


## KenoLinka: Feels Like Keno (but Better)

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### Introduction

I first became aware of John Reid and his “Link2Win” games late in 2016. John had contacted the North American Association of State and Provincial Lotteries (NASPL) with a description of his games. NASPL sometimes receives documents from inventors, and they sometimes forward such to me for an opinion. In the case of Link2Win, I saw at first glance a way of playing a game of chance that was refreshingly unlike anything I had seen before. I gave it closer attention, and developed a correspondence with the inventor, who is based on the Isle of Man. I now feel ready to give an account of what I feel are compelling advantages of this style of game. In fact, I feel some urgency to do so, since several US lotteries have recently been allowed to expand their offerings beyond the traditional numbers, lotto, and scratch-off games by offering quick-draw Keno.

I think that anyone who sees a demonstration of the Link2Win play style will be able to assess whether this is something simple, elegant, distinctive, and appealing. I believe it is, but I encourage people to judge that for themselves. My purpose here is to highlight features that are essentially quantitative, since that is my special area of competence. That may sound dry. However, I assure you that my aim is to connect directly to how playing *feels* to the player.

Further, in this document I focus just on Link2Win games that offer play experiences similar to Keno- generically, “KenoLinka” games. You will see that the similarity is in the experience, not in the mechanics of the games. **No game looks less like Keno, or feels more like it.**

While maintaining respect for the ancient game of Keno, I think that the KenoLinka game out-performs Keno on the very same quantitative attributes that have made Keno successful as a quick-draw game. I think that Link2Win games generally, and KenoLinka specifically, have a refreshing simplicity in presentation that distinguishes them from existing lottery games. I think these games are **“different, and better in the ways that matter.”**

**I believe that any lottery that now offers, or plans to offer, quick-draw Keno should consider the KenoLinka game as a complement or alternative.**

## What is the Key Difference about the Link2Win method?

In Keno, what matters is *matching*. Players of Keno (and all other lottery draw games) are accustomed to picking numbers, waiting for the lottery to draw numbers, and seeing whether their pick *matches* the lottery's draw. Keno involves a very large number of balls (usually 80) and the lottery draws more balls than the player picks (typically 20 by the lottery, up to 10 by the player). A player may win a prize, depending upon how many of the player's picks *are matched* in the lottery's draw.

In Link2Win, what matters is *linking*. Link2Win games differ in that few symbols are involved, and all of them are used by both the player and the lottery. The player arranges all the symbols to cover every cell of a small grid, and the lottery draws all the symbols one at a time. **If any two numbers drawn in sequence by the lottery also "touch" on the grid (i.e. occupy adjacent cells in any direction), the player scores a "link"**. A player may win a prize depending upon *how many links* are achieved.

As you are reading this, you are understanding thoughts that I convey to you by the order and linkage of symbols. Making sense of speech is about word order and linkage. Humans are naturally good at this, so much so that we do not regard it as a special skill – it is just part of being human and is something we attend to without trying.

**Link2Win games engage people through this natural capacity.**

## Comparing Keno with the new KenoLinka

I have compared KenoLinka to the range of Keno games that account for significant play in the US. The first part of this document is a summary that focuses on just one representative comparison between comparable small games - 4 Spot Keno and KenoLinka 3x3. This first comparison produces core findings that apply across the full range of comparisons that I have undertaken – which are available at the end of this summary, starting on **page 7**.

### KenoLinka 3x3

The KenoLinka game uses a set of only 9 symbols on a 3x3 grid, yet there are over 300,000 ways to fill it. **This count of 9 is small enough that we could break away from the traditional iconography of "lottery draw game" by using a different symbol set altogether.** Below I will use "numbers" and "symbols" interchangeably.

To illustrate scoring, consider that the player saw the lottery draw:

Lottery Draw	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Ninth
Drawn Number	3	1	8	2	7	9	4	6	5

While holding the grid or card:

Entry and Results	Links and Game Result									
<table border="1"> <tbody> <tr> <td>7</td> <td>3</td> <td>9</td> </tr> <tr> <td>8</td> <td>1</td> <td>2</td> </tr> <tr> <td>5</td> <td>4</td> <td>6</td> </tr> </tbody> </table>	7	3	9	8	1	2	5	4	6	<p>One link is formed between any two numbers that are Consecutively drawn, and also Located next to each other on the matrix</p> <p>Game Result: 3 Links</p>
7	3	9								
8	1	2								
5	4	6								

**To recap:** If any two numbers drawn in sequence by the lottery also "touch" on the grid (i.e. occupy adjacent cells), the player scores a "link". Links can be formed in any direction, including diagonally.

The red arrows identify 3 links on the player's card that are revealed by the Lottery's drawing.

## How the Two Games Play

For comparison, I have set these two games up to deliver the same top prize (\$70, as is done in Georgia), at a similar prize expense, for a \$1 wager. Each game has three prize tiers; the underlying probability distributions constrain how big the lesser prizes can be.

Now, top prize odds of less than 1 in 500 (which applies to both games) do not support large top prizes (I cover games with bigger odds in my expanded comparisons at the end of this summary, commencing on **page 7**). My purpose here is to illustrate, at a high level, differences and key factors that *apply generally* to all game versions of Keno and KenoLinka. Further, the two compared games are relevant as 4 Spot Keno is the lowest “spot” that gets significant wager action in Keno.

The complete distribution of odds, together with comparative prizes, is set out in the tables below.

Keno – 4 Spot			
Match	Odds 1 in ...	Percentage of Plays	Prize
4	326.44	0.31%	\$70
3	23.12	4.32%	\$5
2	4.70	21.26%	\$1
1	2.31	43.27%	-
0	3.24	30.83%	-

Overall Odds: 1 in ...	3.86
Prize Expense	61.50%

KenoLinka – 3x3			
Links	Odds 1 in ...	Percentage of Plays	Prize
8	463.00	0.22%	\$70
7	32.76	3.05%	\$5
6	6.76	14.79%	\$2
5	3.31	30.19%	-
4	3.21	31.14%	-
3	6.14	16.28%	-
2	24.86	4.03%	-
1	307.22	0.33%	-
0	n/a	0.00%	-

Overall Odds: 1 in ...	5.54
Prize Expense	59.90%

**Here is a key property that Keno, in general, shares with Link2Win, in general: incremental successes and near-wins are relatively frequent, and least-wins happen often enough to trigger that intuitive process (described below) that keeps us in the game.**

This is why the ancient game of Keno works as well as it does, when people play repeatedly at short intervals.

