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THE SPORTING SCENE

WHAT WOULD JESUS BET?

A math whiz hones the optimal poker strategy.

BY ALEC WILKINSON

Poker played poorly is purely a gambler's game. Losers tend to think that they didn't get the cards, and not that they were beaten by someone who played better than they did. They return to the table and wait for big hands and lose more. Accomplished players strive to diminish the effects of luck. From the pattern of their opponents' bets and behaviors, they work like detectives to determine their cards. They play opportune hands deceptively, and feckless ones, too, and shed unpromising ones before the cards cause them too much harm. They know that some hands that seem auspicious are not, and that others are stronger than they appear.

Games for which a flawless strategy is known are said to be solved. Tic-tac-toe is solved; blackjack is solved; checkers is solved. Chess is not solved, and poker is not, either. Solutions theoretically exist; they are simply too intricate, so far, to be comprehended. Among mathematicians, chess is regarded as a game of perfect information, because nothing is hidden. If its ideal strategy were discovered, there would no longer be any reason to play it—no move could be made for which the response was not already identified. Poker is a game of imperfect information, since so much is concealed. Solving it would not overcome the disadvantage of being unable to know why your opponent is acting as he is. Such concepts derive from an abstruse field of applied mathematics called game theory, which was formulated, in the nineteen-forties, to address difficult economic problems.

Game theory was conceptualized by John von Neumann, who was one of the mathematicians involved in the Manhattan Project, and collaborated with Albert Einstein. In 1944, Von Neumann, with Oskar Morgenstern, published "Theory of Games and Economic Behavior." Until then, people typically entered markets with a strategy, but such preparation could help them prevail only if they knew

what other people would do. Game theory provided a tool. Von Neumann saw that the tidal rhythms of transactions and uncertainties involved in markets were embodied in the narratives of parlor games, and especially in poker, where each player also has a strategy to claim the largest share of the money changing hands. Since the strategies of most games were subject, if simplified, to fairly concise mathematical calculations, the workings of markets could be also.

"Theory of Games and Economic Behavior" is riddled with charts, equations, and diagrams. Without an understanding of higher math, it is impenetrable. In an essay reprinted in the book's sixtieth-anniversary edition, John McDonald, quoting John Maynard Keynes, writes, "Businessmen play a mixed game of skill and chance, the average results of which to the players are not known by those who take a hand." Von Neumann's theory is designed to narrow this gamble. . . . It tries to make the imponderable ponderable."

To diagram certain game-theory problems, Von Neumann used hands of poker as examples. Fifty years later, it occurred to an amiable U.C.L.A. graduate student named Chris Ferguson to apply game-theory concepts to grand-master poker. Relying on them, he became known, in 2000, as the first person to win a prize of more than a million dollars in a poker tournament.

Chris Ferguson is tall and lanky, with very long brown hair and a brown goatee; his admirers call him Jesus. When he plays cards, he wears a black cowboy hat that he was given by a friend. The brim protrudes over his forehead like an overhang, sometimes throwing his eyes, behind dark glasses, into shadow. At the poker table, he has all the animation of a state trooper handing out a speeding ticket. When he's especially engaged, he sits almost cataleptically still, with his hands clasped in front of his chin. His

right hand is balled into a fist, and his left hand rests open on top of it. To bet, he lowers his right arm like a lever, then returns to his original pose. The gesture is exactly the same whether the bet is a bluff or a boast.

In the 2008 World Series of Poker, in Las Vegas, Ferguson played poker ten hours a day for thirty-five days in a row.

cards. (Ferguson is also adept at throwing cards like missiles, which he learned from a book by the magician and card specialist Ricky Jay.) Leaning on one elbow, he used the bed for a table and showed me a double shuffle, a shuffle that appears to be genuine but isn't a shuffle at all—all the cards remain where they were. "I learned it for protection, in the nineties," he said,

It's not important in chess, but it's important in poker. It's a rather deep game, when you get involved."

Ferguson doesn't recall when his father taught him poker—he feels as if he's known it all his life—but he remembers that when he was in the fourth grade he lost thirty-five cents in a game, and it bothered him. In high school, he played



Chris Ferguson (left) says, "You might get lucky and beat me, but you'll never outplay me." Photograph by Martin Schoeller.

