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## THE HIGH TECH TRIFECTA

**They've got multimillion-dollar bankrolls, lightning-fast networks, and a probability-crunching system that leaves the odds in the dust. Meet the pari-mutuel fund managers who are redefining horse racing.**

Crisscrossing telephone wires snake along the carpeting of Rod Dufficy's cluttered home office near Hong Kong's Happy Valley racetrack. Dressed down in baggy black velour sweatpants and a matching gym shirt, Dufficy, 32, sits at a large L-shaped desk, rocking back in his chair and eyeing three computer screens crowded with numbers. He is cramming for a race that begins in 22 minutes, calling up information from an online database and sifting it through a betting-analysis program built into his system. The Australian is one of Hong Kong's elite breed of super-successful professional gamblers, computer-assisted horse bettors who work in teams and net millions at the races each year. Tonight, however, is not one of Dufficy's big-money sessions; he is down US\$300,000 heading into this race. "I'm going to have a lot of outlay on this next one," he says. "Maybe \$550,000."

Three slender Hong Kong sisters face Dufficy, waiting for a printer to spit out a list of a couple hundred bets with potentially big payoffs. One sister grabs the sheets and snips them into strips, which she distributes to the other women. They punch the information into their handheld wagering machines, which transmit it to the track via telephone lines, filling the room with the chirping of outgoing data.

Four minutes and three-quarters of a mile later, Dufficy looks up at a large-screen TV and watches thoroughbreds lunging past the finish line. He

desktop monitor. "We've got wins - quinellas and a tierce," he says calmly, referring to wagers that required selecting the first two and three finishers. He made \$330,000 on this single race. "It'll put me ahead by \$30,000 tonight," he says. By week's end, his earnings will add up to a profit of about \$130,000 for essentially two days of work - a typical cycle for Dufficy, who, in fact, wagers and wins less than some other computer-assisted bettors in town.

But there's plenty of dough to go around. As Dufficy and members of the half-dozen or so computer teams in Hong Kong will tell you, this city stands as the land of opportunity for tech-inclined handicappers. The allure centers on Hong Kong's massive handle - the total amount of money wagered on each race - which is the highest in the world. It allows the teams to lay hundreds of thousands of dollars on a single race without upsetting the odds. But Hong Kong racing has other attractions as well: Run by the not-for-profit Hong Kong Jockey Club, it is scrupulously honest (fixing would hurt computer bettors' calculations), and there is a pool of only 1,200 horses per season (a manageable number for the teams to track performances). Then there are the extravagantly exotic bets and parlays, comprising a rich smorgasbord of financial opportunities that seems custom-made for the computer teams. One, the Triple Trio, requires picking the top three finishers in three races and routinely pays six-figure dividends.

"Racing is becoming more and more like a stock market model," says one insider. Horses should be thought of as Dell or Microsoft - their past performances are the equivalent of economic charts.

Unlike other sports, in which bookmakers subjectively set the betting odds or point spreads, horse racing is built around a pari-mutuel system. Payouts are based entirely on the public's opinions, expressed by the horses they bet on. Horses that receive the most bets have the shortest odds and pay the smallest dividends; the least popular horses pay best because fewer people need to divvy up the pool of money. In a pari-mutuel system, the house has no edge and no interest in who wins. (At the end of a race, the track earns only the fee charged for handling each bet; in Hong Kong it's 19 percent of the wagers, which total

capabilities can easily find the public's miscalculations and exploit them for great financial gain.

Computer teams pick their winners by culling data from past performances. They use custom-tailored software programs to determine their own odds, search for overlays (situations in which their odds - the calculated, objective odds - are more advantageous than the public's typically subjective odds), and place bets that can deliver big dividends for reduced risk. Team leaders provide the multimillion-dollar bankrolls, supplemented with investments from the 30 to 40 other members. Their jobs range from accounting to code writing to placing the bets. Annual salaries start at \$50,000 for those who enter the wagers by phone and rise to more than \$1 million for chief technology officers.

