The Massive Hedge Fund Betting on AI

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As chief executive officer of one of the world's largest hedge funds, Luke Ellis prides himself on a healthy appetite for risk. "My job," he says, "is to not blink." About five years ago, he did, though—in a big way. What spooked him was an experiment at his firm, Man Group Plc. Engineers at the company's technology-centric AHL unit had been dabbling with artificial intelligence—a buzzy, albeit not widely used, technology at the time. The system they built evolved autonomously, finding moneymaking strategies humans had missed. The results were startlingly good, and now Ellis and fellow executives needed to figure out their next move.

Man Group, which has about $96 billion under management, typically takes its most promising ideas from testing to trading real money within weeks. In the fast-moving world of modern finance, an edge today can be gone tomorrow. The catch here was that, even as the new software produced encouraging returns in simulations, the engineers couldn't explain why the AI was executing the trades it was making. The creation was such a black box that even its creators didn't fully understand how it worked. That gave Ellis pause. He's not an engineer and wasn't intimately involved in the technology's creation, but he instinctively knew that one explanation—"I can't tell you why …"—would never fly with big clients looking for answers when Man inevitably lost some of their money.

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Illustration: Jack Hughes for Bloomberg Markets

So Ellis and the team opted to take the program off the fast track for prolonged testing. Sarcastically, he says the creation was kept on a separate server, as if it could somehow infect Man Group's main computer system. "It used to sit in a nuclear bunker in the corner," Ellis jokes, slumped casually in a chair off the main trading floor in London, drinking a soda. Ellis, who became CEO last year, was on the executive committee then. "Were we scared by it? Yes. You wanted to wash your hands every time you looked at it."

The program stayed in quarantine until 2014, when a senior portfolio manager with a Ph.D. in mathematical logic named Nick Granger decided it was time to take it out of testing. He gave the AI system a small amount of money from a portfolio he was managing—then more, then more again. At each step, the program was profitable. "It withstood everything we threw at it," says Granger, who has a bookish demeanor, with short blond

hair, squinty eyes, and rectangular dark-rimmed glasses. “We couldn’t break it.”

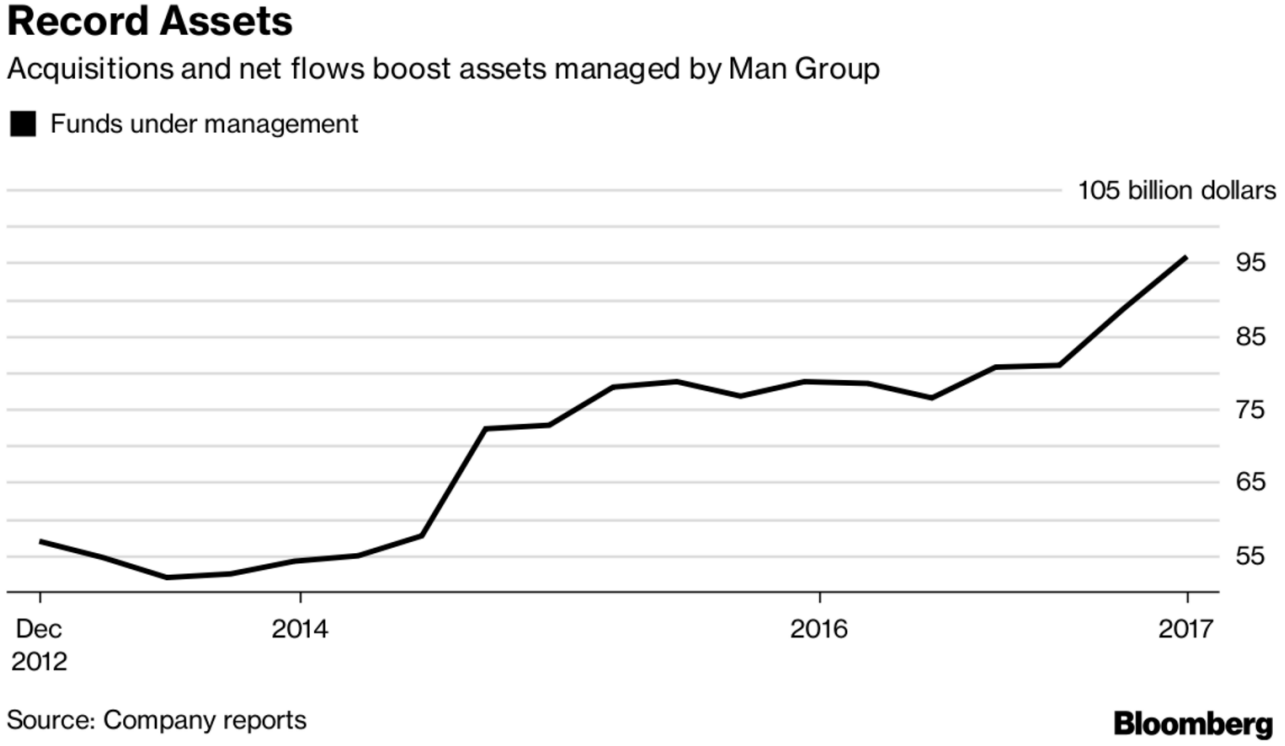
Over time, Granger built up the firm’s confidence in the technology. By 2015 artificial intelligence was contributing roughly half the profits in one of Man’s biggest funds, the AHL Dimension Programme that now manages $5.1 billion, even though AI had control over only a small proportion of overall assets. Elsewhere in the company—and in the industry as a whole—AI technology is being used to find the speediest way to execute trades, to make bets on market momentum, and to scan press releases and financial reports for keywords that could signal that a stock will rise or fall. Even Man’s very human discretionary division, where business is centered on experienced asset managers, is exploring AI techniques.

