Out of the Box

Introduction

Backgammon has been around for about 5,000 years, probably originating in Mesopotamia (modern Iraq). Over all those years the board with its 24 points and 30 checkers hasn't really changed. Even the dice haven't changed that much although nowadays we use plastic rather human bone to make them and precision dice are rather truer than the orginal version!

Somewhere along the way – nobody knows when – the idea of getting four of whatever double you rolled rather than two found its way into the game, probably the first attempt to speed up the game. The word 'backgammon' first appeared in print in 1644; before that the game had various names such as 'tables'.

Backgammon theory evolved very slowly and very little was written about the game until the advent of doubling which changed the game forever. Doubling was introduced in 1926 and the multi-player version of the game, chouette, very shortly thereafter.

There was a spate of books in the 1930s but, at least to my knowledge, nobody wrote down the basic mathematics behind doubling until "The Backgammon Book" was published by Jacoby and Crawford in 1970.

There was then another spate of books in the 1970s as everyone tried to cash in on the backgammon craze. Some were markedly better than others but there were lots of errors in all of them because we just didn't have the tools to test even the most commonly held concepts.

The Early Days

Let's briefly step back in time and imagine we are in 1972. Here is the opening position:
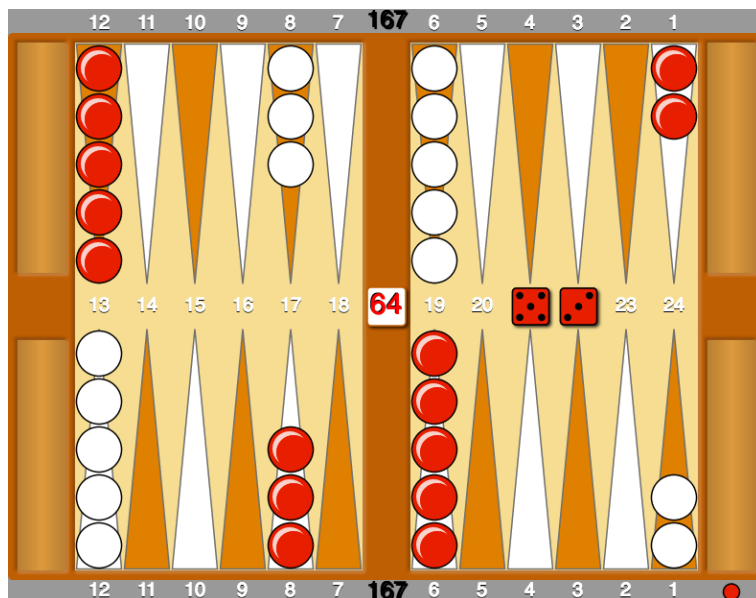
XGID=-b----E-C---eE---c-e----B-:0:0:1:53:0:0:3:0:10

How would you play 53, 62 and 64?

53 would have been played 13/10, 13/8 because it was thought to be wrong to make a point as deep as the 3-pt so early. 62 would have been played 13/5 as it was thought to be strong to slot the 5-pt. 64 would likely have been played 24/14. The idea of playing 8/2, 6/2 would have drawn derision from all sides and 24/18, 13/9 was little used.

At the time all 'experts' were agreed on these plays and in all fairness nobody knew any better. The plays seemed logical at the time. Then in about 1975 Jason Lester started playing 8/3, 6/3 with 53 and noticed his results

improved. Soon everybody adopted that play and thus a small step in the development of backgammon theory was achieved.

Exactly when 13/5 was discarded in favour of 24/18, 13/11 I don't know but 13/5 slowly died out. With 64 we now know that 24/14; 24/18, 13/11 and 8/2, 6/2 can all be correct depending upon a number of factors such as the match score.