The games tabulated above each have three winning tiers. This means that matching only one number in 4-spot Keno, or getting five links in KenoLinka 3x3, are “1 away” near-wins.

This discussion focuses on two essentially quantitative features that affect how a game “feels” in play:

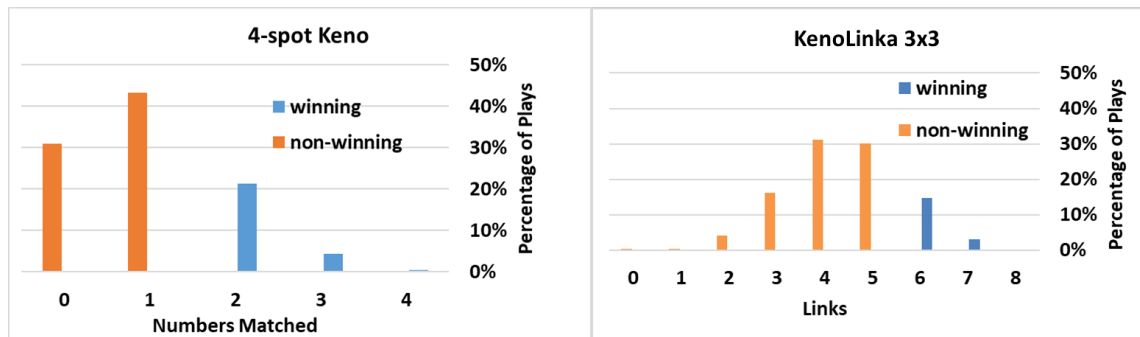
- I. the frequency of incremental successes, winning and the near-win outcomes, and
- II. how the kind and value of prizes won by most players increase, with continued play.

In what follows, I rely on visualizations (based on the kind of information tabulated above) to support the discussion.

## Incremental Successes, Near Wins & Wins

The charts below show that near-wins are very common. Most players will experience plenty of these. In both games, the near-win happens about twice as often as the win. Although in the case of KenoLinka, the near win experience is likely to *feel* higher, as players counting four links are, in both incremental and percentage terms, getting close to a win - having achieved 4 out of the required 6 links.

Comparison Outcomes for 4 Spot Keno & KenoLinka 3x3

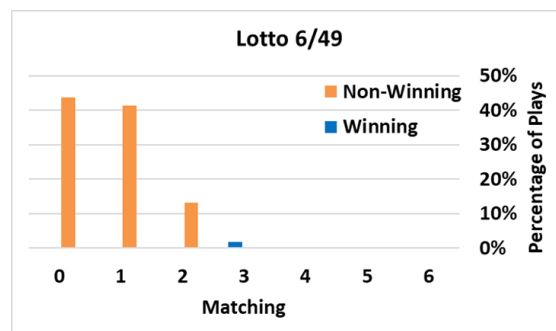


It is apparent when comparing the distribution of outcomes in these two games, that the KenoLinka game:

- delivers to players superior “**incremental successes**” and a *greater sense* of “**near wins**” (based on 4 & 5 links being near wins), and
- avoids the very negative player experience of getting nothing - it has the great advantage that **getting no link is impossible** - whichever symbol lies in the central cell touches all the others, and must be drawn in sequence with at least one. (In contrast, 4 Spot Keno delivers a nothing result 31% of the time).

With no link being impossible, the lowest outcomes of one, two or 3 links in KenoLinka *feel* more like success, than a no match in Keno. The range of non-winning experiences in KenoLinka has five levels, with the most probable outcomes (4 and 5 links) concentrated just short of a prize. *Most* KenoLinka plays achieve 4 or 5 links, which is even higher than the near win (1 match) in the Keno game. Thus, the KenoLinka player is *always* counting success and those players who count on their fingers will be exercising one hand constantly. *Generally*: this is a consistent outcome for all KenoLinka games against their comparable Keno counterpart.

In this respect both Keno and KenoLinka are far better than the traditional 6 out of 49 Lotto game below, where 85% of all plays get no more than 1 match. Near wins are very low.



## Why Incremental Successes and Near Wins Matter

I have made frequent reference to “incremental successes” and “near wins”, and I must explain why I think these are important.

Most of the time, in most things, we humans operate according to an intuitive understanding of the world, rather than a rigorous analytical understanding. We understand that things that are moving tend to keep moving, even without a concept of momentum. We understand that a thrown ball will usually get where it seems to be going. The physical world usually rewards our expectation that things will move smoothly, and that we can tell where things are going by seeing how they start.

In the same way, experiencing a few wins and near-wins informs an intuitive process that influences the player’s expectation of what will happen if play continues. Like most intuitions, this one has smooth-line properties. Since the least win is about twice as hard to achieve as being “one off”, most people intuit that getting the next level of win will be about twice as hard again. So why not keep playing?