Those big clients Ellis was initially worried about clearly like what they’re seeing and have rushed to join Man’s algorithm-centric funds. All told, four Man funds collectively managing $12.3 billion are incorporating AI. Assets under management at Man have surged about 77 percent since the beginning of 2014. AHL Dimension fund assets have more than quintupled since then.

The firm has gone from viewing AI with skepticism to making it a cornerstone strategy. Among the company’s biggest expenditures now is computer equipment—along with hiring engineers to keep up with the technological change and the ensuing growth. AI is now not only out of the nuclear bunker but on a pedestal. “It went from a total isolation to ‘OK, you are allowed to sit at dinner with the rest of us, but don’t talk’ to the point where it’s become a part of the family,” Ellis says.

Man Group’s embrace of artificial intelligence puts it at the forefront of a seismic change that’s not only reshaping global finance but also raising profound questions about an industry in which self-altering algorithms are making multibillion-dollar decisions with little human involvement. Even as Man embraces the revolution, its CEO is awestruck by the speed of the

transformation—cautious that it can live up to the hype, nervous about what the new tools say about the future. “My hope is always that there will be parts that humans do that AI doesn’t do,” Ellis says. But, he adds, “I wouldn’t bet my life on it.”



For the uninitiated—most of us—watching an artificial intelligence system at work is like trying to decipher an impenetrable language. Slavi Marinov, a 31-year-old Bulgarian computer scientist hired by Man two years ago, is attempting to translate the code into understandable terms for a pair of visiting journalists. In what he insists is an elementary demonstration at Man’s London headquarters, Marinov types commands onto a black screen. The keystrokes tell the machine to find patterns in futures market returns.

He’s making a bet on whether the market will rise or fall. With a few more keystrokes, he’s telling the machine to scour millions of data points, including granular trading information on companies around the world. He hits enter and a stream of numbers rains down the screen, like those Hollywood graphics that run behind the opening credits of a techno-

thriller:

0.3426383
0.237250642
0.53534377

The cascading numbers show the computer “thinking,” crunching data at speeds a human could never achieve. “The element that makes the decision is these layers of numbers,” says Marinov, who made education software at a startup before joining Man. As seconds pass, the system is adjusting what data to give more importance. It’s coming up with a probability for what’s going to happen next. Once the machine determines an optimal position to hold based on that information, it takes stock of broader market trends and the cost of making a trade before deciding whether to go forward. All in a few moments.