Here's a second example:
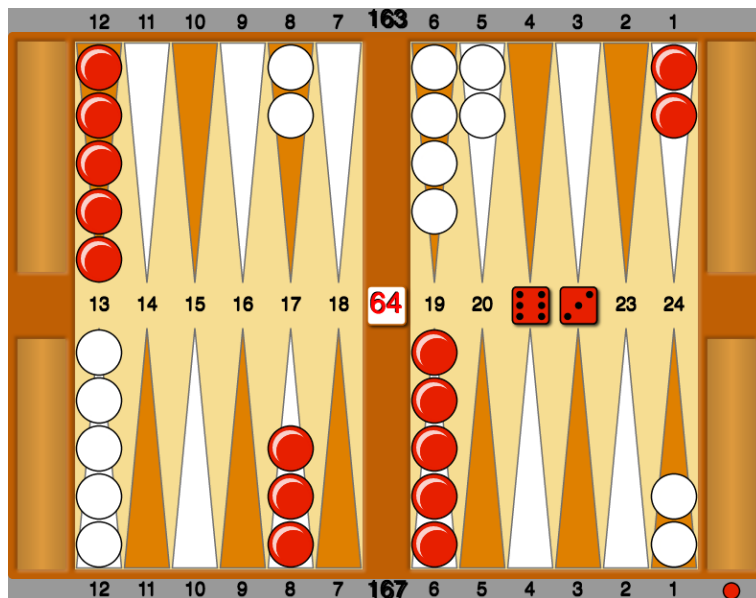
XGID=-b----E-C---eE---b-db---B-:0:0:1:63:0:0:3:0:10

White has opened with 31 played 8/5, 6/5. How should Red now play 63? Back in the 1970s it was thought to be too risky to play 24/18, 13/10 and so virtually everybody would play 24/15. The play remained the standard until Roy Friedman published a briefly-lived magazine called "Leading Edge".

In one edition he published some deep analysis on this position and demonstrated that with 62, 63 and 64 Red should split to the bar with the 6 and bring a checker down with the other number. Very soon everybody adopted this new tactic and nowadays it is rare to see anybody make the simple running play although it may be right at some match scores. As a final wrinkle modern analysis shows that with 64 the running play is correct!

One final position from this era:
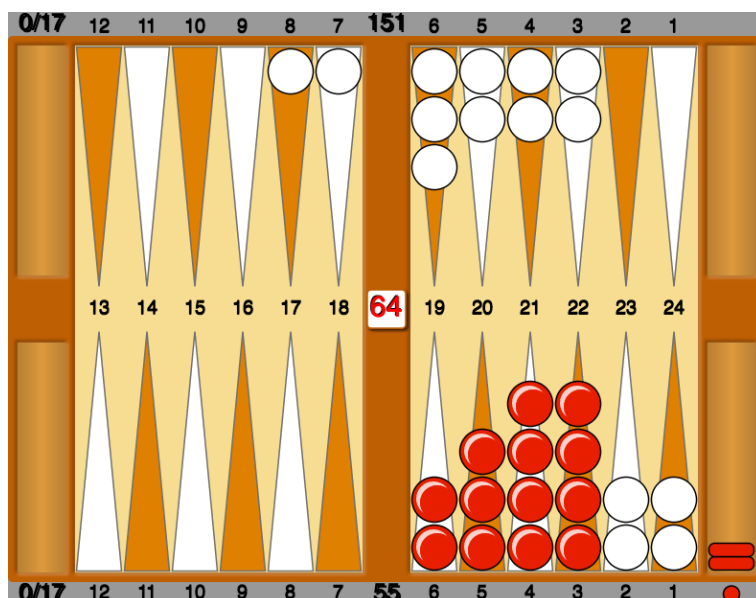
XGID=-bbDDCB----------aacbbb---:0:0:1:00:0:0:0:0:17:10

This is probably the most famous back game position in backgammon history. It is the first game of a seventeen point match between Walter Cooke (son of Barclay) and Jesse Sammis. Should Red double? If doubled, should White drop or take?

Cooke did double and a short time later the cube was on 32! Sammis needed to roll 66 on his last roll to win and did just that! The key question is: were the original double and the take correct? For years opinion kept changing with both players being criticized for their actions at one point or another. With the advent of computers we finally discovered that both actions were right although some of the subsequent cube actions were errors/blunders. Eventually Kent Goulding formulated some rules for how to analyse such positions.

The problem with all the above is that human beings tried their best and using manual rollouts to determine correct plays and cube actions was better than nothing but most such rollouts were statistically insignificant. Theory developed largely through observation and practice but it was at best a dark art. Proof of this is clear when you study "Paradoxes and Probabilities" by Barclay Cooke, a leading theorist and player of the day. Of the 168 problems in the book his solutions to nearly half of them are wrong and some of them are very wrong indeed.

Computers

So after 4,980 years we still struggled to understand the game and theory development was mired in uncertainty. However, things were about to change. Alan Turing, the father of modern computing, had demonstrated the power of machines when he and his team cracked the Enigma Code at Bletchley during the second world war.

From there the road to modern computing was very long and hard but we are all now well aware of the power of modern computers and the Internet. This is not the place for the full history of computers in backgammon but that in itself is a fascinating story. Briefly, it starts with "Gammonoid" which defeated the then world champion Luigi Villa in a match in 1979 although the computer had most of the luck.

