


# ANTE UP, HUMAN


THE ADVENTURES OF POLARIS, THE POKER-PLAYING ROBOT.  
BY JULIE REHMEYER

AMAZING  
TRUE\*  
STORY!

ILLUSTRATIONS BY NATHAN FOX  
COLOR BY RICO RENZI



WELCOME BACK TO ANOTHER WHITE-KNUCKLE HAND OF ONE-ON-ONE, LIMIT TEXAS HOLD 'EM. AT OUR FEATURED TABLE: IJAY "DOUGHNUTZ" PALANSKY, HARVARD-TRAINED LAWYER TURNED PROFESSIONAL CARD PLAYER. TOOK IN NEARLY \$1 MILLION IN 2007 PLAYING ONLINE. HE'S GONE UP AGAINST THE BEST, BUT THIS MIGHT BE HIS TOUGHEST CHALLENGE YET.



DOUGHNUTZ STARTS WITH AN UNSUITED JACK-FIVE. NOT GREAT, BUT WORTH A BET. LOOKS LIKE HE'S GOING TO THROW IN A \$1,000 RAISE, PRESSING HIS OPPONENT.



THE OTHER PLAYER RAISES HIM BACK. THAT'S AN AGGRESSIVE MOVE.



...AGAINST A POKER FACE LIKE THIS?

DOUGHNUTZ COULD RERAISE, BUT HE JUST CALLS THE BET. HE'S SHOWING A LITTLE CAUTION HERE, WHICH COULD BE WISE. AFTER ALL, HOW CAN YOU PLAY ...

IN MANY WAYS, TODAY'S SHOWDOWN BEGAN TWO YEARS AGO, WHEN A TEAM OF COMPUTER SCIENTISTS AT THE UNIVERSITY OF ALBERTA BEGAN BUILDING A COMPUTER THAT COULD MASTER LIMIT TEXAS HOLD 'EM.

WE WERE LOOKING FOR A CHALLENGE.

MACHINES HAVE BEEN TAUGHT TO BEAT FLESH-AND-BLOOD PLAYERS AT CHECKERS AND CHESS.

BUT NO COMPUTER HAS EVER TAKEN DOWN A HUMAN POKER CHAMPION. IN POKER, YOU HAVE TO MAKE SMART GUESSES, SQUEEZING INSIGHTS OUT OF YOUR OPPONENT'S BEHAVIOR OVER THE COURSE OF A MATCH.

COMPUTERS AREN'T GOOD AT THAT KIND OF ANALYSIS.

STILL, A POKER-PLAYING COMPUTER IS THEORETICALLY POSSIBLE. MATHEMATICIAN JOHN NASH POSITED THAT EVERY ZERO-SUM GAME BETWEEN TWO OR MORE PLAYERS CONTAINS A STRATEGY GUARANTEED NOT TO LOSE.

WE WANTED TO CREATE A PROGRAM THAT COULD DISCOVER THAT STRATEGY FOR HOLD 'EM.

MIKE JOHANSON (LEFT) AND MICHAEL BOWLING

IT'S LUCKY WE'RE GOOD AT MATH, BECAUSE WE SUCK AT POKER.

WHAT A MATCHUP, FOLKS. DOUGHNUTZ HAS PLAYED 92 HANDS AGAINST POLARIS, THE PROGRAM CREATED BY THE UNIVERSITY OF ALBERTA TEAM. SO FAR, POLARIS IS DOWN BY \$12,500.

DOUGHNUTZ IS SLIGHTLY BEHIND IN THIS HAND, ALTHOUGH HE DOESN'T KNOW THAT BECAUSE HE CAN'T SEE POLARIS' CARDS.

DOUGHNUTZ	47%	♠ 4	♠ 5
POLARIS	52%	♠ 2	♠ 2

POT \$6,000

WHOA! THAT'S A GREAT FLOP FOR DOUGHNUTZ! HE'S ONE HEART AWAY FROM A FLUSH, AND ANY FOUR OR NINE WILL GIVE HIM A STRAIGHT. EVEN PAIRING HIS JACK OR FIVE WOULD HELP. PUT IT ALL TOGETHER AND HE'S GOT A 66 PERCENT CHANCE OF ENDING UP WITH THE STRONGEST HAND. POLARIS' MEASLY PAIR OF TWOS DOESN'T LOOK SO GOOD ANYMORE.



BUT THAT ISN'T STOPPING POLARIS, WHO COMES OUT WITH A \$1,000 BET!



DOUGHNUTZ RAISES. I LIKE THIS PLAY—HE'S GOT SO MANY POSSIBLE HANDS HERE. HIS FIVE OF HEARTS WOULD MAKE A PRETTY LOW FLUSH, BUT HE CAN STILL BLUFF SUCCESSFULLY WITH STRONG BETS LIKE THIS ONE.