Photographer: Chris Ratcliffe/Bloomberg

At Man and other hedge funds, two interconnected factors drive the adoption of AI. First, consider the exponential advances in computing power—even from the first iPhone to the 10-year anniversary model. Man has a vast data center outside London filled with row after row of servers. The machines are loaded with cutting-edge processors that until recently might have been used to render graphics for advanced video games. Each processing card costs about $1,000, a fraction of the cost a decade ago.

The second main catalyst behind AI's phenomenal growth is the sheer availability of data. If processing power is AI's engine, information is its

fuel. It allows engineers to teach algorithms to adapt and learn skills without human intervention. Marinov types a few commands into his computer to pull up an online waiting list used by engineers who want time on the company's top-end equipment. The demand can be so high that a warning alert is triggered if the processors are getting hot from overuse, like an Xbox that's been played all day by a teenager on summer break.

An estimated 90 percent of all the data in existence today were created in the past two years. Man Group stores thousands of terabytes of data, equivalent to more than 10,000 standard office PCs—from stock ticker information to weather forecasts to the movements of container ships. Meanwhile, the price of stockpiling information has plummeted—a gigabyte of storage cost $300,000 in 1981, compared with 10¢ today. "The data is cheaper than it used to be, the availability of data is enormous, the cost of storage is essentially irrelevant," says Sandy Rattray, Man Group's chief investment officer. "How to use it? That's hard."

For all the talk of machines eliminating the need for humans, the job of building and managing an AI system is labor-intensive, which means Man is more interested in hiring engineers and data scientists than MBAs. Completely autonomous machines aren't taking over anytime soon. "The idea that the humans will just disappear and would be banned from the process is just not right," Granger says. "It's just that they move to different tasks, to higher value-added tasks. We need smarter humans than we did."

QuicktakeMachine Learning

The sort of machine learning that Man and its competitors are adopting has been around for decades; a *New York Times* article from the 1950s describes an algorithm trained to classify images. But the technology is only now beginning to live up to its promise. At its most basic, a machine learning system is taught how to make judgments based on lessons from historical information. These tools are being applied to reading X-rays, answering questions people ask of Siri and Alexa, self-driving cars, and improving energy efficiency. Facebook

and Google taught computers to identify dogs, cats, and other images in photos.

Finance is perhaps AI's most daunting challenge. Training a computer to correctly identify a Labrador is different from getting it to suss out a bond market. Markets move in mysterious ways, influenced by news events, economics, politics, regulation, and human judgment. "In the financial world," says Gary Collier, Man AHL's co-chief technology officer, "the ground is always shifting."

Illustration: Jack Hughes for Bloomberg Markets

Computer code has been a standard tool on trading floors for years. Telling a computer what to do when certain things happen is the foundation of quant funds that have long used statistical analysis to find advantages. Machines could perform a task five times or 5,000 times, but the code would never change or evolve without mathematicians, engineers, and statisticians intervening.

Artificial intelligence goes further by enabling the system to adapt based on the information it receives. At Man, engineers set parameters: exposure caps, asset class, volatility, trading costs, etc. Compliance and risk management rules are ingrained into the system's DNA, preventing it from going rogue or breaking the law as a fast track to profit. These constraints set up the borders within which the machine does its work. The system then seeks out patterns, making connections among the data that humans can't see. AI makes educated predictions based on what happened in the past, trading when the odds are in its favor. Man has several such systems at work. The fastest trade several times per day; others hold a position for two weeks or more.

There's one particular AI story Man executives love to tell. In August 2015 worries about the Chinese economy sparked a sudden selloff. Man's system had been betting on a market downturn and quickly profited from the decline. But after U.S. markets fell about 3 percent, the system jumped back into the market, detecting a buying opportunity. AI can't predict the future, of course, but algorithms can learn patterns. It's betting the market will recover, just as it had in past selloffs with similar characteristics. The edge comes from having a machine that can detect those similarities. "No one had told it to go and look for dips to buy into; it learned itself to look at previous behavior," Granger says. It was one of the algorithm's most successful days. Last November and December, when the world was still coming to grips with the election of U.S. President Donald Trump, Man's AI was quick to buy into the market, profiting from the rally that followed. (Man declined to comment on fund performance.)