The timeline stretches through "Expert Backgammon" (1992) to 1994 when an IBM research scientist, Dr. Gerry Tesauro, developed TD-Gammon to try out his new ideas in neural net computing. I could spend a long time on neural net computing but suffice it to say that the basic premise is that the machine can learn from its own mistakes to correct its play. From TD-Gammon we had JellyFish (1995), Snowie (1998), Gnu (2002) and then we reach 2009 and the advent of Extreme Gammon (XG), which is today's leading backgammon software program.

Innovation

There are two types of innovation, continuous and disruptive. As an example, moving from a mechanical typewriter to an electric typewriter is continuous while moving from an electric typewriter to word processing is disruptive. Disruptive innovation is much more difficult and it needs very special people like Gerry Tesauro to make it happen.

The Austrian satirist Karl Kraus used to perform a sketch that involved him looking for a key in a small pool of light. A passer-by offers to help, and finding nothing, asks if that, indeed, is where the key was lost. "Not at all," says Kraus, "I lost it over there," and he points to the dark. "So why are you looking here?" asks the passer-by. "Because," Kraus answers, "this is where the light is."

Most people, when confronted with a problem, continue to look in the light. Tesauro, and the other neural net pioneers, searched in the dark and ultimately found the key.

'Out of the Box' is a phrase originally coined in business to get people to think outside the normal confines of their job and to embrace new ideas. Not everybody needs to think out of the box as demonstrated by this New Yorker cartoon:

"Never, ever, think outside the box."

Luckily for us neural net programs took backgammon theorists well outside the box and drove the development of backgammon theory at an unprecedented rate and radically changed our understanding and thinking about the game. It is by using such tools that we can now understand just why so many of Cooke's solutions in "Paradoxes and Probabilities" were so badly wrong.

The Modern Era

We will now look at how computers have taught us to think about the game and demonstrate just some of the new ideas that have been introduced by our silicon friends.

Firstly they removed a level of uncertainty around rollouts. Computers can roll out positions literally thousands of times and, using a technique called Variance Reduction, they produce accurate results in a matter of hours and sometimes minutes. Let's look at an example (note that all positions in this section are from money games with the Jacoby Rule in effect, unless otherwise stated):
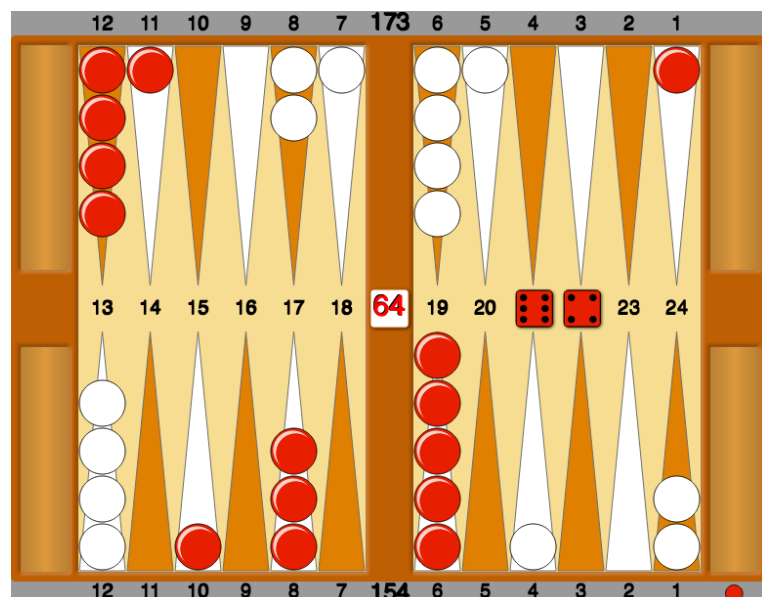

XGID=-b--a-E-C-A-dDA--bada---A-:1:-1:1:64:0:0:3:0:10

How should Red play 64?

There are at least six plays to consider (I'll let you list them). Rolling all six out manually would take weeks and is impractical. However, after a few hours work XG can tell us that the best play is 10/4*, 8/4 – but only by a small margin. This not only gives the solution to this specific problem but gives us guidance for similar positions in the

future. That guidance is that securing a solid asset (a new point) in the opening is often better than hitting twice. That won't always be true but it gives us an idea to work with.