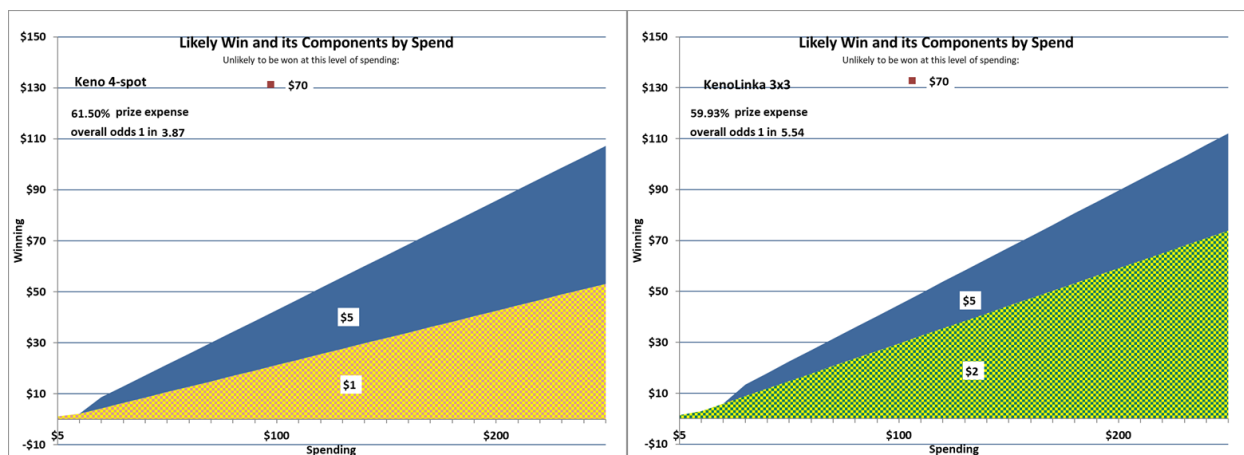
Intuition does not generally lead people to anticipate that getting one more match or link will be five to six times harder than getting the one that gave them a win (as is the case in both these games). That would be analogous to a thrown ball rapidly decelerating. Rather, intuition based on the near-win and small-win experience helps persuade us to keep playing.

**Accordingly, “incremental successes” and “near wins” are important factors that matter towards achieving greater player engagement and with that, repeat play.**

## Likely Winning Experience

We understand intuitively that a player who buys 100 tickets is more likely to win a prize than a player who buys only one. We know that a more precise account of how winning depends on volume of play must be just a matter of math.

I developed the layouts and form for the charts below to help myself understand the experience of players of our US lottery games. Some of what I learned surprised me, and these same graphs have been essential references as I have engaged others in talking about the design of prize structures. Experience shows that with a little practice, people whose strengths are not particularly in mathematics can get the *same insights* from these charts as I did, after I worked through the math to generate them.



In the above graphs, each prize-tier is represented by a wedge. The wedge *first appears* at the level of spending where we can say, “most players who spend this much will win this particular prize-tier.” The *thickness* of the wedge represents the *average value of wins across many players* (the **Expected Value**, or **Return to Player**, at this level of play).

The most common prize in the game is the first to appear as spending increases. Usually this is also the lowest-value prize. In these charts, the lowest-value prize is represented differently depending upon whether it is the same as the wager (a break-even prize of \$1 as in the 4-Spot Keno chart on the left), or more than the wager (\$2 as in the KenoLinka 3x3 chart on the right).

The charts show that most players who spend less than \$250 will not win a \$70 prize (that is why the \$70 legend floats above the wedges). Players of both games will win \$5 from early on. Players of KenoLinka enjoy better-than-breakeven prizes throughout, while about half of the Keno win at this level of play is in breakeven prizes.

The main learning points from a glance at these charts are:

- i. most players will win the lowest two prize tiers within the first \$30 spent, and no other prize tier unless they spend hundreds of dollars;
- ii. players who do not win the \$70 prize will have a win-back of about 44%, and
- iii. KenoLinka players win at least \$2, Keno players \$1.

## Conclusion

Are these two games strongly differentiated by the experiences they deliver, whether near-win or likely win? I suggest that in this simple-case comparison, the quantitative differences are subtle, but favor the KenoLinka game.

Both games give near-wins about twice as often as wins. KenoLinka, with 4 or 5 links in the near-win, is clearly ahead in delivering incremental successes and provides near wins to a greater percentage of non-winning players. While likely total winnings are the same over a big range, most players would rather win twice their wager once (KenoLinka), than break even twice (Keno). Note that in this case, the prize expense to the lottery is about 1.5% lower with the KenoLinka game. From the Lottery’s point of view, a lower prize expense for a better winning experience is always preferred.

I have found that KenoLinka provides *similar advantages* over Keno’s *whole range* of value propositions, up through top prizes in the tens and hundreds of thousands for a \$1 wager. That is, in general a KenoLinka game can be made that delivers the same or greater top prize, with play experience that better supports sustained play, and generally with a slightly lower prize expense.

In my view, KenoLinka games ***“feel like Keno, but are better in the ways that matter.”***

In the next section, I show how KenoLinka games can be built to address a broad range of value propositions, including 8- Spot and 10- Spot Keno.

## Flexibility in Keno and KenoLinka

### Keno

The feeling of winnability supported by incremental success and abundant near-wins is one feature that distinguishes Keno from other traditional lottery draw games. Another distinguishing feature of Keno is the ability to offer a very wide range of value propositions within a single game, in the sense that the *single draw outcome published by the lottery* determines winners of top prizes ranging from less than \$100 to more than \$100,000 for a \$1 wager. Keno players may choose to play for higher prizes by selecting more numbers: while the 4-spot wager may typically pay less than \$100 as the top prize, the 10-spot typically pays \$100,000.

Each of the Keno games described here is represented in tabular form in the Annexure.

As an alternative or addition to choosing more numbers, Keno players usually have the choice of choosing a modifier. The modifier is usually (though not always) an *extra cost option*. Simplest is a multiplier: after the lottery's draw from the field of 80, a multiplier is drawn from a set (for instance 2, 3, 4, and 5) where bigger numbers are represented with decreasing abundance (by far the likeliest result is "2").

A multiplier doesn't create any additional "ways to win", it merely increases the prizes. Multiplier modifications are so simple that I will not discuss them further here - and of course, a simple multiplier can be added to Link2Win games as well.

Another popular Keno modifier that does create more winning opportunities is the "Bullseye" (BE). After the lottery draws its 20 symbols, it designates one of them at random as the BE. If a player's pick included the BE, it wins a prize *even if the BE is the only symbol matched*, and the BE match increases the value of other prizes also. If the player's pick does not include the BE, the base game pay table applies.

The lottery may thus pay "top" prizes anywhere from less than \$100 to several hundred thousand as a result of a single draw, depending on how players use the available range of "spots" and modifiers.

