

Inverse at Princeton: lessons from the von Neumann dog

It is not always easy to separate truth from myth from falsehood, especially where all three walk into a bar together. This is a lesson taught by the von Neumann household dog, Inverse. Where he learned it is a matter of some speculation, starting with his infamously perverse housemaster, at least in matters of humor, Johnny Von Neumann, celebrated mathematical genius, Manhattan project consultant, co-father of the modern computer, Rand Corporation strategic consultant, member of the Atomic Energy Commission, &, arguably most important of all, pioneer in the field of game theory.

In 1928, a wunderkind then working with David Hilbert, he published a seminal essay on the subject, “ ,“ & then in 1944, with a Princeton colleague (the economist Oskar Morgenstern) *Theory of Games and Economic Behavior*, which not only defined the new field, but brought it to the foreground of post-war national strategic planning. His impact on the processes of strategic thinking & game-modeling are each far greater than to the content.

In fact, the content can sometimes even be misleading, where what’s really taught is the *inverse* of what it seems. For example, in 1950, he and Bertrand Russell (British philosopher with mathematical interests) were both advocates of an ultimatum requiring a reversal of the brand new Soviet nuclear weapons capability, to cut off the WMD arms race before it got out of hand, during a brief window when the United States had a clear-cut nuclear advantage, & near-monopoly—as if that leverage would have forced the Soviets to capitulate, a highly questionable proposition, given their European ground-force capabilities, held in check, many argued, only by the threat of an American nuclear umbrella.

In von Neumann at least must have already figured the improbability of Soviet capitulation into his equations. Factoring in much of what the next 25 years would indeed bring by way of potential costs & casualties, but not what the next 25 after that would reveal, he seems to have concluded our narrow window ought to be exploited to maximum advantage. One must note that “Johnny,” as he was known, had seen the Nazis come to power & accurately predicted the effects a couple years in advance. As a Hungarian, he also knew the Soviet mind, and its effects, including its enslavement of Eastern Europe.

Had the people of Hungary & Czechoslovakia been on von Neumann’s timetable & risen up in 1950, rather than a few years later, it’s still quite uncertain that the United States would have done more to back them, even with its near monopoly on nuclear weapons. It’s a mistake to think things are ever as simple as the single issue at hand, or seemingly in focus. Just think of everything else going on by 1950, including in Korea. It’s hard to see where the nuclear capacity would necessarily be strategically decisive. By the mid-1950s, this was presumably all the more visible, with the evolution of MAD—Mutually Assured Destruction, as the always tentative & unsure basis of preventive détente.

In such a world, everything may be inverted—a rational insanity, insane reason. Some of this von Neumann understood--& some he didn’t. There is a famous example in which President Nixon explicitly sought to spread the idea he was so ideologically obsessed, he was prepared to act like a madman, even use nuclear weapons on North Vietnam, if

necessary, to secure concessions. The problem with such an approach is that one only makes the impression credible by mad actions, the real end of which no one really knows.

That was not von Neumann's way, nor his reasoning model, which was to examine decision-making realistically, in search of rational solutions, if available. The idea of "game" did not imply something light or frivolous, a *mere* entertainment, in other words, but "As von Neumann used the term, a 'game' is a conflict situation where one must make a choice knowing that others are making choices, too, and the outcome...will be determined in some...way by all the choices made....." [Poundstone, p.6].

With rigorous mathematical logic, he proved the "mini-max theory," for example, proving that such a rational course exists for both parties in a two-party situation in which their interests are diametrically opposed. He, better than most who thought they understood him, would have recognized the limits specified, including the fact that real-world situations are never that limited. They not only include more parties, more unexpected twists & turns, but also more of what would come to be called *unknown unknowns*, not factored in at all.

The real irony may be that in many of the most significant actual historical events of the last half century plus since von Neumann's calculations, these *unknown unknowns* held the power to invert the seemingly rational conclusions reached. Reading the Strategic Options Memos submitted to President Kennedy in reference to the Cuban Missile Crisis, for example, makes these seemingly highly rational analysis look utterly inadequate, even foolish if not insane, in the light of subsequently learned information. It is to the credit of his innermost circle that Kennedy was able to negotiate the ignorance around him, partly by recognizing his own—how much had not been adequately factored in as things spiraled out of control on their own steam, including prevailing "rules of engagement" *on both sides*.

