the SAT, which are pretty much pure IQ tests. The chapter ends by a disclaimer that the book is *not* an attempt to say that IQ tests measure nothing important, or that there would be many kinds of intelligence. IQ does measure something real and important, but that doesn't change the fact that people overvalue it and are generally confused about what it actually *does* measure.

Dysrationalia: Separating Rationality and Intelligence talks about the phenomenon informally described as "smart but acting stupid". Stanovich notes that if we used a broad definition of intelligence, where intelligence only meant acting in an optimal manner, then this expression wouldn't make any sense. Rather, it's a sign that people are intuitively aware of IQ and rationality as measuring two separate qualities. Stanovich then brings up the concept of dyslexia, which the DSM IV defines as "reading achievement that falls substantially below that expected given the individual's chronological age, measured intelligence, and age-appropriate education". Similarly, the diagnostic criterion for mathematics disorder (dyscalculia) is "mathematical ability that falls substantially below that expected for the individual's chronological age, measured intelligence, and age-appropriate education". He argues that since we have a precedent for creating new disability categories when someone's ability in an important skill domain is below what would be expected for their intelligence, it would make sense to also have a category for "dysrationalia":

> Dysrationalia is the inability to think and behave rationally despite adequate intelligence. It is a general term that refers to a heterogenous group of disorders manifested by significant difficulties in belief formation, in the assessment of belief consistency, and/or in the determination of action to achieve one's goals. Although dysrationalia may occur concomitantly with other handicapping conditions (e.g. sensory impairment), dysrationalia is not the result of those conditions. The key diagnostic criterion for dysrationalia is a level of rationality, as demonstrated in thinking and behavior, that is significantly below the level of the individual's intellectual capacity (as determined by an individually administered IQ test).

The Reflective Mind, the Algorithmic Mind, and the Autonomous Mind presents a three-level model of the mind, which I mostly covered in A Taxonomy of Bias: The Cognitive Miser. At the end, we return to the example of George W. Bush, and are shown a bunch of quotes from the president's supporters describing him. His speechwriter called him "sometimes glib, even dogmatic; often uncurious and as a result ill-informed"; John McCain said Bush never asks for his opinion and that the president "wasn't intellectually curious". The same sentiment was echoed by a senior official in Iraq who had observed Bush in various videoconferences and said that the president's "obvious lack of interest in long, detailed discussions, had a chilling effect". On the other hand, other people were quoted as saying that Bush was "extraordinarily intelligent, but was not interested in learning unless it had practical value". Tony Blair repeatedly told his associates that Bush was "very bright". This is taken as evidence that while Bush is indeed intelligent, he does not have thinking dispositions that would have make him make use of his intelligence: he has dysrationalia.

Cutting Intelligence Down to Size further criticizes the trend of treating the word "intelligence" in a manner that is too broad. Stanovich points out that even critics of the IQ concept who introduce terms such as "social intelligence" and "bodily-kinesthetic intelligence" are probably shooting themselves in the foot. By giving everything valuable the label of intelligence, these critics are actually increasing the esteem of IQ tests, and therefore making people think that IQ measures more than it does.

> Consider a thought experiment. Imagine that someone objected to the emphasis given to horsepower (engine power) when evaluating automobiles. They feel that horsepower looms too large in people's thinking. In an attempt to deemphasize horsepower, they then being to term the other features of the car things like "braking horsepower" and "cornering horsepower" and "comfort horsepower". Would such a strategy make people less likely to look to engine power as an indicator of the "goodness" of a car? I think not. [...] Just as calling "all good car things" horsepower would emphasize horsepower, I would argue that calling "all good cognitive things" intelligence will contribute to the deification of MAMBIT [Mental Abilities Measured By Intelligence Tests].