**The ability to select from among a progression of several different value propositions, within one game** is important for the *player*, because it supports a feeling of control – I can play four spots for a good chance at small gain, or venture more spots for a slimmer chance at bigger gain, any time I wish. I can even do both of these things at the same time, and see the lottery's single drawing determine the outcomes of both bets. It is important for the *lottery*, because it allows one "game engine" (that is, the system that registers wagers, randomly determines results, communicates outcomes, and pays winners) to serve a broad range of propositions to the playing population. The lottery gains the simplicity of running one big game, with the financial stability of several smaller games combined.

### KenoLinka

KenoLinka also allows the player to select from amongst a progression of value propositions, whose outcomes are determined by a single drawing (of 9 numbers) within one game. For example, players may choose to:

- play a single 3x3 grid as set out earlier; or
- play a single 3x3 grid with a modifier, that increases prizes and adds "ways to win", or
- play with two independent 3x3 grids (a double play), so that the maximum number of links becomes 16, rather than 8, or
- add a modifier to the above double play - the modifier being added to one of the grids.

The range of value propositions supported by these KenoLinka options is even broader than that offered by Keno. The advantages to the lottery of running a 'single game' are the same as with Keno.

## The KenoLinka Modifiers

The modifiers used in KenoLinka have the virtue of simplicity: they do not require any additional draws or determinations. The KenoLinka modifier is based on forming a link with the first two draws. As with the Keno “Bullseye” modifier, the KenoLinka modifier can provide “more ways to win”, and it increases the value of all wins in the base game.

**Surprisingly, unlike any other modifier I have seen, its effect is felt more strongly on the rarer outcomes associated with bigger prizes.**

This surprising property turns out to have great advantages for game design.

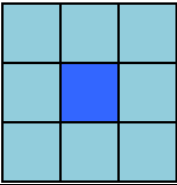
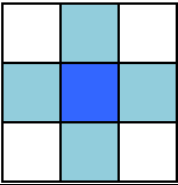
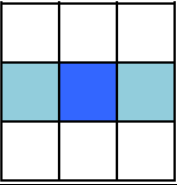
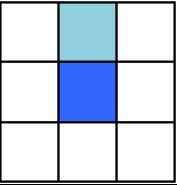
I will illustrate this with the next example, contrasting the Bullseye modifier on 4-spot Keno to a modifier for KenoLinka 3x3.

Keno Bullseye sounds a little complicated, and it is. BE increases the number of ways to win in the 4-spot game from 3 to 7, and shifts money toward bigger prizes. In the case of 4-spot Keno, it also makes the least win a *less-than-breakeven win* (2 matches, no BE pays \$1 for a \$2 bet). It also increases the maximum possible win from \$70 to \$350 (continuing with the example of Georgia). The size of the top prize tends to be salient for players. Although the BE decreases the value of the least win, it does not change its frequency. The minimal win may continue to help support an intuition of winnability.

Within the Link2Win system, all the symbols are used, so matching is never relevant. However, **if the first two symbols drawn produce a link that connects the center cell with some other required cell, this event is a win in itself, and it increases the value of prizes defined on links.**

The center cell and the other required cell can be identified by way of a pattern, and a player can have a choice from a number of patterns – each having (1) a different degree of difficulty to obtain, and (2) different modification factors to the base odds and prizes of the game.

The KenoLinka 3x3 grid game gives players the choice from 4 patterns:

<b>KenoLinka Modifier</b>			
Applies when 1 <sup>st</sup> two Numbers Drawn form a Link covering the Centre Cell and a Shaded Cell			
A	B	C	D
			
Odds: 1 in 4.5	Odds: 1 in 9	Odds: 1 in 18	Odds: 1 in 36

As a first example, suppose that a link that connects the center with *any one of the 4 “side” (not corner) cells*, formed due to the first two symbols drawn by the lottery, is defined as a “win”. This win as described is of Pattern “B” (being the “cross” pattern), and is marked on the following charts as a “+”. This event will happen (on the average) in 1 game out of 9.

While the odds of achieving this Pattern “B” are 1 in 9, this modifier’s occurrence is *not independent* of the number of links formed. If it were independent, we would expect that getting any number of links in combination with “+”



would be nine times harder. In fact, the “+” combines easily with 1 link (3 times harder) and very hesitantly with 8 links (49 times harder).

This creates a striking advantage:

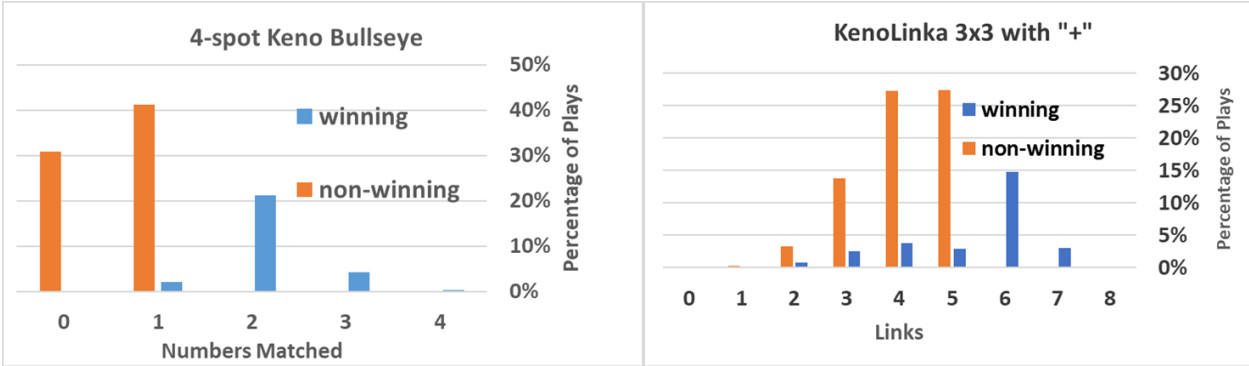
- it provides comparatively good chances for players to achieve the extra win (1 in 9), either alone or in combination with a smaller prize, and
- it makes the top outcome much harder to achieve, thus allowing the lottery to offer a bigger top prize.

It is worth noting that the BE modifier for Keno also is *not independent* of the number of matches achieved, but the relation runs disadvantageously in the other direction: the more numbers matched, the more likely also is the BE win.