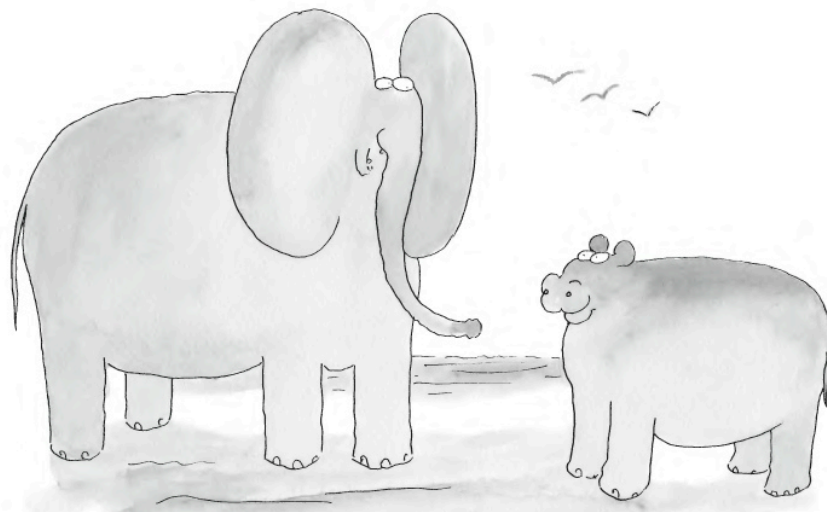
On the crown of his hat he wore an adhesive patch bearing the logo for FullTiltPoker.com—a site he helped to launch—as he does whenever he appears in public as a poker player. Ferguson had a room in the Rio Hotel, where the tournament was held, and when he was finished playing, usually around three or four in the morning, he went upstairs and slept until noon, then came back to the lobby and sat down at a table. A few times, he finished at seven in the morning. Eventually, he found himself unable to fall asleep any earlier than that.

One night in Las Vegas, I went to his room so that he could show me some fancy forms of shuffling—cheat forms, shuffles that allow dealers to deal specific

“to see if people were doing it to me. A really good magician is going to beat a good spotter. A good dealer is supposed to deal in a way that you know he can't be cheating.”

Ferguson was born in Los Angeles in 1963. His mother, Beatriz, was a mathematician and his father, Tom, taught game theory at U.C.L.A. Tom Ferguson brought home specialized board games and card games and taught them to Chris and his older brother, Marc, who is now a computer programmer. “Whenever there was a rainy day, we would get to stay inside and play Risk,” Tom Ferguson told me. His younger son “learned to think about playing and strategies and what other people know about what you know.

on the weekend with friends. At seventeen, accompanied by some of them, he began making occasional trips to Las Vegas. He and his friends would pool gas money, sleep in cheap hotels, and eat at the buffets. He liked Vegas because the people in the casinos called him “sir,” and “you could lean back in your chair and no one would yell at you, unlike school.” His friends went for fun, but Ferguson went to establish whether he played poker well. “I saw Vegas as a challenge,” he told me. “Play ten hours a day, pay for my room and my food, and get home with more money than I started with. I think of that as my transition into manhood—when I was able to prove to myself that if I had no support from my family, and no job,



Victoria Roberts

"I've been in three documentaries, but I've never been nominated."

as long as I could get to Vegas, and have a hundred dollars in my pocket, I could survive."

As an undergraduate, at U.C.L.A., Ferguson thought that joining the swing-dance club would be a good way to meet people, and now he is an expert dancer. He met his girlfriend, a Brazilian woman named Fabiola Gomes, at a night club. Gomes, a personal trainer, is petite and animated, with thick ringlets of dark hair. They live in her house in Las Vegas. Until two years ago, Ferguson, who is forty-five, lived mostly with his parents.

From a fifty-two-card deck, 2,598,960 five-card hands are possible. The basis for most poker strategy is a ruthless notion: What can I discern about my opponents' habits that I can attack? Such an approach is called "maximally exploitive." It is the way nearly all professionals proceed, relying on logic and intuition. While he was still a student, Ferguson decided also to employ a method called "optimal strategy," which derives from a game-theory question posed by Claude Chevalley, in 1945, in *View*: "Each player being ignorant of the strategies followed by his opponents, which strategy will he follow in order to get the maximum possible advantage for himself?"

The optimal strategy "doesn't mean 'How do I win the most?'" Ferguson told

me when I met him in Las Vegas. It means, when up against an expert opponent, "How do I lose the least?" Part of it is mathematically determining whether one's cards are favorable, but a player using optimal strategy also builds into his play bets that sometimes appear improbable and make it mathematically difficult for the opponent to know what to do. With optimal strategy, "if we're playing heads up, you might get lucky and beat me, but you'll never outplay me," Ferguson said.