Man Group's research into artificial intelligence happens in a tall building with views of the 18th century Radcliffe Observatory at the University of Oxford, a short train ride west of London. The company's engineers, statisticians, and coders share the space with academics and researchers studying how algorithms, AI, and related advances can be applied to finance. The partnership, called the Oxford-Man Institute of Quantitative

Finance and funded with an initial £10.45 million ($14.2 million) endowment from Man Group, gives the hedge fund access to experts and an early look at technical papers.

The institute is library-quiet. Coders, headphones on, tap away at computers. Equations adorn whiteboards. A central focus of Man's work here is adapting machine learning techniques that were created for things such as image recognition, not finance or trading. The hedge fund has built up its own code library—some written by its people, some adapted from publicly available databases. Engineers can draw from it as they develop new AI techniques, says Anthony Ledford, who runs the Oxford lab as Man AHL's chief scientist. "You have to take the nugget of the idea and apply it to our world," he says. "It's not a blueprint for how to actually go about building a trading system."

Ledford, a self-assured mathematician who spent part of his 20s backpacking through Australia, is the gatekeeper who helps decide which new AI techniques Man Group will adopt. He's skeptical about artificial intelligence and says a lot of the hype around the technology is fed by marketing. He's an exacting sort. His wife indulges his hobby as a horologist; rebuilt old clocks fill their house in the English countryside. To some at Man who must endure Ledford's peer review sessions, the straight-talking former professor is an endearing Scrooge. "He's quite a tough person to argue with," Granger says. "He generally gives you more grief than anyone else. It's a fear factor in a positive way."

AI engineers use punishments and rewards to guide the machine; it's like teaching a mouse to push a button for food. In what's broadly known as deep learning, algorithms are trained to hunt for predictive patterns within libraries of historical information. They are "stimulated" when they find similarities in, say, the pricing data of stocks or commodities. In another approach, called reinforcement learning, the machine recalibrates itself on the go according to the success or failure of certain actions. Researchers

also program penalties into algorithms to discourage certain behavior by the AI, such as creating strategies that are too similar to those humans already employ.

Still, Ledford says for AI to work, you need more than a bunch of geeks banging out code. The advantage comes from the data. Every week a parade of salespeople comes through Man's offices pitching data sets. The information is typically disorganized, like a puzzle that's been shaken apart, making it difficult for computers to understand. "That's the hardest thing. We've got very, very noisy data," Ledford says. "It's very difficult to find the signal."

Man Group, perhaps best known to the outside world for its sponsorship of the Man Booker Prizes literary award, wasn't always a tech-centric investment house. The firm was founded in 1783 by James Man as a barrel maker-cum-brokerage on Harp Lane, about 500 meters from its current office along the Thames in London. Over the next two centuries, it supplied rum to the Royal Navy and traded commodities such as coffee and sugar before eventually focusing exclusively on financial services. In 1989, Man began acquiring a computer-driven trading shop called AHL, which now houses all the company's most cutting-edge AI work. (The original founders of AHL—the name derives from their initials—have gone on to create two competing tech-driven hedge funds, Aspect Capital Ltd. and Winton.)

As promising as Man's technology may be, the firm is battling industry headwinds. Investors are revolting against high fees charged by hedge fund managers who produce mediocre results. Last year clients pulled out $112 billion from the industry. In the past two years, more hedge funds have shut down than have been started. Man Group's stock is up 40 percent this year, but it's still down 77 percent from its pre-financial crisis peak in 2007.

An encouraging sign for Man is that investors everywhere are trusting their

money increasingly to technology. Computer-driven quantitative funds—the cluster that's invested heavily in AI—are the only part of the hedge fund industry that grew last year. Others exploiting AI include Renaissance Technologies, Two Sigma, and Bridgewater Associates. Paul Tudor Jones, the billionaire U.S. investor, reportedly is adopting some of the technology after experiencing sluggish returns. Point72 Asset Management LP, the family office that manages billionaire Steven Cohen's fortune, also has been hiring experts in the field.

But AI isn't a magical machine. You can't just pour data in at the top and expect money to gush out of the bottom. Many algos turn out to be duds. Some Man employees warn that AI often produces theories that are already known—an expensive waste of time—or predictions that don't translate to real-time trading. Luckily for Man, the system has been right more often than not, making small amounts of money gradually rather than placing big adventurous bets. "We are not trying to put something out there that takes huge amounts of risk," Granger says.