Now let's move to something more complex:
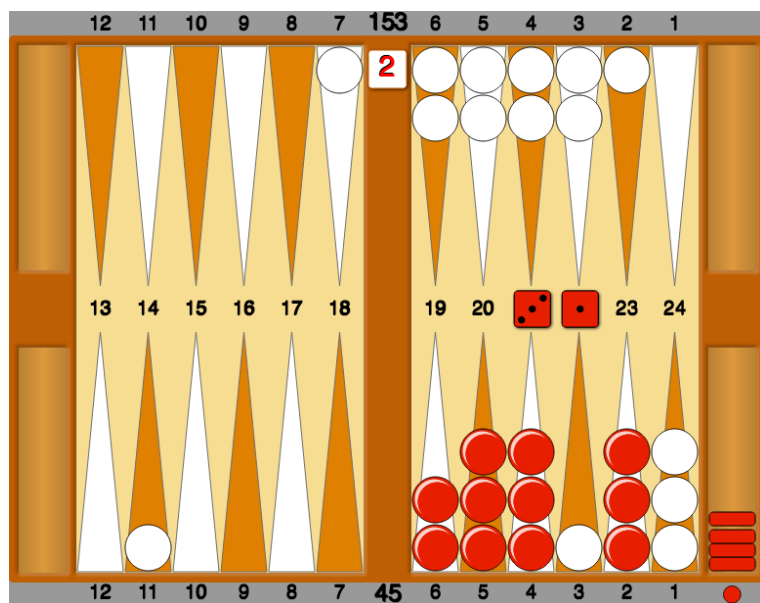
XGID=-cCaCCB----a------abbbba--:1:-1:1:31:0:0:3:0:10

Without much thought I played 4/3*/off. I went on to lose the game. Analysing the game with XG afterwards I was amazed to find that my play was worse than a double blunder (an equity loss of more than 0.16). The correct move is 6/3*, 4/3 taking a relatively small risk now to avoid worse problems later. Note the blot in White's home board is a factor in this decision.

Backgammon is fundamentally a game of risk and reward and one of the things the bots (computer programs) have taught us is to how to understand these concepts much more clearly. I would wager that anybody suggesting 6/3*, 4/3 in a 1970s chouette would have been treated as an idiot and I am not sure it wouldn't be the same in a modern day chouette!

Let's change the position slightly to give White his 2-point thus:
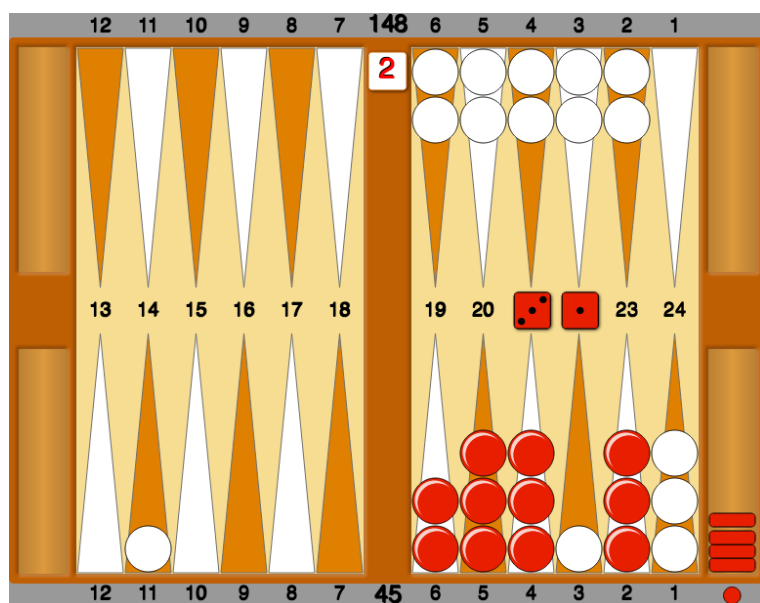
XGID=-cCaCCB----a-------bbbbb--:1:-1:1:31:0:0:3:0:10

Now you would assume that 4/3*/off would be correct but that is not the case. 6/3*, 4/3 is still correct and 4/3*/off is still a blunder! This really reinforces the idea of taking a small risk immediately to avoid later problems. Getting this play through your chouette partners would be even more difficult!

This type of education is worth its weight in gold and modern players are far stronger for understanding and then applying these risk/reward concepts.