Of course von Neumann can't be blamed for the fact that "dinosaurs" like Lemay were still operating on assumptions & ways of thinking developed in WW II & the immediate post-war period, still itching to unleash the full arsenal, sure of "victory" at a reasonable cost (maybe 20 million, max), with well over 100 million on the other side. The old "we can bomb them into the stone age idea." Nor was it easy for Kennedy, who knew better, to "manage" the institutionalized forces he supposedly directed, with the good sense to recognize the same dilemma on the other side. It took extraordinary measures, including the foresight to go out of the chain of command internally as well as externally.

Externally, Kennedy used an unofficial back-channel to negotiate with the Soviet Premier, including parts of the deal to remain "off the record." Internally, the White House made a direct contact to the reconnaissance squadron leader to arrange a falsehood in order to avoid an uncontrollable sequence of events already embedded in the institutional "rules of engagement." Being fired upon over Cuban territory would trigger return fire to take out the radar & batteries, for example, both done as matters of self-defense. Given the fact that some intermediate range Russian missiles were armed & officers had standing orders to fire if attacked, Kennedy had good sense to be concerned about how little control he'd have over subsequent events.

Most of the government's hard-nosed analysts hardly looked far or deep enough to see the immensity of the unknown or have any idea what their recommended actions portended. The squadron leader complied with the White House request, however, and officially returned "without having been fired on," though with a few bullet-holes. A quarter century later, it came out that those manning missile sites (some armed but not yet discovered) had "rules of engagement" that specified firing should ground installations come under attack, on the "use it before you lose it" principle. None of this was known, or seemingly seriously considered by most of those advising the president.

Also not known, nor seemingly considered by most others in high leadership, were what came to be called "nuclear winter effects," only described a decade or more later. The sense of potentially enormous secondary & tertiary impact effects on future generations went almost entirely unreflected in the seemingly rational strategic calculations of the experts—though the more grounded & rational leaders weren't entirely blind to them either.

Nor was Johnny von Neumann, who no doubt understood more than most how things could turn into their opposites or, with a nudge from an unidentified variable, produce results wildly different from expectations, orders of magnitude different from calculations. The calculations themselves could be impeccable, and even the estimates used, yet the outcomes could be totally different as influenced by factors not considered at all, seemingly so small at the time, no one noticed they were missing from the equations, even a seer like von Neumann, who was otherwise uncannily adept at following dynamics out from a couple years to a quarter century.

It is hard to say how he might have advised Kennedy in 1962, the nuclear situation being then so dramatically different from what it was during that brief window in 1950 when the United States had what might have been a near-enough nuclear monopoly to consider trying to prevent proliferation at almost any cost. Looking out 25 years or so at the level of weaponry that would exist by then, and factoring in the probabilities of some use in the interim (e.g., the situation in Cuba, and a half-dozen other closer calls than may be generally realized), one might well conclude that, bad as it could be, it would only get much worse if we didn't force the issue then, in 1950.

By 1963, however, looking out 25 years would bring one to the relatively peaceful dismantling of the Soviet Union, a far superior outcome. On the other hand, we still don't know the outcomes looking further out, and issues of proliferation have far complicated the dilemmas. The "chain reaction" from the original development & use continues on various historical time scales. Not even the most brilliant strategists had the skills to look far out with much confidence, a fact all too nonchalantly acknowledged & ignored. After all, we have to decide *something*, despite the incomplete information.

Where so much is at stake, we can afford neither mismanagement nor lack of management. What good management involves needs to be clarified, however, learning from our history. The first step in this is to include more serious attention on the unknowns, which is another way to say, bring a good bit more humility to the table.

Another great example of the issue had von Neumann looking into the technical & economic possibility of spreading dark dyes on Arctic & Antarctic ice to raise the global temperature a degree or two, in the belief that would produce widespread human benefits. I don't know where he got the idea, whether the calculations were primarily an intellectual exercise, or how seriously the possibility was ever considered. It's especially interesting, however, given the fact of being a dozen years or so beyond von Neumann's quarter-century horizon—before global climate change would become a concern. How do we make sense of the fact the one of the smartest persons in the world could seemingly miss such a vast issue just over his intellectual horizon?

Only by giving the “unknown unknowns” more weight in such equations. If that renders the calculations useless, having too wide a range of possible outcomes, that may well be attributed to the nature of reality, providing a more accurate probability wave. It's not surprising to find resistance to doing so, being uncomfortable with so much uncertainty, particularly where actions may nevertheless be called for, where paralysis is not necessarily the optimal response, which must lie somewhere between paralysis & arrogance (a version of *hubris*, thinking one knows more than one does).