The teams are usually headed up by Westerners or Australians; insiders speculate that Chinese gamblers are inclined to emphasize fate and numerology and therefore find computers and horses incompatible. These team leaders walk off with what's left after salaries and operating costs. William Ziemba, alumni professor of financial modeling at the University of British Columbia and a longtime observer of the scene, estimates that a top-notch outfit can pull in as much as \$100 million in a good season, netting the boss a cool \$50 million or more.

"Computer teams are at a terrific advantage," explains Richard W. Munchkin, author of the forthcoming *Gambling Wizards*. "Imagine if Fidelity were the only professional investing company, and all the other investors were amateurs who chose stocks at random, on the weekends, for entertainment. Fidelity would be making a lot of money at the expense of those less serious investors."

While computer-generated horse picking is not particularly new, it has reached an apex of sophistication in Hong Kong and is spreading beyond China. Teams have recently made inroads in the United States and Japan. You can easily spot tech bettors at the track in Tokyo because they're the ones wheeling suitcases filled with yen. In the US, seven-figure windfalls are unlikely because of small racetrack handles, but pick sixes (choosing the winning horse in six races) paying over \$100,000 are possible.

irrows on the practice, and some bettors claim the HKJC has shut down their accounts after it discovered they were connected to teams. "I'm running out of trustworthy people to hold accounts for me," half-gripes, half-brags one Australian bettor. While complaining that his wife's account was canceled, he is well aware of the professional gambler's credo: If they're not throwing you out, you're doing something wrong.

Competition among Hong Kong's computer teams is fierce. Technological secrets are closely guarded, nobody's keen to publicize their betting strategies, and the cagiest players aim to hide their wagers from other teams - all of which monitor the flow of racing money via an independent online service called Telequote, based in Hong Kong. Nobody's more skilled at masking bets than Bill Benter, regarded by many of his peers as the most successful sports bettor in the world: "Normally, you'd see the odds go from 141-1 to 116-1 and know it's got to be a big professional bet," says Dufficy. "But Bill has his betting model set to disguise his action with little \$5,000 dribbles. He ultimately puts the right amount on a horse, but he does it over a sequence of time. He leaves no footprints, and that drives other bettors crazy."

The prevailing paranoia is summed up by a rebuffing email from another big player, who refused an on-the-record interview, chiding: "To highlight what I do only INVITES competition, so a high tech magazine is the least desirable place to have an article about me appear. Plus, any publicity is also [very bad] in terms of impact on the Jockey Club. They do not like computer teams, so advertising how much we make [will only hurt us]." Nonetheless, several team leaders agreed to talk about their operations, though not for attribution.

Working from mathematical models that are calculated to deliver a 24 percent return on investments, Hong Kong's most sophisticated computer-assisted bettors operate with long-term certainty of what their profits should be. "Racing is becoming more and more like a stock market model," says Ziemba, who specializes in statistical analysis and edited *The Efficiency of Racetrack Betting Markets*, a collection of scholarly papers on the mathematics of horse wagering that includes a chapter by Benter outlining the system used in Hong Kong. Horses should be thought of as Microsoft or Dell, Ziemba says, and their

for the street's quantitative analysts. Racing is a financial market catching up with the rest of the world. One big difference, though, between the stock market and a horse race is that you can choose when you want to take your profits from a stock. With horses you must do it at the end of each race. So there is a lot more action."

The bedrock of a predictive betting system resides in a massive collection of data on each horse - including details about the tracks and jockeys. "You massage all of that information into a mathematical equation that can be used for predicting probabilities," he explains. "If you wanted to get started in this, you would spend a year building the probabilities system, and it could cost \$1 million to put together." And that data bank needs constant updating.

Benter, for example, has employees whose sole job it is to review race tapes after every meet. They judge each horse on 130 characteristics - attributes like speed during the first third of the race, whether it got bumped coming out of a turn, the quality of its recovery from the bump, and, of course, how it finished - and assign numerical grades. This information goes into the database, where it can be cross-referenced and called up to help predict the outcome of any impending race that particular horse runs in.

The computer essentially simulates the race before it happens, based on what has transpired in the past and any anticipated conditions in the future. The software then determines each horse's likelihood of winning a race. When a horse's computer-generated odds are better than the public's odds, the team slams in its wagers. "You create a model that can analyze each type of bet, judge the conditions [in terms of money in the pool and the associated odds], and tell you when it will be most favorable to bet," explains Ziembra. "You do not necessarily want to bet a ton every time - you only do it when you can find advantages."