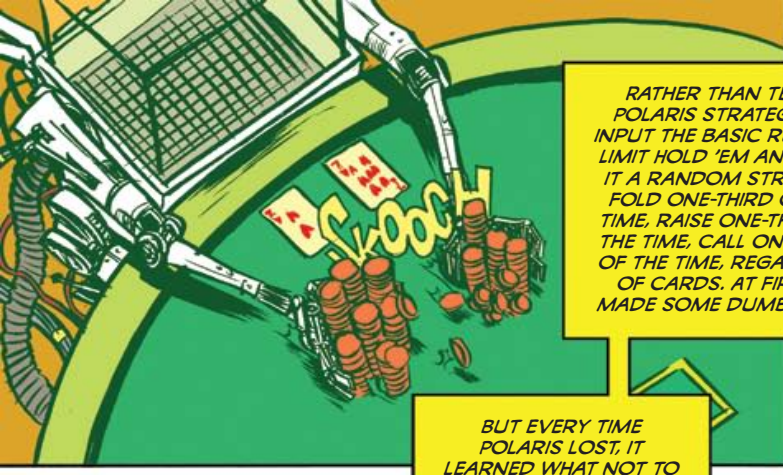
I DON'T KNOW WHAT POLARIS IS DOING RAISING HERE. IF DOUGHNUTZ HAS ANY HAND AT ALL, EVEN PAIRING ONE OF THE CARDS ON THE BOARD, POLARIS IS TOAST. NO HUMAN WORTH THEIR SALT WOULD PLAY THIS WAY.

ANOTHER RAISE FROM DOUGHNUTZ. WE'RE GETTING QUITE A POT HERE.



THAT'S THE MAXIMUM NUMBER OF RAISES THIS ROUND, SO POLARIS JUST CALLS. WOW. THIS IS SOME VERY AGGRESSIVE PLAY FROM POLARIS.





RATHER THAN TEACH POLARIS STRATEGY, WE INPUT THE BASIC RULES OF LIMIT HOLD 'EM AND GAVE IT A RANDOM STRATEGY: FOLD ONE-THIRD OF THE TIME, RAISE ONE-THIRD OF THE TIME, CALL ONE-THIRD OF THE TIME, REGARDLESS OF CARDS. AT FIRST, IT MADE SOME DUMB PLAYS.

BUT EVERY TIME POLARIS LOST, IT LEARNED WHAT NOT TO DO, AND IT GOT SMARTER. EVENTUALLY IT DEvised A STRATEGY APPROACHING NASH'S IDEAL.

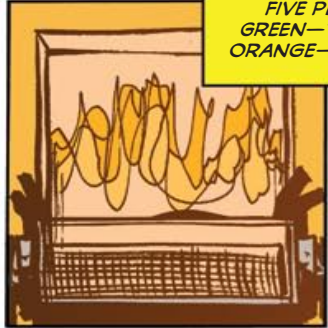
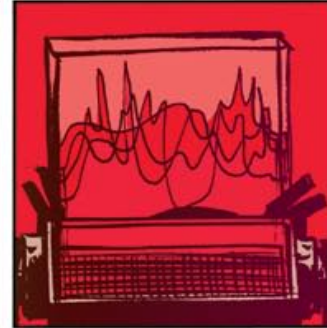


BUT IN POKER, YOU DON'T JUST WANT TO WIN—YOU WANT TO WIN BIG. TO DO THAT, YOU'VE GOT TO TAKE ADVANTAGE OF YOUR OPPONENT'S WEAKNESSES. SO AFTER POLARIS LEARNED BASIC STRATEGY, WE GAVE IT VARIOUS PERSONALITIES, EACH DESIGNED TO EXPLOIT A DIFFERENT PLAYING STYLE.



FOR INSTANCE, BY TELLING POLARIS TO THINK OF EVERY POT AS LARGER THAN IT ACTUALLY IS, WE COULD GET IT TO PLAY MORE AGGRESSIVELY.

EVENTUALLY, POLARIS DEVELOPED FIVE PERSONALITIES, FROM GREEN—THE MOST PASSIVE—TO ORANGE—THE MOST AGGRESSIVE.



A LOT OF PRESSURE HERE. THAT'S A \$14,000 POT; WHOEVER WINS WILL GAIN A HUGE ADVANTAGE. AND YOU HAVE TO LIKE DOUGHNUTZ'S CHANCES RIGHT NOW.




OOPS—NOT ANYMORE! THAT TWO JUST GAVE POLARIS THREE OF A KIND AND THE EDGE IN THE HAND. IF POLARIS WEREN'T PLAYING SO AGGRESSIVELY, IT WOULD HAVE ALREADY FOLDED!