The table below shows the likelihood of seeing the “cross” pattern in combination with each number of links, and the corresponding increase in difficulty due to the combination:

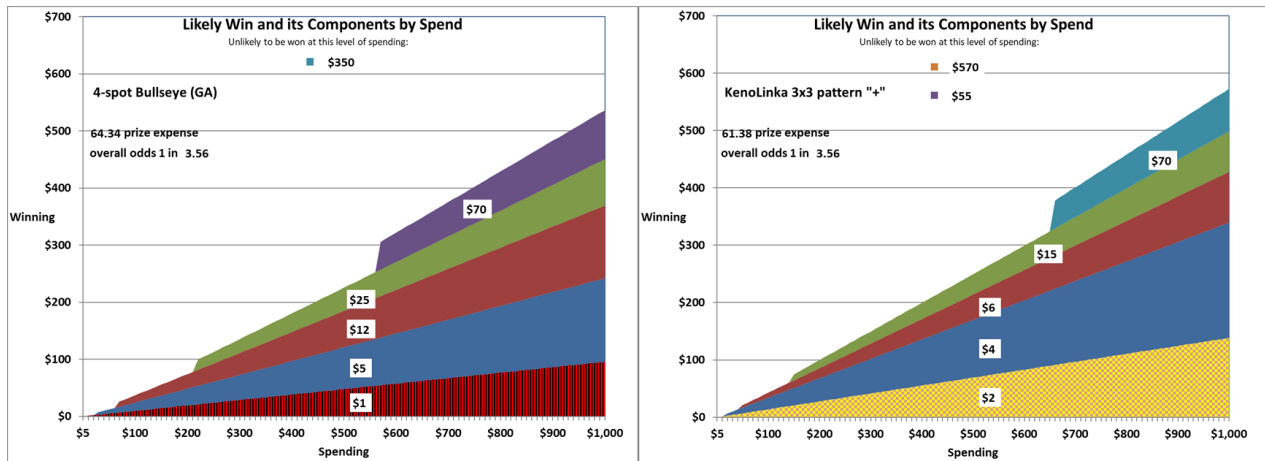
Links	KenoLinka 3x3 with "+"		
	base	with "+"	increase
8	462.86	22680.00	49.00
7	32.77	965.11	29.45
6	6.77	105.98	15.65
5	3.31	34.81	10.52
4	3.21	26.10	8.13
3	6.14	39.75	6.47
2	24.84	135.00	5.43
1	306.49	1008.00	3.29
0	n/a	n/a	n/a

The effect of adding this event on the Win/ Near Win experience is also positive, as the chart below illustrates. The conversion in the KenoLinka game of the abundant 4- and 5-link “non-wins” to “wins” is significant. Consequently, the intuition of winnability is preserved and enhanced.



In KenoLinka, the “+” event is much less likely to occur in combination with the rare 7-and 8-link outcomes. Consequently, it is possible to define generous prizes contingent on those combinations, without inflating the prize expense.

The next set of charts compares the likely winning experience between the modified games.



The top prize (\$350 for Keno, \$570 for KenoLinka) is not likely to be won by players spending \$1000. This is indicated by the legend for the top prize floating above the prize wedges in the chart. Within the KenoLinka game, the prize that depends on 7 links with “+” is also too rare to be won by most players spending \$1000.

The \$70 prize is now less accessible also, because wagers that have a chance of winning it now cost \$2 rather than \$1. Note that this also means that the least prize within 4-spot Keno with BE is now *less-than-breakeven*, as indicated by the red and black marking. Although the overall odds of the modified games are identical, players of KenoLinka avoid less-than-breakeven prizes, and generally win back at a higher rate.

Despite KenoLinka’s advantages in player experience, the KenoLinka game has a prize expense for the lottery that is about 2.7% lower.

In summary, a KenoLinka game based on a single 3x3 grid, and its “+” modification provides a winning experience even better than that of 4-spot Keno and its BE modification provide. The prize expense to the Lottery is lower with the KenoLinka game.

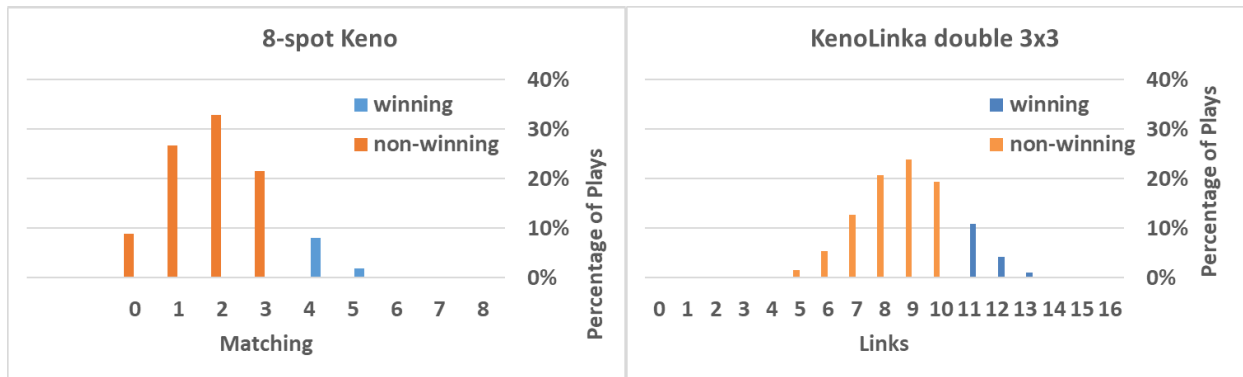
While the 4-spot wager does account for a significant share of traffic in many lotteries that sell quick-draw Keno, there is also great interest in wagers against much bigger top prizes. I will next show three examples of how Link2Win games can offer advantages over Keno in providing wagers against bigger top prizes.

## Bigger Top Prizes: Tens of Thousands

The 8-spot Keno game is particularly interesting because it is offered in a progressive form (that is, with a jackpot that grows from a set starting value until won) by some lotteries. A common top prize value (or starting value) in the 8-spot game is \$10,000 for a \$1 wager. Prizes are paid for four or more matches. Again, taking the GA game as an example, we can construct a KenoLinka game to support a similar top prize. A progressive jackpot could easily be included.