At about 2:45 p.m. in New York on May 6, 2010, the stock prices for Accenture, CenterPoint Energy, and other companies suddenly plunged to a penny per share. Procter & Gamble's stock fell almost 40 percent. At the same time, shares of Apple, Sotheby's, and others momentarily leaped to more than $100,000 each. Markets were in chaos. No single cause explains what became known as the 2010 Flash Crash, but as researchers and regulators picked through the pieces, the role of machines was a unifying thread. Algorithms sent automated trading systems chasing after themselves with catastrophic consequences. This moment of mayhem and others like it—Apple's stock fell suddenly again in 2012—showed the expanding and sometimes counterproductive role computer code plays in the financial world.

AI brings new complexities to the market. The self-altering systems operate in ways that aren't always clear even to their creators. That's OK as

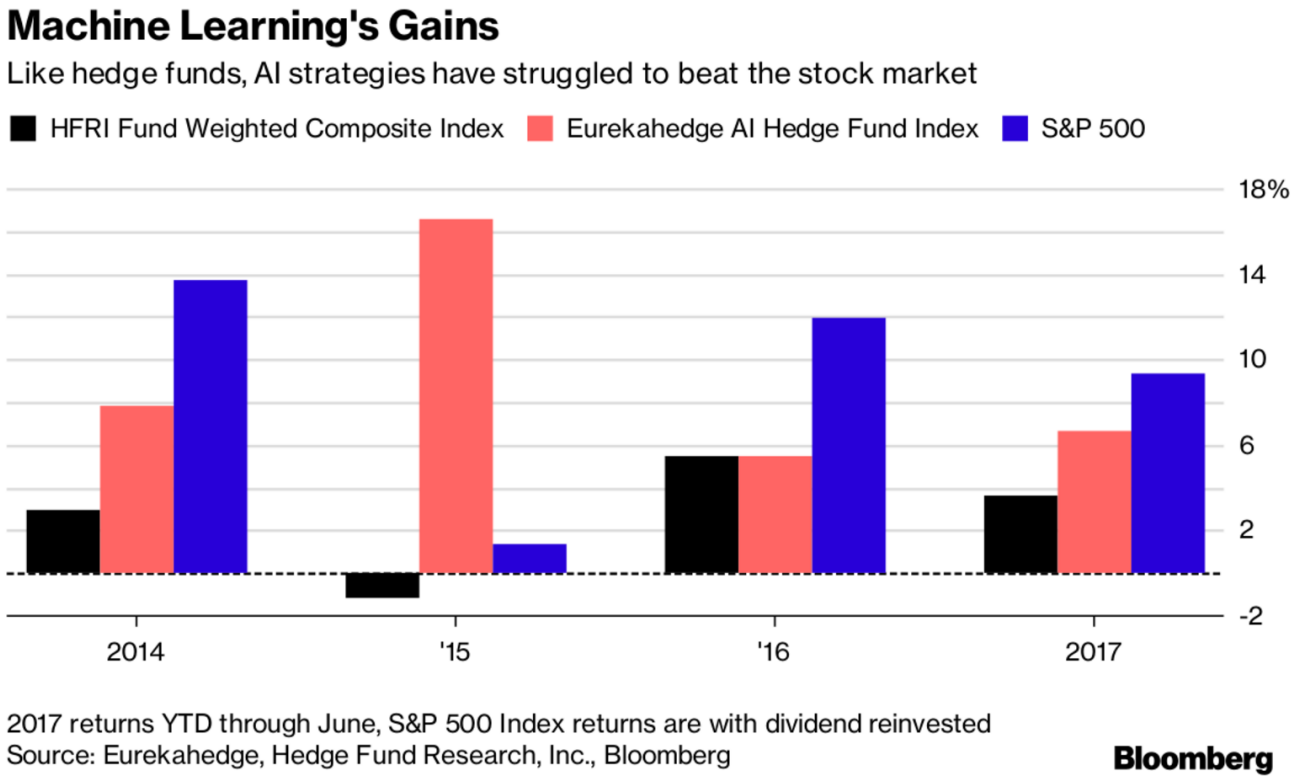
long as money is being made, but if things go haywire, these technological advances are bound to come under scrutiny. And AI programs will only get more complex as computing power increases and more data become available. A Swiss neuroscientist, Pascal Kaufmann, recently joked that we'll know artificial intelligence has advanced to humanlike awareness when it starts cheating. Dark humor, yes, but also an ominous warning.