NOT SURPRISINGLY,  
POLARIS PUSHES  
\$2,000 INTO THE POT.

*POLARIS NEEDS TO DECIDE WHICH OF ITS PERSONALITIES TO USE AGAINST WHICH PLAYER. THAT'S HARD. IT CAN'T JUST PLAY A BUNCH OF HANDS AS EACH PERSONALITY AND SEE WHICH PERFORMS BEST—THE GAME WOULD BE HALF OVER BY THEN.*



DOUGHNUTZ FIRES BACK, AND IT'S NOT A TERRIBLE PLAY. HE STILL JUST NEEDS A HEART, A FOUR, OR A NINE TO COMPLETE HIS FLUSH OR STRAIGHT AND WIN THE HAND.

*POLARIS ALSO CAN'T GO BACK AFTER THE FACT AND ANALYZE WHAT MIGHT HAVE HAPPENED IF IT HAD PLAYED A HAND MORE OR LESS AGGRESSIVELY, BECAUSE IT CAN'T KNOW HOW ITS OPPONENT WOULD HAVE RESPONDED TO DIFFERENT PLAY.*

*BUT POLARIS HAS ONE INNATE ADVANTAGE OVER A HUMAN PLAYER: IT KNOWS ITS OWN STRATEGY PERFECTLY. IT CAN USE THAT KNOWLEDGE TO CALCULATE WHICH OF ITS PERSONALITIES WOULD PLAY ANY GIVEN HAND MOST EFFECTIVELY. LET'S SAY POLARIS WAS PLAYING AT MEDIUM AGGRESSIVENESS—CALLING WITH A PAIR OF SEVENS. WE ASKED IT TO PRETEND IT WAS HOLDING A DIFFERENT HAND THAT WOULD CAUSE ITS MORE AGGRESSIVE OR LESS AGGRESSIVE PERSONALITY TO CALL AS WELL.*

POLARIS IS A 68 PERCENT FAVORITE, BUT DOUGHNUTZ DOESN'T KNOW THAT, AND HE'S HOPING AN AGGRESSIVE PLAY WILL PAY OFF.

A CALL FROM POLARIS. I'D EXPECT A RAISE CONSIDERING ITS CARDS—MAYBE IT'S TRYING TO DOWNPLAY THE STRENGTH OF ITS HAND. THE POT STANDS AT \$22,000 AS WE GO TO THE FINAL CARD.

*SO, FOR INSTANCE, A LESS AGGRESSIVE PERSONALITY MIGHT CALL WITH A PAIR OF KINGS. A MORE AGGRESSIVE ONE WOULD CALL WITH AN UNSUITED TWO-NINE. POLARIS WOULD THEN KEEP TRACK OF WHETHER IT WOULD HAVE WON WITH THOSE HYPOTHETICAL HANDS. IT COULD DETERMINE PRETTY QUICKLY WHICH PERSONALITY WOULD PERFORM BEST AGAINST A PARTICULAR PLAYER.*



POLARIS HAS LEARNED THAT ITS THIRD-MOST AGGRESSIVE PERSONA, RED, IS GOING TO BE THE MOST EFFECTIVE AGAINST DOUGHNUTZ. THAT'S WHY IT'S PLAYING THIS HAND SO STRONGLY.

LAST CARD. DOUGHNUTZ IS DEAD UNLESS HE CAN PICK UP A HEART OR COMPLETE HIS STRAIGHT.

WELL, THAT DOESN'T HELP ANYONE. DOUGHNUTZ HOLDS THE LOSING HAND. HIS ONLY HOPE IS TO BLUFF POLARIS OUT.

AND POLARIS DECIDES NOT TO BET, CEDING CONTROL OF THE TABLE TO DOUGHNUTZ! THIS COULD BE A BIG OPPORTUNITY; DOUGHNUTZ MUST THINK THAT HE CAN PUSH POLARIS OUT OF THIS POT.

SURE ENOUGH, DOUGHNUTZ BETS ANOTHER \$2,000. THAT'S A TOTAL OF \$24,000 IN THERE.

POLARIS RAISES ANOTHER \$2,000! THAT CHECK-RAISE IS INCREDIBLY SOPHISTICATED—PRETENDING TO SHOW WEAKNESS IN ORDER TO SUCKER AN EXTRA BET OUT OF DOUGHNUTZ.

DOUGHNUTZ FOLDS, GIVING POLARIS A MONSTER POT.

IN THE END, WE RAN SIX MATCHES AGAINST TWO LIVE OPPONENTS. CONTROLLING FOR LUCK, POLARIS OUTPERFORMED THEM BY A TOTAL OF ABOUT \$200,000. ♣