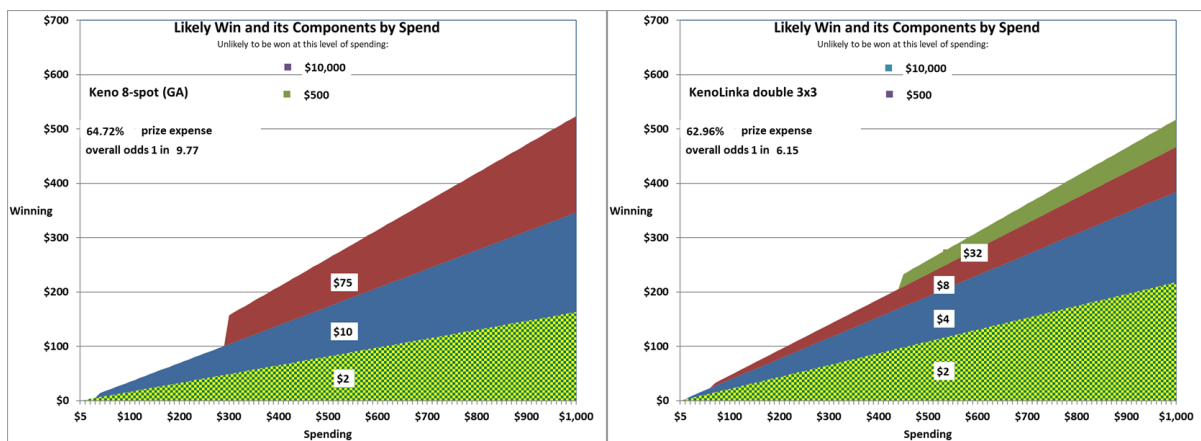
In Keno, if we double the number of spots played (4 to 8), we can increase the top prize from \$70 to \$10,000.

In KenoLinka, we can add a second 3x3 matrix for the same effect. The player may choose to let symbols be randomly placed on both grids, or may arrange the symbols in one of them deliberately. A single 9-symbol Lottery draw determines the results. We define prizes based on the total number of links achieved, on both grids. The probability of getting 16 links supports a top prize of \$10,000, while if prizes are paid for as few as 11 links, the overall odds are 1 in 6.15. Six prize levels can be defined in this way, as shown in the next figure.



The above figure suggests that the near-win experience in this double KenoLinka game may do a better job of supporting the intuition of winnability, than the corresponding Keno game. Partly this is because the 11-link win is not quite twice as rare as the 10-link near-win, while in 8-spot Keno getting four matches is almost three times as rare as getting three. Partly also, it is because the range of outcomes (2 to 16 links) has many more incremental steps, and about two-thirds of the time "eight, nine, or ten" links will be counted.

The next set of charts compares the likely winning experience provided by the two games.



Prizes of \$500 or more are unlikely to be won by players spending less than \$4000. The overall win-back by players spending less than \$4000 is similar in both games, at slightly more than 50%. Yet the composition of the wins differs: KenoLinka provides much more frequent wins, of smaller size. In contrast, about 1/3 of the likely winnings in 8-spot Keno arrive in the form of large \$75 prizes.

Winning \$75 on a \$1 wager is a remarkable thing. In 8-spot Keno, it is a win likely to be experienced by most players who spend \$300 in the game. This is an event that players are likely to celebrate.

Now this might be a good thing in a casino, where their winnings might be spent in a restaurant or bar that perhaps yields a higher rate of return than the games, to the same property owner who runs the casino. But in the lottery business, the prize that stops a chain of play by being spent in a restaurant is lost to the lottery. Our goal is not to drive the player to the restaurant, but to keep the player playing. Prizes can be *too big* for this purpose. Extensive experience with instant game prize structures shows that wins of 5 to 10 times the wager are a very effective way to keep players engaged. In fact, several state lotteries have had success with instant games using a prize structure pioneered by the Minnesota Lottery, where prizes of 5 or 10 times the wager are the *only* prizes in the game.

The Double KenoLinka prize structure (compared above with 8-spot Keno, for spending up to \$1,000) provides a winning experience similar to some successful instant games. Most of the winnings come in prizes of \$2, \$4, or \$8. **Winning plays are 59% more frequent than in 8-spot Keno.** And once again, the KenoLinka prize structure is less expensive for the lottery, in this case by almost 2%.

**Biggest Prizes: Hundreds of Thousands**

10-spot Keno is usually offered with a top prize of \$100,000 for a \$1 bet. We can make the two-card KenoLinka just described support a prize that big, by adding a “pattern” modifier.

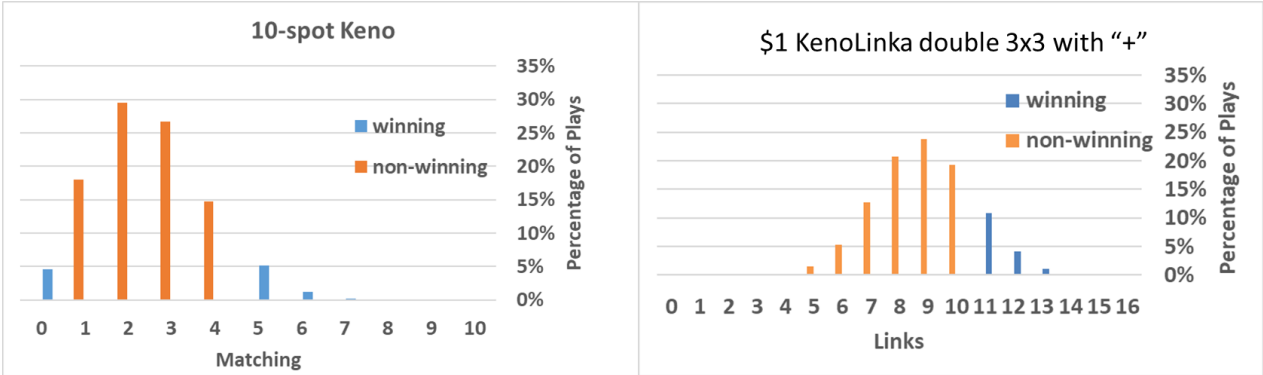
The winning experience of 10-spot Keno is unusual, in that a significant part of a player’s winnings come from matching *none* of the Lottery’s 20 numbers. The probability of this event is slightly less than the probability of matching 5 numbers (see the chart below). In US quick-draw Keno:

- matching 5 numbers almost universally pays \$2,
- there is considerable variation among states in the prize paid for matching nothing: from \$2 to \$5, with \$5 most common.