Which explains why some researchers and ethicists advocate the establishment of an AI review regime similar to the pharmaceutical policing done by the U.S. Federal Drug Administration. Humans need to write constraints into AI systems to guarantee they don't go rogue, says Stephen Roberts, a professor of machine learning at the Oxford-Man research institute. "We're only just coming to grips with how we put policy, legislation, and constraints on the kinds of things machine learning and AI can do," he says. "The answers simply aren't there yet."

Granger says Man Group builds in safeguards. Unusual trades are examined by a human before execution. An autopsy tool helps engineers learn why certain AI decisions are made. Even with these precautions, CEO Ellis says, adopting the technology requires a leap of faith. After all, he says, "If you know exactly what it's doing and why it is doing it, it's not machine learning." He adds, "You have to trust the process. It was scary to take the first jump."

Doubters say the performance of AI-centric funds doesn't match the hype. So far, returns are hardly inspiring. Eurekahedge Pte. Ltd., an industry research house that runs an index tracking 12 money pools that employ the technology, found they've failed to beat the S&P 500 since 2011. Still, the gains were slightly better than the hedge fund industry as a whole. Man's AHL Dimension fund, which started using machine learning in 2014, gained almost 15 percent in the three years through June, almost double the industry average. "It isn't some sort of magic pixie dust," says Adam Duncan, managing director at Cambridge Associates, which advises more

than 1,100 clients and tracks 31,000 funds globally. “It’s just enhanced statistical techniques that allow you to build better predictive models.”



Jeff Tarrant, founder and chairman of the investment firm Protégé Partners, has spent several years studying artificial intelligence in finance. He says that while the technology is still in an early phase of adoption, it will have a transformative impact on the industry—one he compares to Uber Technologies Inc.’s on transportation. Despite its aggressive adoption of AI, Tarrant says, Man Group is among those at risk of being upended. Some new AI-focused funds charge a 1 percent management fee and 10 percent of the profits, half as much as a typical hedge fund. At pure AI firms, much of the process is automated, so there’s no need for a huge workforce. Tarrant says power in the industry is shifting to those who build the best technology, not those who have the most talented portfolio managers. “There is going to be mass unemployment in asset management in the next several years,” he says.

Behind all the hand-wringing is a broader philosophical question: Why are

we turning more of the financial system over to computer code in the first place? What's the upside of diminishing human involvement? In medicine, AI has the potential to spot diseases earlier and save lives. Self-driving cars could reduce the number of fatal accidents. In finance, however, the answer is less clear. Advocates say the technology has the potential to make markets more efficient. Stocks and other securities will be accurately priced because machines will be able to process more available information. For its part, Man Group says the technology sharpens its edge to the benefit of clients, including pension funds and retirees. It's an attractive argument: Who doesn't want their retirement account to grow?

Granger, the first portfolio manager at Man Group to entrust client money to artificial intelligence, says that even as humans turn over more of their lives to technology, they're skeptical of its powers. He points to research on so-called algorithm aversion; it shows people trust humans to do jobs even when, according to the evidence, computers are more effective. Watch, Granger says: When somebody dies in a self-driving car accident, it will be a much bigger deal than the thousands of crashes that happen every day. We live in a world surrounded by algorithms, he says, "and yet there's evidence that people find it hard to trust."

Several years have passed since Granger's initial decision to give money to Man Group's AI. He's been rewarded for his instincts: He became AHL's chief investment officer in July. Granger finds satisfaction in not knowing why Man's AI system is making certain trades. It means the technology is discovering things he doesn't know. "Some people like that, some don't," he says.

Fear of technology is overwrought, Granger says. He thinks back to one of his favorite books, Robert Harris's The Fear Index, a beach-read thriller about a brilliant mathematician who builds an AI-based hedge fund in Geneva. His system works perfectly. It makes him insanely rich. Then it tries to kill him.

Satariano covers technology. Kumar covers hedge funds.