One top bettor explains it like this: "Our computer program churns through the history of the horses and adjusts all the probability in a very sophisticated way. Having established the probability of the horses, we feed that into our betting program, which looks at all the odds for the various outcomes. It looks at your true chances of winning with the latest payoff odds and calculates what the best

through all the probabilities.

"The mathematical aspect involves [following] a basic formulation that all successful gamblers use - whether they know it or not," the bettor says. "It's having what mathematicians call a positive expectation on the bet. You multiply the probability of winning times the payoff odds of one bet. Let's say the horse is 20-1. If it has a .05 probability of winning, you multiply that by 20-1. You get 1.0 - or 1-1 - and that is a fair payoff bet."

The teams excel at complex bets. The biggest Triple Trio ever, paying \$18 million, was snagged by a pair of computer-assisted players who covered 900,000 possibilities with wagers totaling \$1.2 million.

"But if that same horse is paying 25-1, then it has a positive expectation. Now it is 1.25 [or 1.25-1]. It gives you a 25 percent edge. Given that you know the true probability of winning, the amount to bet is a closed-form problem based on how much you can lay down without hurting your odds."

Designing the software to do all this is a delicate operation with seemingly endless pitfalls that can disastrously skew the results. "You have to understand," says Ziembra, "that building this system, maintaining it every week, and updating the model once a year is a lot of work." And doing the work does not necessarily guarantee success. Benter went broke at least once before his system was efficient enough to turn a steady profit. "Every year, more and more people come here and leave with their tail between their legs," says Dufficy.

Whoever writes the team's software needs to decide early on which aspects of a horse's performance to take most seriously. For instance, if a debuting horse's odds of winning are 50-1 and it wins its first race, the software will note that - and might be inclined to view untried horses with long odds as good bets. So the system must be tweaked to give little weight to those outcomes.

Other, more ambiguous factors - turf firmness, recent time trials, second-place finishes, and the jockeys' racing styles, to name a few - must also be taken into account. "Memory is another thing," suggests Kelly Busche, an economist who

town. How quickly do you discount information? And to what degree? What happened two seasons ago should carry less weight than what happened last season. You need a model and a database that are both agile and robust enough to handle a variety of ever-changing situations."

To build a good horse racing model, teams rely on workers with the skills of hedge fund technicians. Rumor has it that one of the teams has wooed programmers from Fortune 500 companies. "You need a hardcore nerd who is good with numbers and has a mathematical and engineering background," says one team leader. "What we do with computers here is similar to what you see with Deep Blue. It's about attacking problems by fussing around and fine-tuning rather than using intuitive knowledge."

Bettors believe the Jockey Club created big, complex bets like the Triple Trio as a hedge against the computer teams' skill-based advantages. The idea was that such wagers would be impossible to handicap, thus enhancing the luck factor and leveling the field. But things have not worked out that way. The biggest Triple Trio ever, paying a dividend of \$18 million, was snagged by a pair of computer-assisted players who covered 900,000 possibilities with bets totaling \$1.2 million. The top teams routinely make their fortunes through complicated parlays, quinellas, and exactas.

Never mind that most teams risk huge sums for their reward and shell out an estimated \$95 million in commissions. The HKJC remains - at least publicly - unimpressed. "We are worried that if you have the computer people, then your average customer sees himself as having no chance," says Winfried Engelbrecht-Bresges, the HKJC's executive director of racing. "But they're the bettors who bring us 95 percent of our revenue."

The story of computer-assisted betting in Hong Kong begins with Bill Benter, the US-educated, impeccably dressed technician who developed the first successful program put to use at Happy Valley. The importance of his pioneering work is confirmed by rivals and experts alike. Benter got his start in the mid-1970s, when he discovered *Beat the Dealer*, a bible for blackjack card counters. He memorized the best-selling book's strategies and hit the casino circuit, where he met his future partner Alan Woods, a former actuary turned

guide - and turned from casinos to horse racing.