Here's another new concept that the bots have taught us:
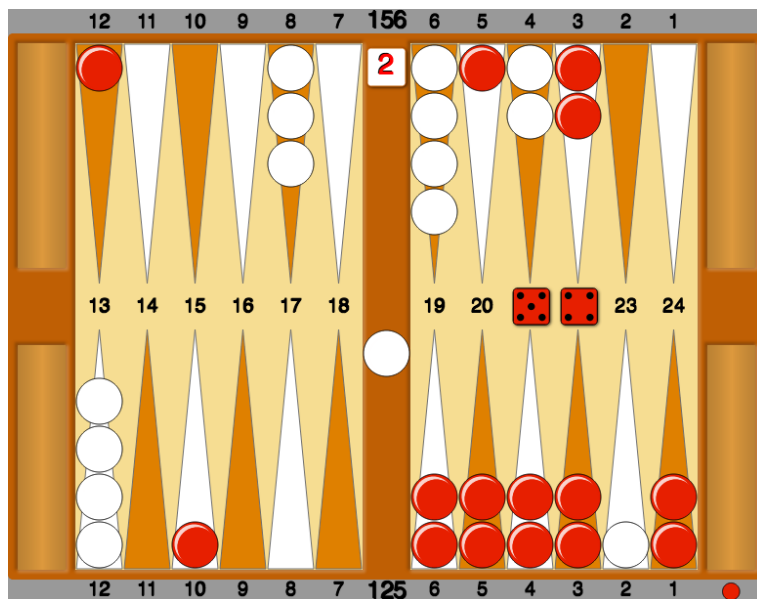
XGID=aBaBBBB---A-dA---c-dAbB---:1:-1:1:54:0:0:3:0:10

Red has the dual objectives of closing out White and escaping his rear checkers. In the past players would likely have tried 13/8, 10/6. The problem with this move is that if White anchors on Red's 2-point Red still has two checkers stuck on White's 3-point. Go back about fifteen years and many would find 22/13, escaping a checker while providing a measure of security by remaking the mid-point.

Fast forward to the present and XG's recommendation, albeit not by much, is 22/18, 13/8, exposing five blots! The point is that the blots effectively protect each other. Virtually any entering and hitting number from White will generate a lot of return shots for Red, thus increasing his gammon chances. It underlines the idea that the time to take risks is when your opponent is on the bar. This concept has only been understood for the last few years and, in fact, played a crucial role in the final game of the 2009 World Championship final.

Our next position shows another play that has become common in the last few years but would not have been considered before the era of the bots:
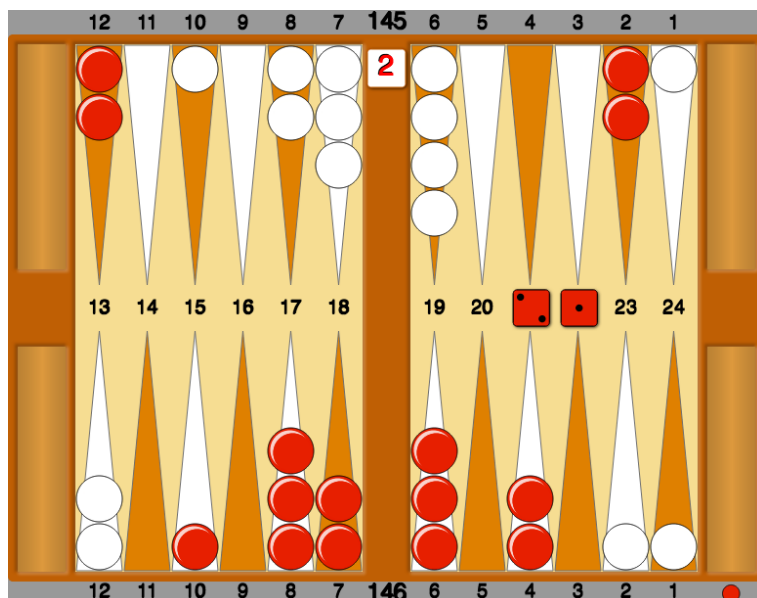
XGID=-aa-B-CBC-A-bB-a-bcd---Ba-:1:-1:1:21:0:0:3:0:10

Our 1970s player would not have taken long to find 10/7 but a strong player in 2016 would easily find 7/5, 6/5. This makes the point that Red really wants for much less risk than you might think. White has no home board to speak of plus he has a blot on his ace-point. Add in the the fact that Red has the security of an anchor and the play becomes very clear indeed. Once more, a small risk now can lead to the accrual of significant future benefits as the game progresses. 10/7 is actually quite a bad error but without the rollout facility of XG the mistake could quite easily go completely unnoticed – as did many weak plays from the years before computers.