Ferguson made occasional trips to Las Vegas during his five years as an undergraduate (he received a degree in math and computer science from U.C.L.A.) and his thirteen years as a graduate student in computer science. On the entry forms of poker tournaments, for many years, he listed his occupation as "student." His thesis adviser was Leonard Kleinrock, whose lab sent what was considered the first message over the Internet, in 1969. Kleinrock told me that Ferguson was "one of the more brilliant and creative young men that I've known in my career at U.C.L.A." During the late eighties, Ferguson was working as a programmer for a more advanced doctoral candidate when the student got a result he couldn't interpret. "Chris, this lowly programmer, writing code, explained what was causing the result," Kleinrock said.

"It was a very deep theoretical idea, and his manner was very low-key, no bravado, just pure intelligence, and, when I saw that, I thought, I want to follow through with this guy."

Kleinrock said that Ferguson "would spend hours bouncing ideas around. All kinds of esoteric mathematical and computer subjects—genetic algorithms, search algorithms, and so on—reams of ideas, then he'd come back the next day pursuing some of them, having thrown the others away." He went on, "Or he would show me how he was progressing on cutting the deck down to any number of cards—sixteenth card or thirty-fourth card—and the perfect riffle of them. I was not the type of supervisor to demand a schedule—we were both enjoying the academic and scientific ideas. He was, by far, the student who took the longest to graduate, though." Ferguson finished his doctorate in 1999, when he was thirty-six, by which time he had spent half his life at U.C.L.A. "He was never the go-go-go academic achiever that wanted to race up there and set the world on fire," Kleinrock said. "Plus, the year after he graduated he became the world champion and won all that money."

Ferguson moved out of his parents' house in California when he became really rich. (Nevada has no income tax.) He has won more than seven million dollars playing poker, and that's still less, apparently, than what he has earned as "something like chairman of the board" of Tiltware, which developed and licensed the software for FullTiltPoker.com, where people play poker, sometimes against Ferguson and other professionals, for money. In 2002, dissatisfied with the customer service of the online poker sites he visited, he saw the opportunity for a site "for the player, by the player, and of the player," and began writing software for it. FullTiltPoker.com began operations two years later. Ferguson and a dozen other pro players involved with the site are known as Team Full Tilt.

Initially, Full Tilt represented a novelty—other sites had pro players affiliated with them, but usually only one or two, and they weren't necessarily available to play hands with customers. "It grew about three per cent a week for the first year, and two per cent a week for the two years

after, and suddenly you realize you're there," Ferguson said. According to H2 Gambling Capital, a gaming consultancy, the online poker business made \$3.8 billion last year. The largest site is PokerStars.com, which is based on the Isle of Man. FullTiltPoker.com is the second largest, and one of the fastest growing. It has a sister site, FullTiltPoker.net, where only play money is used. Being rich, Ferguson said, makes his attention less acute, but his judgment more reliable. "Your judgment can be skewed if you're desperate," he said.

In 2006, Congress passed the Safe Port Act, which included a measure called the Unlawful Internet Gambling Enforcement Act. It makes it illegal for banks and credit-card companies and other money-handling operations to transfer funds to online-gambling sites. Some companies promptly withdrew from the online-gambling market in the United States. Full Tilt's servers were already in Canada, in the Mohawk territory of Kahnawake, an Internet-gaming haven; the site's software and customer-service operations had gone to Dublin, which is sometimes called the Silicon Valley of Europe. (The details of the business's current ownership are a bit opaque, owing in part, perhaps, to a pending lawsuit by an early Team Full Tilt member.) Unlike many other sites, Full Tilt continued taking American customers.

The Department of Justice, on its Web site, has a link to an F.B.I. page with the heading "Online Gambling, Don't Roll the Dice." It begins, "If you've ever thought about visiting a cyber casino, here's something you should know: it's illegal to gamble online in the United States." It goes on to say that among the activities that are illegal are "cyber bets on sporting events or in virtual card games."