Equipped with a \$150,000 bankroll provided mostly by Woods, the two card counters planned to apply the theories of winning at blackjack to winning at the races. *Beat the Dealer*, after all, had been written with the aid of a computer that analyzed every possible situation at a blackjack table and assigned numerical values based on which cards remained in the deck. The idea, when you follow that best-selling guide, is to rigorously stick to its formula and bet high even when you have only a tiny advantage. In the long run, despite frequent fluctuations and potentially long periods of losing, you will win a prescribed percentage of money. By the time Benter refined his program to the point where it worked consistently, he and Woods had bitterly fallen out over money disputes. But in the end, each wound up with an odds- and probability-crunching machine - both built by Benter.

More than a decade later, Benter seems to have more in mind than just being a racing guru. He's lectured at Hong Kong universities, consulted with internationally known mathematicians, and branched out into other technological endeavors (one is a digitized transcribing system for doctors). He's also served as president of a Hong Kong Rotary Club and made substantial donations to respected charities.

Woods is still on the scene, but his working style is described as being completely different from Benter's. He uses off-the-rack Pentium computers, still runs DOS, and employs an out-of-print program called Revelation for his database. At its core, it remains the original system created by his former partner, customized so that Woods can override it with his personal input. Benter now works with Sun Microsystems processors and uses the far more stable Unix operating system. His setup is said to be much more finely tuned than Woods', allowing him to reach conclusions with limited human interface, thus permitting fewer opportunities for subjective opinions to foul up the beautiful mathematics. When Benter's winners cross the finish line, you don't hear so much as a whoop from his crew. As any fan can tell you, the real miracle of this technology is that winning fails to come as much of a surprise.

botted from the starting gate at Gulfstream Park in Hallandale Beach, Florida, one day in February last year, the odds for the winning horse suddenly went from 10-1 to 8-1. A gambler reported the shift to Gulfstream's vice president of finance, Bob Zambreny Jr., who did a bit of investigating. He discovered that in a three-second span, 167 exacta wagers were placed from an outfit in Fargo, North Dakota, called Racing Services - a discreet betting parlor that attracts sky-high wagers with low commissions and liberal rules. Further snooping uncovered a computer team operating in the United States using handicapping software similar to the systems used by Hong Kong teams.

Zambreny and Racing Services decline to identify the team leader. But whoever it was had a special interface that allowed him to batch his bets - to place dozens of wagers per second - into the Racing Services system. This allowed the team to lay down a skein of complex exacta wagers after nearly all wagers were in, the odds were practically set, and it was relatively clear as to how much could be staked before upsetting the odds beyond a tolerable degree. The bets, automatically placed by the computer, ultimately paid out \$246,020 on a total bet of \$25,569. Even more impressive, over a 50-day period, the team had reportedly netted \$3.3 million in profits on \$12.9 million in bets.

Gulfstream quickly barred the team from using a computer to place bets, asserting that all bettors must have an even chance. But Susan Bala, president of Racing Services, plays down the unique access granted to the team and says she would let any customer place his wagers via computer from her shop. "We haven't had Joe Blow come in off the street and ask us to let him use his computer in here. But if he did, we would talk to him. We're a service company." Computerized betting is giving horse racing a much-needed dose of pizzazz, Bala argues. She hopes that computer-assisted betting will attract the same people to racing who once devoted afternoons to daytrading. "Technology is driving horse racing to new places," she says.

Other racing professionals are beginning to come around. After the Gulfstream incident, US racing executives discussed the possibility of introducing computerized betting. "I can see a future where patrons would be able to plug their laptops into docking stations," acknowledges Zambreny. "They would

possible. Barry Schwartz, chair of the New York Racing Association, welcomes high tech action: "Computers are simply another tool for handicapping. There's no guarantee of winning just because you're using one. These bettors are willing to risk money just like everyone else."

No guarantees, but the evidence from Hong Kong suggests it's the closest thing to a sure bet. There, the models have been taken as far as they can go, and it will be up to a new generation of Benters to tweak them for use in other locales. As handicapping systems seep into the mainstream, the innovators anticipate a future involving artificial intelligence - a Kubrickian computer that blends the human sensitivity of the best old-fashioned gamblers with the brute force of a supercomputer. If that day ever comes, traditional horse bettors may really have something to worry about.

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