The next position is a personal favourite:
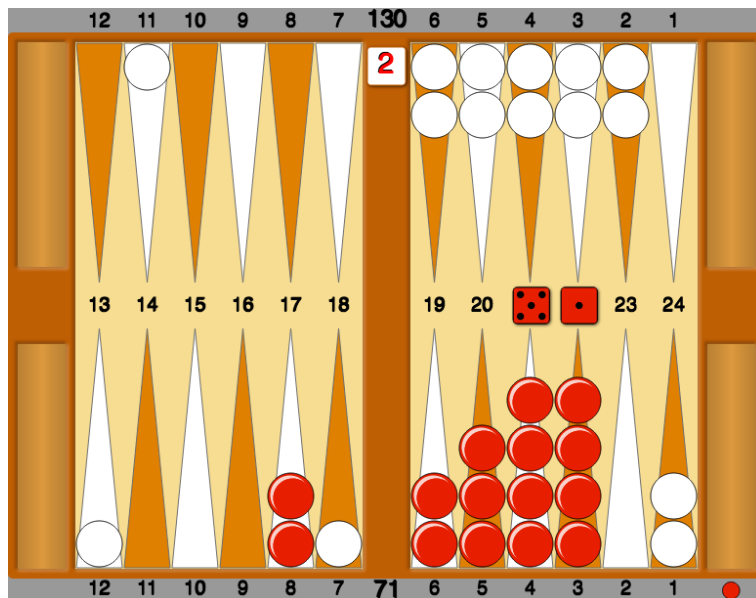
XGID=-b-DDCBaB---a-a----bbbbb--:1:-1:1:51:0:0:3:0:10

I have given this position to a large number of students and they all play, as I did, over the board, 8/7*, 8/3 – what could be simpler?

The problem is that Red's resulting structure is likely to generate many future shots as he attempts to bear off his checkers. Much better and by a huge margin is 8/7*/2!! This leaves twelve shots rather than six but the resultant structure is far safer if the shot is missed. It is very hard to make plays like this but winning backgammon is about maximizing your chances and though it surprises nearly everybody 8/7*/2 does just that. Would you have the nerve to make such a play in a major tournament final?

The area that has benefited most from the bots is the understanding of doubling. We have come a long way since Georges Mabardi said in 1930: "If two absolutely perfect players engaged in a match, there would never be an accepted double."

In the last twenty years we have progressed significantly but Paul Magriel's 1976 statement remains as true today as it was forty years ago: "Good checker play will never compensate for serious errors of judgement in doubling."

What is the correct cube action for both players in the next position which is taken from my local chouette?
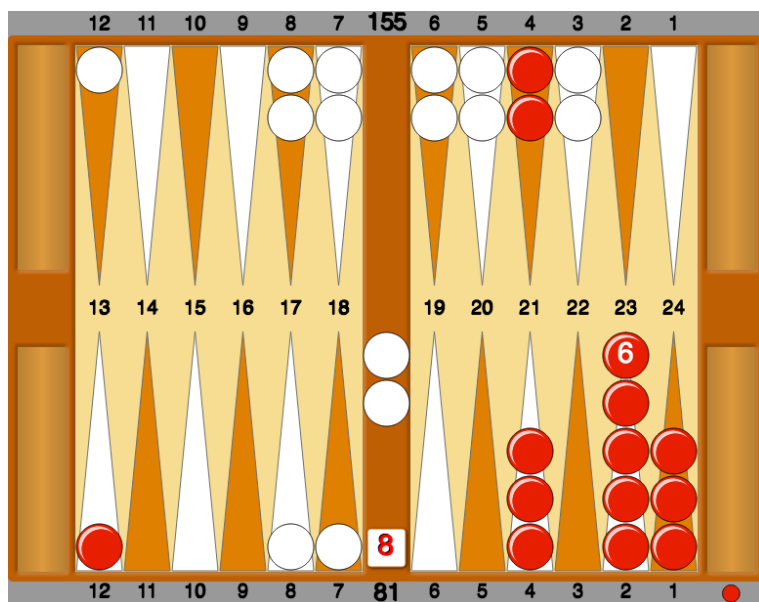
XGID=bCF-C--aa---Aa---bbbbBb---:3:1:1:00:0:0:3:0:10

I had this position as Red. I was in the box facing two strong players. White has just fanned three times in a row on Red's three-point board while Red has rescued himself from near certain death. Is he strong enough to redouble or perhaps he is now too strong?