In the minds of many legal scholars, this position is disingenuous—is, in fact, a bluff. It is not clear that any law governs online poker. The Safe Port Act defines a bet or wager as "the staking or risking by any person of something of value upon the outcome of a contest of others, a sporting event, or a game subject to chance." Lawyers and advocates of online poker assert that poker is a game of strategy and not one "subject to chance." Roulette, in which a person can apply no effective plan whatsoever, is a game dominated by chance. The element of

chance in poker is addressed tactically—if a player doesn't like his cards, he folds them. "Games of skill need to be distinguished from games of chance," Charles Nesson, a professor at Harvard Law School, told me. "Games of skill, strategic games that apply strategic thinking—checkers, chess, and poker, among them—are not."

The Department of Justice says that, in addition to the Safe Port Act, the Federal Wire Act also applies to online poker. The Wire Act was passed in 1961 to prevent the use of telegraphs and telephones to send horse-racing information to bookies. In 2002, two men argued in the Fifth Circuit Court of Appeals that the money they owed their credit-card companies didn't have to be paid, because they had been gambling with it in an online casino, and, according to the Wire Act, gambling online was illegal. The court ruled that the Wire Act specified only bets on sports, and "does not prohibit non-sports internet gambling."

"That ruling gave a lot of comfort to people interested in ramping up gaming sites," Amy Marlyse Burgert, a lawyer in Houston, whose practice includes online gaming, told me. "So long as you weren't sports wagering, you could look at this and see an opportunity."

A spokesperson for the Department of Justice, in an e-mail, told me, "The Department's view for some time has been that all forms of Internet gambling, including sports wagering, casino games and card games, are illegal under federal law. While many of the federal statutes do not use the term 'Internet gambling,' the Department believes that their statutory language is sufficient to cover Internet gambling." As to why there had been no prosecutions for online poker, the spokesperson said, "Just because someone hasn't been prosecuted yet doesn't mean that they won't be."

What this statement amounted to, according to Nesson, was "a threat." He went on to say that "the typical approach to it has been to point out the irrational-

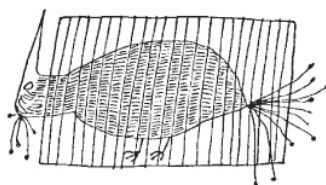
ity of the D.O.J. position, both in legal and, in some sense, logical terms. But that's been a loser argument, because the policy is not about rationality, and it's not about to be displaced by rational argument. It goes deeper than that—it's an appeal to a kind of fundamentalism."

I asked I. Nelson Rose, a professor of law at Whittier Law School and one of the leading authorities on Internet gambling, if he thought Ferguson was breaking any laws. "There may be a state law somewhere, but it isn't easy to find," he said. "You'll notice, though, the prosecutors are not arresting people involved in Internet poker. Ferguson would be easy to grab, assuming you had a good solid law."

By remaining open after the Safe Port Act, Full Tilt and Ferguson "made the best bet in the history of poker," Steven Lipscomb, the head of the World Poker Tour, said. "They deserve a lot of credit for the courage to make a stand." He told me this somewhat grudgingly; his own company had been reluctant to risk entering the American online market, and after the passage of the Safe Port Act it had seen its shares all but collapse. Furthermore, Ferguson and six other players had sued the World Poker Tour in 2006; the case, an antitrust suit, was settled amicably in 2008. "Their site has been wildly successful, and they are richer beyond their wildest dreams of what they'd ever have got from poker," Lipscomb said.

Poker allows two ways to win: own the best hand, or make the best hand go away, sometimes by bluffing. The imperative to bluff, it turns out, is inherent. "I can take a purely mathematical model of poker and hunt for a purely mathematical solution," Harold Kuhn, a professor emeritus at Princeton who knew Von Neumann, told me, "and a phenomenon will appear which has always seemed to be psychological but isn't—it's mathematical—which is that you will bluff, and your opponent will drop out. The necessity for bluffing is built into the mathematics of the model."

Any hand has multiple strategies, Ferguson said. "If I'm facing someone I've never played before and have no idea of his weakness, and I play an optimal strategy, I know I will not make a mistake that will give him any money," he said. "If you don't know the optimal strategy, you



don't know your weaknesses or his; you don't know when he's taking advantage of you, and you can take advantage of him. As people deviate from optimal strategy—as they bluff or fold or call too often or not enough—it's actually pretty clear. If you're able to see how they deviate, you can see how to take advantage of them."