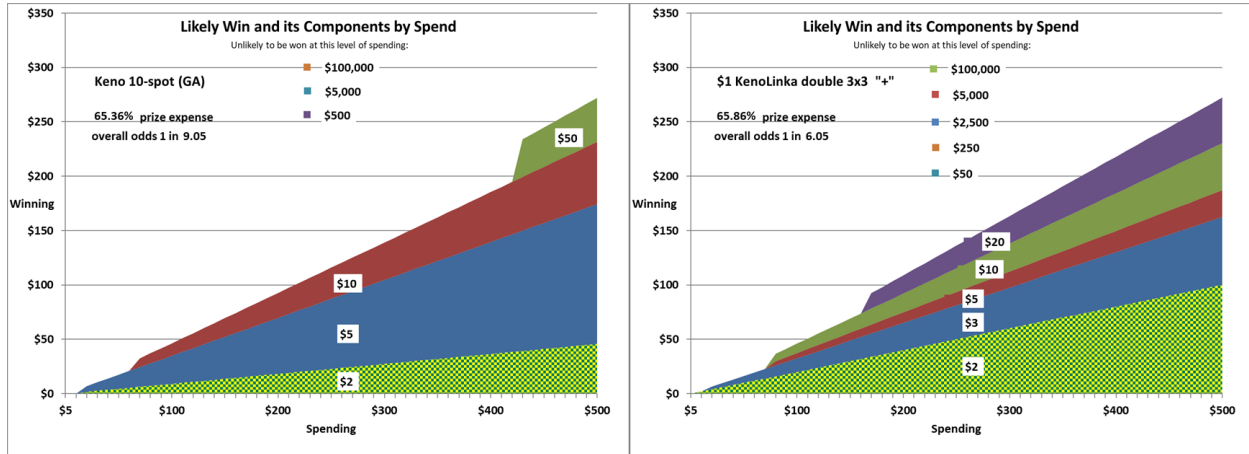
While the “nothing” win is a significant part of the players’ winnings, it does not “lead” anywhere: matching one more number pays nothing. The feeling of incremental progress is absent. The “nothing” win does not help support an intuition about how winnable the next bigger prize may be. While paying a significant prize for this event is justified by its probability, it is not clear that it is a good investment in terms of supporting continued play.

In constructing a KenoLinka game to address the main value proposition of 10-spot Keno, I choose to ignore the potential to pay for low-probability events that do not support an expectation of bigger wins (KenoLinka can easily do this). Rather, I would support a \$100,000 top prize for a \$1 wager, with instant-game-like wins to support continued play, using the 2-card KenoLinka just described, with a pattern modifier.

Only one of the two grids (the one that players may arrange as they prefer; call it the “first” grid) participates in the pattern. The pattern to be used is the same “+” described earlier. Once again, this pattern (an event with odds of 1 in 9) enhances the value of all prizes won on links. However, since in *this* case the modifier is added at no additional cost (to be comparable to \$1 Keno), the occurrence of the pattern does *not* constitute a win-in-itself. The charts below show that the win- and near-win experience in the KenoLinka double 3x3 game compares even more favorably against 10-spot Keno than against 8-spot.



The chart that follows compares the winning experience provided by these games, focusing on the likely wins experienced within the first \$500 of play. Both games provide abundant wins in the \$2 to \$10 range, in keeping with design principles that are effective in instant games. Wins are more frequent in the KenoLinka game, while the prize expense in this case is similar.

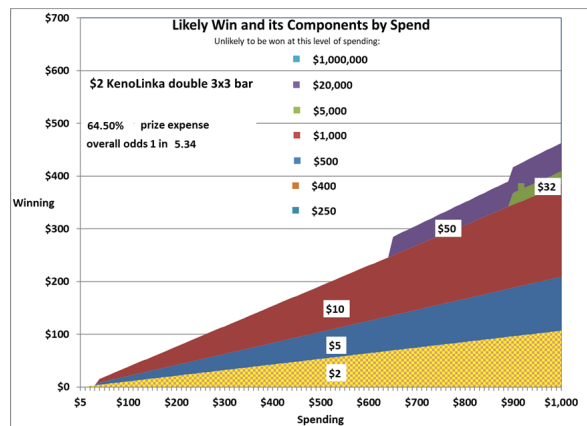
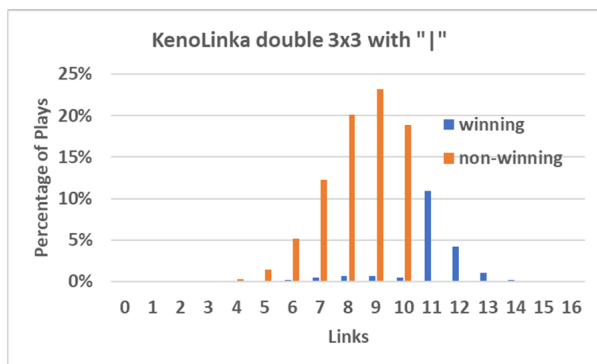


Players can usually stretch the top prize of the 10-spot Keno game to \$500,000 with a multiplier, or to \$300,000 with the BE option, both at the cost of doubling the wager. Players of the KenoLinka double 3x3 game can likewise stretch its top prize by using an extra-cost modifier.

As a further example: Instead of the “+” pattern, we specify the more selective pattern formed when the center cell is linked to *one specific side cell* (say that in the top row) by the first two draws- designated by “|”, a bar symbol. This event happens in 1 game out of 36. This pattern is graphically shown on **page 8** as Pattern “D”.