This is a highly unusual position with many complex factors in play. White's five blots (including those on the bar) and Red's four dead checkers are very important. Over the board I decided the position was so volatile that I had to redouble. Both players took and after ten minutes we did a settlement which turned out to be remarkably accurate.

The answer is that Red isn't strong enough to redouble! Those dead checkers and his busted home board give him huge problems getting his checkers home. If he doesn't roll a five or a six in the next couple of rolls things can get really bad for him and he could soon be facing a couple of 32 cubes.

However, if the cube were in the middle then it would be correct to double to activate gammons (assuming the Jacoby Rule to be in effect). Did you get that one right?

And one more from very recently:
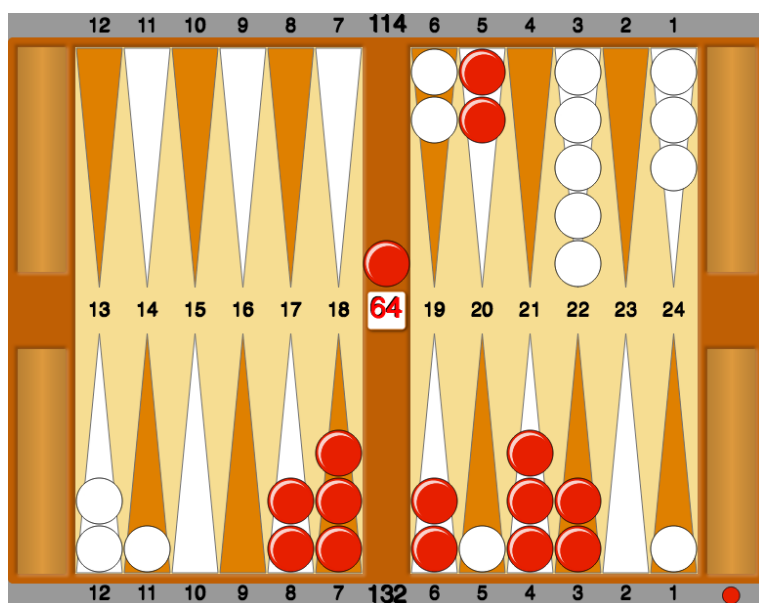
XGID=-a-BCaBCB--ab------bB-e-cA:0:0:1:00:0:0:1:0:10

Red is on the bar, has a home board with as many points made as White's, and is 18 pips behind in the race. What is the correct cube action? I doubled and my opponent, with an expression of incredulity, beavered with some gusto!

After 55 (bar/5*) by Red, 13 (bar/24, 14/11) by White and 42 (20/16, 7/5) by Red it was all over and White was lucky to save the gammon.

Over to XG. It is a double blunder by White to take. His split army and his dead checkers on his 3-pt and 1-pt mean he is effectively fighting a war with only 7 active checkers – not a good idea! I showed this position to a bunch of players at the recent Brighton tournament. Nobody doubled, everybody took and two people beavered! Need it be said that we have a very long way indeed to go before we even begin to get to grips with the complexity of doubling?

Our final two positions come from match play. As demonstrated by the Mabardi quote above, the complexities of match play were little understood for many years. Once more it is only since the advent of the bots that we have begun to understand how different cube action can be in match play, particularly towards the end of a match. Even checker plays can vary considerably depending upon the score. Concepts like "Gammon Go" and "Gammon Save" are relatively new terms in the lexicon of backgammon.

Let's start with a doubling problem. Red trails 3-5 in a match to 7. Red has opened with 31, played 8/5, 6/5. White has responded with 32, played 24/22, 13/10. That leaves this position:
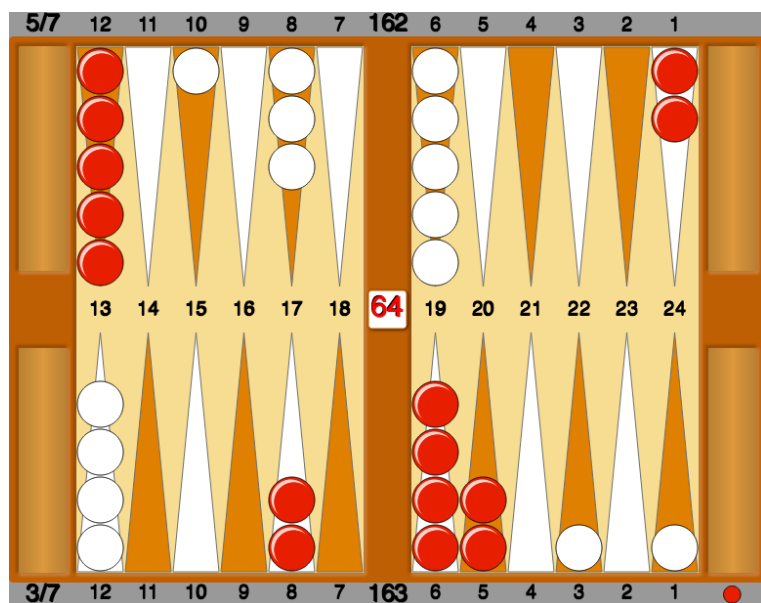
XGID=-a-a-BD-B---dE-a-c-e----B-:0:0:1:00:1:3:0:5:10