A player using optimal strategy assumes that his opponents know he is doing so—in other words, that his strategy has been found out. He can announce, for example, that a third of his bets will be bluffs, and then construct the game in such a way that his opponent still can't tell whether it is better to fold or call. If two players have each put fifty dollars into the pot, and the optimal-strategy player bets a hundred dollars and his opponent folds, the opponent loses fifty dollars. If he calls, one-third of the time he will win, because the optimal-strategy player is bluffing, and two-thirds of the time he will lose, because the optimal-strategy player is betting a hand that is strong enough to win. The opponent now has no means of knowing when it is better to call than to fold. This is described as making the opponent "indifferent." He might as well flip a coin. "Now it's a mind game," Ferguson said.

"What are the guys who don't play optimal strategy doing?" I asked.

"I'm not sure what they're thinking," Ferguson said. "They're flying by the seat of their pants. I learned poker by sitting at home and thinking how to play hands—if I play my hands this way, what can my opponent do to take advantage of me, and if he can, what do I need to do so that he can't anymore? I want to be the least exploitable player. Other people learn through experience, and if they're

good they're going to come up with a strategy that's pretty similar to what I do. It turns out that there's just a right way to play. I learned by applying game theory. They learned through what I consider a more arduous process, playing countless hands. Am I smarter because I use game theory? I don't think so. It's hard to learn poker, because you can play a hand horribly and win, and also play perfectly—almost—and lose. How's the guy who doesn't know the game well going to know the difference?"

Some players think that approaching poker through math causes someone like Ferguson to lose sight of all the peripheral elements of the game, such as "tells," unconsciously revealing behaviors that intuitive players regard as rich in information. Ferguson doesn't dismiss these aspects of the game—he both looks for tells and tries not to display them—but he believes that game theory protects him from making intuitive judgments that might fail, or from being distracted by information that's not necessarily germane. Exploitive players "model their opponents, and then they come up with a strategy that will beat that opponent—'He raised here, he must have that hand' or 'He plays that way, I'm going to play this way'—and they stop there," Ferguson said. "I don't stop there. I say, 'If I play this way, how can he play to counteract what I'm doing—how might he adjust?' The beauty of it is that it doesn't depend on your opponent. Once I figure out what the optimal strategy is, I know it. A year from now, it will be the same. It doesn't matter who I'm playing against. The research is everlasting."

Another player who uses game theory and math as heavily as Ferguson does is

Andy Bloch, who is thirty-nine, and has two degrees in electrical engineering from M.I.T. and a law degree from Harvard. "Most other people are trying to outplay you—bluff you out of pots, trying to get a read on you," Bloch told me. "If you're playing against someone like that, you can manipulate them into making bad calls and folds. Chris is one of the most difficult people to get an edge on, if you can get an edge at all. Against other players, I'm going to try, but with Chris I don't even really try. He's too difficult to read. Players unfamiliar with game theory, the intuitive players, are going to have a really hard time reading and understanding him, because some of the plays he makes are going to confuse them. They'll see a bluff and think he bluffs too much, because the bluff doesn't make sense."

At the tail end of the 2008 World Series of Poker, the Bellagio held a tournament, and Ferguson entered, although he was exhausted—he had played in thirty-three of fifty-five events of the series, and had won around seven hundred thousand dollars. The buy-in at the Bellagio was fifteen thousand dollars, cash only. Ferguson paid with three five-thousand-dollar chips that a friend had given him to satisfy a debt. He sat with eight other players at a table in a high-ceilinged room with huge windows at one end, off the casino proper. In all, there were four hundred and forty-six players at forty-five tables. There was a low, sibilant rustle in the room, the sound of chips being agitated in hundreds of hands. On the walls were television screens showing a golf tournament and an action movie, with the sound turned off.

Ferguson calls himself a tournament specialist, meaning that he doesn't play for table stakes—what are known as live games. In live games, players can always buy more chips when they lose. Ferguson regards this as tedious. In a tournament, when you've lost your chips, you're done. A tournament player has to accumulate chips to withstand challenges, which become more consequential as the match progresses. Players are often allowed to enter tournament games a few hours after play has started, which is what he likes to do. "I lose the advantage of knowing the table," he says, meaning



the other players, but, because he has rested, his decisions are better.

Thousands of men and women are believed to play poker for a living. The entry fees at big tournaments can be so high that chairs are sometimes filled by people representing syndicates—groups of players who have pooled their money and sent one player to represent them. If there are winnings, they split them.

Ferguson kept getting cards he didn't want. He turned their edges over slightly to read them, then tossed them back and folded his arms across his chest and looked impassively at the movie. Now and then he leaned back on the legs of his chair. He was roused briefly by a man in a white T-shirt and black shorts, with black shiny hair, who walked mostly sideways among the tables toward the door. "I'm a friggin' idiot," the man said. "That's what I am. Stone-cold idiot."