Since the modifier is taken at extra cost, we can specify that forming the “|” pattern constitutes a win-in-itself. Since the pattern is much less likely to occur in conjunction with a high number of links, we can offer a game with a top prize in the millions of dollars!

The charts below describe the play experience of **this KenoLinka game, which I believe offers players a value proposition unmatched in Keno**. Most outcomes feel like near-wins, play-sustaining prizes are abundant, lots of prizes in the hundreds and thousands of dollars are in the pay table, and the top prize is \$1 million cash.



## Summary

I hope that the examples developed above have shown that the KenoLinka games, in addition to their **distinctive and simple visual presentation**, offer **quantitative advantages** over the most successful traditional lottery draw game for quick play, namely Keno.

KenoLinka games:

- offer near-win experience that supports hopeful intuitions about winnability and avoids the “no success” outcome,
- provide actual winning experience that sustains engagement, in accordance with principles known to be effective in instant games, including paying better prizes for the wins most players will experience and providing more frequent wins,
- allow players to choose from a progression of value propositions, whose outcomes are determined by a single drawing, within the one game, and
- can include a simple modifier that allows much higher top prizes to be offered while also providing “more ways to win”.

Thus, KenoLinka games should be attractive and engaging for **players**.

Further, KenoLinka games can provide superior play experience at a prize cost that is generally 1% to 2% lower than the closest Keno game. Given that Gross Gaming Revenue (GGR, wagers minus prizes) on quick Keno games is generally about 36%, a 2% reduction in prize cost yields a 5.5% increase in GGR, a substantial benefit for the **lottery**.

For the benefit of those readers who want more detail, some tables descriptive of the games described here are set out in the following **Annexure**.

The application of Link2Win in lottery is not limited to quick-play draw games. Link2Win games larger than those described here can outperform Lotto-type games in supporting even bigger prizes. That will be the topic of another document.

Annexure

**Keno Games described in this article**

Match	4-spot Keno Odds		Prize	
	base	with BE	base \$1	with BE \$2
4	326.44	1,632.18	70	350
3	23.12	154.15	5	25
2	4.70	47.03	1	12
1	2.31	46.22	0	5
0	3.24	n/a	0	n/a

Match	8-spot Keno Odds		Prize	
	base	base \$1	base \$1	base \$1
8	230,114.61		10,000	
7	6,232.27		500	
6	422.53		75	
5	54.64		10	
4	12.27		2	
3	4.66		0	
2	3.05		0	
1	3.75		0	
0	11.33		0	

Match	10-spot Keno Odds		Prize	
	base	with BE	base \$1	with BE \$2
10	8,911,711.18	17,823,422.35	100,000	300,000
9	163,381.37	363,069.71	5,000	25,000
8	7,384.47	18,461.17	500	2,000
7	620.68	1,773.36	50	150
6	87.11	290.38	10	35
5	19.44	77.78	2	7
4	6.79	33.94	0	3
3	3.74	24.93	0	2
2	3.39	33.87	0	2
1	5.57	111.38	0	5
0	21.84	0.00	5	0

**KenoLinka Games described in this article**

Links	KenoLinka 3x3 Odds		Prize \$1	
	base	base	base	base
8	462.86		70	
7	32.77		5	
6	6.77		2	
5	3.31		0	
4	3.21		0	
3	6.14		0	
2	24.84		0	
1	306.49		0	
0	n/a		n/a	

Links	KenoLinka 3x3 with "+" Odds				Prize \$2	
	base	with "+"	base	with "+"	base	with "+"
8	462.86	22,680.00	70	570		
7	32.77	965.11	5	55		
6	6.77	105.98	2	13		
5	3.31	34.81	0	4		
4	3.21	26.10	0	4		
3	6.14	39.75	0	4		
2	24.84	135.00	0	4		
1	306.49	1,008.00	0	4		
0	n/a	n/a	n/a	n/a		

Links	KenoLinka double 3x3 Odds			Prize \$1	
	base	base	base	base	base
16	214,236.73			10000	
15	7,584.97			500	
14	637.19			32	
13	96.89			8	
12	24.04			4	
11	9.18			2	
10	5.17			0	
9	4.19			0	
8	4.82			0	
7	7.89			0	
6	18.67			0	
5	66.01			0	
4	372.59			0	
3	3,806.74			0	
2	93,933.97			0	
1	n/a			n/a	
0	n/a			n/a	

Links	KenoLinka double 3x3 with "+" Odds				Prize \$1	
	base	with "+"	base	with "+"	base	with "+"
16	214,236.73	10,497,600.00	5,000	100,000		
15	7,584.97	279,024.90	250	2,500		
14	637.19	17,089.68	20	250		
13	96.89	1,936.61	6	100		
12	24.04	373.13	3	12		
11	9.18	115.65	2	3		
10	5.17	54.87	0	0		
9	4.19	38.41	0	0		
8	4.82	38.90	0	0		
7	7.89	56.69	0	0		
6	18.67	119.92	0	0		
5	66.01	376.88	0	0		
4	372.59	1,845.25	0	0		
3	3,806.74	15,599.40	0	0		
2	93,933.97	308,938.38	0	0		
1	n/a	n/a	n/a	n/a		
0	n/a	n/a	n/a	n/a		

Links	KenoLinka double 3x3 with " " Odds				Prize \$2	
	base	with " "	base	with " "	base	with " "
16	214,236.73	41,990,400.00	5,000	1,000,000		
15	7,584.97	1,116,099.59	400	20,000		
14	637.19	68,358.74	32	5,000		
13	96.89	7,746.43	10	1,000		
12	24.04	1,492.52	5	250		
11	9.18	462.59	2	50		
10	5.17	219.46	0	10		
9	4.19	153.66	0	10		
8	4.82	155.61	0	10		
7	7.89	226.76	0	10		
6	18.67	479.66	0	10		
5	66.01	1,507.53	0	10		
4	372.59	7,380.98	0	10		
3	3,806.74	62,397.60	0	10		
2	93,933.97	1,235,753.51	0	10		
1	n/a	n/a	n/a	n/a		
0	n/a	n/a	n/a	n/a		