Stanovich then continues to argue in favor of separating rationality and intelligence, citing surveys that suggest that folk psychology does already distinguish between the two. He also brings up the chilling effect that deifying intelligence seems to be having on society. Reviews about a book discussing the maltreatment of boys labeled feebleminded seemed to concentrate on the stories of the boys who were later found to have normal IQs, implying that abusive treatment of boys who actually did have a low IQ was okay. Various parents seem to take a diagnosis of low mental ability as much more shocking than a diagnosis such as ADHD or learning disability that

stresses the presence of normal IQ, even though the life problems associated with some emotional and behavior disorders are much more severe than those associated with many forms of moderate or mild intellectual disability.

Why Intelligent People Doing Foolish Things Is No Surprise briefly introduces the concept of the cognitive miser, explaining that conserving energy and not thinking about things too much is a perfectly understandable tendency given our evolutionary past.

The Cognitive Miser: Ways to Avoid Thinking discusses the cognitive miser further, starting with the "Jack is looking at Anne but Anne is looking at George" problem, noting that one could arrive at the correct answer via disjunctive reasoning ("either Anne is married, in which case the answer is yes, or Anne is unmarried, in which case the answer is also yes") but most people won't bother. It then discusses attribute substitution (instead of directly evaluating X, consider the correlated and easier to evaluate quality Y), vividness/salience/accessibility effects, anchoring effects and the recognition heuristic. Stanovich emphasizes that he does not say that heuristics are *always* bad, but rather that one shouldn't always rely on them.

Framing and the Cognitive Miser extensively discusses various framing effects, and at the end notes that high-IQ people are not usually any more likely to avoid producing inconsistent answers to various framings unless they are specifically instructed to try to be consistent. This is mentioned to be a general phenomenon: if intelligent people have to notice *themselves* that an issue of rationality is involved, they do little better than their counterparts of lower intelligence.

Myside Processing: Heads I Win - Tails I Win Too! discusses "myside bias", people evaluating situations in terms of their own perspective. Americans will provide much stronger support for the USA banning an unsafe German car than for Germany banning an unsafe American car. People will much more easily pick up on inconsistencies in the actions of their political opponents than the politicians they support. They will also be generally overconfident, be appalled at others exhibiting the same unsafe behaviors they themselves exhibit, underestimate the degree to which biases influence our own thinking, and assume people understand their messages better than they actually do. The end of the chapter surveys research on the linkage between intelligence and the tendency to fall prey to these biases. It notes that intelligent people again do moderately better, but only when specifically instructed to avoid bias.

A Different Pitfall of the Cognitive Miser: Thinking a Lot, but Losing takes up the problem of failing to override your autonomous processing even when it would be necessary. Most of this chapter is covered by my previous discussion of override failures in the Cognitive Miser post.

Mindware Gaps introduces in more detail a different failure mode: that of mindware gaps. It also introduces and explains the concepts of Bayes' theorem, falsifiability, base rates and the conjunction error as crucial mindware for avoiding many failures of rationality. It notes that thinking dispositions for actually actively analyzing things could be called "strategic mindware". The chapter concludes by noting that the useful mindware discussed in the chapter is not widely and systematically taught, leaving even intelligent people gaps in their mindware that makes them subject to failures of rationality.

I mostly covered the contents of **Contaminated Mindware** in my post about mindware problems.

How Many Ways Can Thinking Go Wrong? A Taxonomy of Irrational Thinking Tendencies and Their Relation to Intelligence summarizes the content of the previous chapters and organizes the various biases into a taxonomy of biases that has the main categories of the Cognitive Miser, Mindware Problems, and Mr. Spock Syndrome. I did not previously cover Mr. Spock Syndrome because as Stanovich says, it is not a fully cognitive category. People with the syndrome have a reduced ability to feel emotions, which messes up their ability to behave appropriately in various situations even though their intelligence remains intact. Stanovich notes that the syndrome is most obvious with people who have suffered severe brain damage, but difficulties of emotional regulation and awareness do seem to also correlate negatively with some tests of rationality, as well as positive life outcomes, even when intelligence is controlled for.