For money this would be a ludicrous double but at this match score it is virtually a double blunder not to double! The cube is dead for White and he must play the game to the end. If Red wins a gammon he wins the match with perfect efficiency. These factors combine to make this a powerhouse double and yet I constantly see players waiting until the fat lady has sung before they venture a double at this score.

Our final position shows an unusual checker play when behind in a short match. Red trails 1-4 to 5 (post-Crawford). How should he play 51?
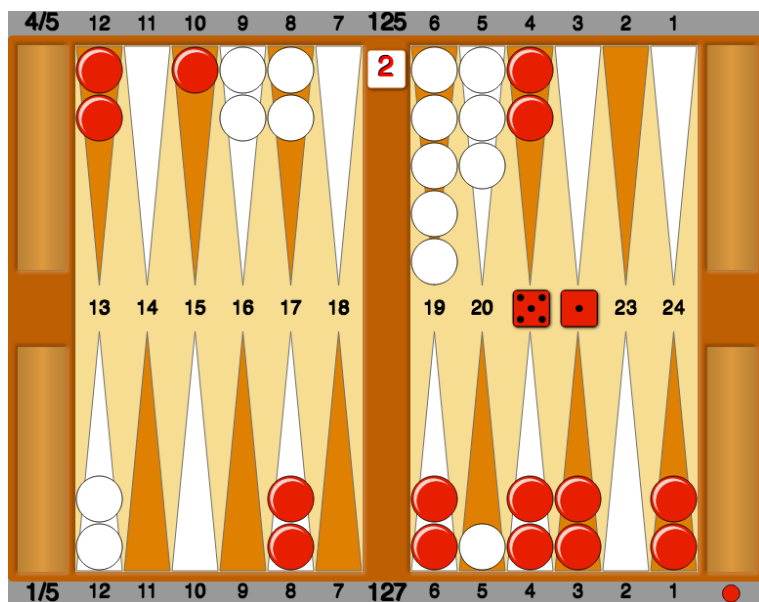
XGID=-B-BBaB-B---bB-Abb-ecB----:1:-1:1:51:1:4:0:5:10

In a money game 15/9 would be clear but that play does leave White a free hand. At this score the correct move is what is known as a banana split play, 15/10, 6/5*. This may seem like madness but White fans 25% of the time and that gives Red blitzing chances and note that a gammon for Red wins him the match. If Red is hit he can revert to a holding or back game. White can never redouble because of the match score so Red can make wide open plays like this one without much fear.

Did you even consider 15/10, 6/5*? Remember, you can't make a play if you don't even consider its possibility.

Summary

The key point about the positions in the preceding section is that our 1970s player would virtually certainly not have made the correct plays/doubling decisions but of course he wouldn't know that he had made any mistakes. His model of the game didn't include the concepts we have discussed and, crucially, there was no technology to assist him. As far as he was concerned he was playing perfect backgammon in his era – sadly we now know this was not the case.

In summary then, I hope this article has given you something to think about and hopefully taught you some techniques that are new to you. There is no doubt that the bots have broadened our thinking and that sometimes we truly have learnt to think outside the box. Our whole thinking about risk and reward has undergone fundamental change since Gerry Tesauro created TD-Gammon.

Jeremy Bagai, in his excellent book, "Classic Backgammon Revisited", comments thus on the future development of backgammon theory: "The pendulum of style continues to swing throughout the modern era, but the arc gets shorter as progress is made."

What he says is true but there are complexities within that arc that mean that we still have a very long way to go before anyone can say that they really understand backgammon.

I close with one of my favourite quotes from the strong American player Mike Corbett: "A good question lights a thousand fires; a good answer merely permits savages to sleep." So please, keep asking the questions so that we can continue to improve our understanding of this most complex of games.

Chris Bray
January 2016