It may be that humility was not one of von Neumann's defining attributes. Nor was he inclined to sit back & be paralyzed by the unknown. He was more likely to invent a way to make it known...eventually. Being one of the experts in quantum physics, he had more understanding of the nature of probability waves than most.

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I don't know how the von Neumann dog got to be called *Inverse*. (Maybe he'd been a particularly poetic puppy.) The important point here is that von Neumann and *Inverse* were both very real, historical individuals known to their Princeton, NJ neighbors & colleagues at the Institute of Advanced Study.

Equally real, it seems, is the story from a fellow named Bigelow about his visit to the von Neumann house, arriving for an interview two hours late. As he entered, greeted by the eminent professor, a somewhat rambunctious dog he'd met out front pushed its way in, practically between his legs, & made itself at home. At the door on the way out, the professor seems to have said something like, “Don't forget your dog,” the exact words of which Bigelow may not have recalled precisely.

“My dog? But that is not my dog...” Bigelow reported having blurted out, before concluding “and apparently it wasn't his either.” The story (quoted from its published source, in Regis 1987) is included on the Snopes.com urban legends rumor page, along with many other reported versions of the same story, some going far back, others more current.

Most of these others were clearly told as jokes, however, whereas the Bigelow story is presented as a documentary report of what ostensibly actually happened—itsself an inversion of the actual. Left out of the story rather completely is the central fact—that Bigelow himself seems to have totally missed the joke, making the “true story” its own

fiction. The following is more or less what we shared recently with the [urban legends site](#), then, in reference to its article titled “Not My Dog,” more specifically in relation to the Regis account of Bigelow’s version of the visit to von Neumann’s house.

The irony is that it is a true story—but only in terms of Bigelow’s mistaken version of his own experience, particularly his incomplete & presumably incorrect interpretation. At the end of his account of the incident, for example, he supposedly “realizes” that von Neumann “believed it was my dog,” & concludes “it apparently wasn’t his either.” His account of his own mental processes is accurate, seemingly without a glimmer of its own deficiency.

Can it really be that Bigelow never got the joke, neither on the way home or every after, nor anyone else he told the story to who might have clued him in, certainly not Regis or others who have quoted his story since? If so, it is high time to set the record straight.

It is an historical fact that Johnny was a notorious trickster, and also that his dog, Inverse, was a well loved presence in the household, around the neighborhood & even at the Institute for Advanced Study (where there may even be a statue of him). “Inverse himself may have had some reputation as a trickster, though perhaps only “guilty by association,” i.e., by virtue of a von Neumann tendency to “blame it on the dog.”

Does a true account that lacks awareness of its own mis-perceptions & false conclusions make it a half-true story? Despite Bigelow’s rather sloppy conclusion to the contrary (“apparently”), I’d bet von Neumann never expressly said the dog wasn’t his, nor actually expected that his guest wouldn’t get (& enjoy) the joke. After all, saying something like, “Don’t forget your dog” might be considered good advice generally. Bigelow’s account may have reported von Neumann asking something like, “Do you always travel with your dog?” The general lack of precision in his account has already been established, however, and by the time the story is published in 1987, Inverse had supposedly become “a great dane.”

I imagine Johnny couldn’t resist invoking the joke, all the more for someone two hours late, but he may not have accounted for his guest’s denseness, expecting him to get the joke eventually. Or perhaps he was testing him. Johnny was used to playing tricks on the best & the brightest, after all. He once drove Einstein to the train station, en route to NYC to receive an award, leaving him on the platform for the train heading west.

Peter Sellers picked up the dog joke in a *Pink Panther* film, when his French Inspector C. asks a character with a dog by his side, “Does your dog bite?” When told, “No,” Inspector C. goes to pat the dog, but gets attacked. “I thought you said your dog didn’t bite?” he reacts indignantly. “But that is not my dog,” says the character.

At the Bod Library, we are pleased to name our newly opened game & market-modeling annex in honor of *Inverse von Neumann*, who put up with Johnny’s whimsy, & may even have encouraged it, especially where things could turn into their opposites, with these in turn doing the same without reverting to what they were like before--just seen from a slightly different angle, or at another scale or order of magnitude.