The Social Benefits of Increasing Human Rationality - and Meliorating Irrationality concludes the book by arguing that while increasing the average intelligence of people would have only small if any effects on general well-being, we could reap vast social benefits if we actually tried to make people more rational. There's evidence that rationality would be much more malleable than intelligence. Disjunctive reasoning, the tendency to consider all possible states of the world when deciding among options, is noted to be a rational thinking skill of high generality that can be taught. There also don't seem to be strong intelligence-related limitations on the ability to think disjunctively. Much other useful mindware, like that of scientific and probabilistic reasoning. While these might be challenging to people with a lower IQ, techniques such as implementation intention may be easier to learn.

> An implementation intention is formed when the individual marks the cue-action sequence with the conscious, verbal declaration of "when X occurs, I will do Y." Often with the aid of the context-fixing properties of language, the triggering of this cue-action sequence on just a few occasions is enough to establish it in the autonomous mind. Finally, research has shown that an even more minimalist cognitive strategy of forming mental goals (whether or not they have implementation intentions) can be efficacious. For example, people perform better at a task when they are told to form a mental goal ("set a specific, challenging goal for yourself") for their performance as opposed to being given the generic motivational instructions ("do your best").

Stanovich also argues in favor of libertarian paternalism: shaping the environment so that people are still free to choose what they want, but so that the default choice is generally the best one. For instance, countries with an opt-out policy for organ donation have far more donors than the countries with an opt-in policy. This is not because the people in one country would be any more or less selfish than those in other countries, but because people in general tend to go with the default option. He also argues that it would be perfectly possible though expensive to develop general rationality tests that would be akin to intelligence tests, and that also using RQ proxies for things such as college admission would have great social benefits.

> In studies cited in this book, it has been shown that:
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> - Psychologists have found ways of presenting statistical information so that we can make more rational decisions related to medical matters and in any situation where statistics are involved.

- Cognitive psychologists have shown that a few simple changes in presenting information in accord with default biases could vastly increase the frequency of organ donations, thus saving thousands of lives.
- Americans annually pay millions of dollars for advice on how to invest their money in the stock market, when following a few simple principles from decision theory would lead to returns on their investments superior to any of this advice. These principles would help people avoid the cognitive biases that lead them to reduce their returns - overreacting to chance events, overconfidence, wishful thinking, hindsight bias, misunderstanding of probability.
- Decision scientists have found that people are extremely poor at assessing environmental risks. This is mainly because vividness biases dominate people's judgment to an inordinate extent. People could improve, and this would make a huge difference because these poor assessments come to affect public policy (causing policy makers to implement policy A, which saves one life for each $3.2 million spent, instead of policy B, which would have saved one life for every $220,000 spent, for example).
- Psychologists from various specialty areas are beginning to pinpoint the cognitive illusions that sustain pathological gambling behavior - pseudodiagnosticity, belief perseverance, over-reacting to chance events, cognitive impulsivity, misunderstanding probability - behavior that destroys thousands of lives each year.
- Cognitive psychologists have studied the overconfidence effect in human judgment - that people miscalibrate their future performance, usually by making overoptimistic predictions. Psychologists have studied ways to help people avoid these problems in self-monitoring, making it easier for people to plan for the future (overconfident people get more unpleasant surprises).
- Social psychological research has found that controlling the explosion of choices in our lives is one of the keys to happiness - that constraining choice often makes people happier.
- Simple changes in the way that pension plans are organized and administered could make retirement more comfortable for millions of people.
- Probabilistic reasoning is perhaps the most studied topic in the decision-making field, and many of the cognitive reforms that have been examined - for example, eliminating base-rate neglect - could improve practices in courtrooms, where poor thinking about probabilities have been shown to impede justice.

These are just a small sampling of the teachable reasoning strategies and environmental fixes that could make a difference in people's lives, and they are more related to rationality than intelligence. They are examples of the types of outcomes that would result if we all became more rational thinkers and decision makers. They are the types of outcomes that would be multiplied if schools, businesses, and government focused on the parts of cognition that intelligence tests miss. Instead, we continue to pay far more attention to intelligence than to rational thinking. It is as if intelligence has become totemic in our culture, and we choose to pursue it rather than the reasoning strategies that could transform our world.