I stood near Ferguson's table. Julio Rodriguez, who writes for CardPlayer.com, was filing updates on the game. I asked Rodriguez how unusual Ferguson was in being so fluent in math. "A lot of players know the math," he said. "There's no way around it, really, but the majority of them go on instinct, or feel, or a read on a player. It seems like a lot of them are just born with a sense of games. If you talk to a lot of these guys outside, they're never not playing a game. They're reading you. That's why they're so engaging. They know what people want; it's very easy for them to please you. They also know how to deceive."

I asked why he thought Ferguson appeared to be playing so cautiously. This early in the tournament, he said, "everyone's mostly sitting on their hands, waiting for someone to make a mistake. Chris is very stoic. He'll wait as long as he has to. He's watching the other players."

"They're watching him, too?"

Rodriguez pursed his lips and shook his head slightly, as if to say the effort would be pointless. "He's like a robot," he said. "You get nothing."

As it happened, the afternoon went poorly for Ferguson. Almost two hours in, he had lost nearly half his chips. His expression remained flat. He lifted his hat a few times and scratched his head. Three times in a row he was raised out of a pot. Much of the time, his cards had been good enough to get him into the hand but not sufficient to allow him to stay. He

called a ten-thousand-dollar bet and lost. Finally, he shoved all his chips toward the center of the table, showed his cards, and was out. He shook hands with the other players and wished them well, reminding me of something his father had said: "One of the nice things about Chris growing up and playing games is he didn't mind losing. Most kids I play with are scared of losing. He knows that losing, you learn something." I asked Chris if losing bothered him, and he said it only really upset him if he lost as the result of a mistake. Anyway, he said, thinking you would win all the time at poker was unrealistic.

Ferguson and I went to dinner at a Mexican restaurant at the Palms. The restaurant didn't have a table ready. The hostess gave us a beeper, so that we could wander around the casino. Ferguson was tired and wanted to sit down. The first chair we found was in front of a row of video poker machines. I put a dollar in the machine.

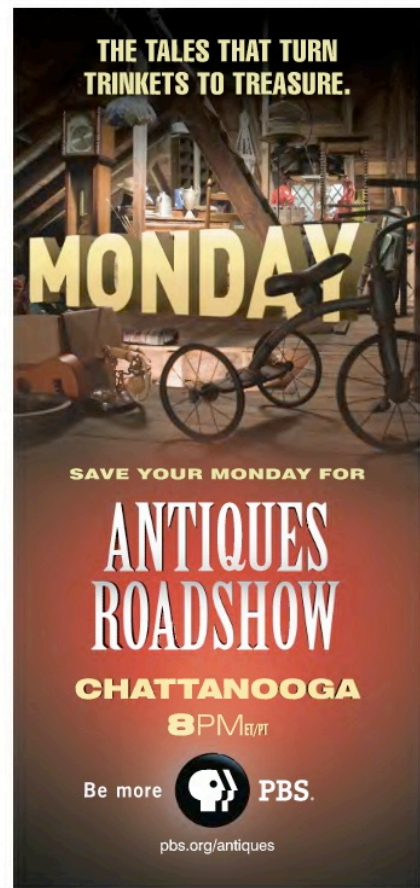
"This is something I never do," Ferguson said. The machine offered several games. "The only one I know the optimal strategy for is Jacks or Better."

"Play that," I said.

"They don't have it," he said. He chose one called Super Double Double, the closest he could find to Jacks or Better, and five cards appeared on the screen. He played quickly, hitting a button to hold or to draw cards.

A pair of tens arrived. "This is a really bad hand," he said, and drew three more cards, none of which improved it. He talked as he played. "I'm trying to figure out whether to hold ace-queen, to the two fours, because the payout is different," he said. And, "Here's what I'm thinking: pair of queens and the sevens. I'm throwing away the sevens—I don't think there's any question about it." And, "What's the payoff to me if I just held the kings? There's a chance I get another king about one-eighth of the time. There's a chance I get four kings; I'm guessing that's an additional eighth unit toward the payout—I'm up to three-eighths. I need to get up to a half."

The red light on our beeper began flashing. Two nines appeared. Ferguson discarded the three other cards, and in the draw he got two more nines. At the cashier's cage, I collected fourteen dollars and applied it to the dinner. ♦



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