

# CCA & the Odds

By Miguel Marqués

We have all ended a CCA game blaming the odds, through the cards and/or dice, for our crushing defeat. How often should we blame them? Let us see through some selected examples how, most of the time, we should be able to handle the odds, and learn to accept our mistakes as commanding Leaders!

## 1. Command Management

The engine of CCA is the command system, limited to a hand of cards. Some wargamers do not want to make a first step into CCA because they like to have an “unlimited” command on their armies. But if you do make this first step, then you discover the joy of hand management: you have a starting hand, good or bad, that will recycle during the battle (becoming alternatively better or worse). You do not only have to make the best use of a card on a given turn, but also know when to buy time and just renew your hand, or when to keep some cards with obvious instant use for a later longer-term attack.

Knowing the probabilities of drawing the different types of cards may be useful. First, you can see the common deck of command cards as two separate decks. Indeed, you could split it into two half-decks of 30 cards, one for each player (*I am Spartacus* re-shuffling aside). If, for example, your hand is 5 and the game lasts 25 turns, you will go through “your” entire deck.

### Hand size

Considering that both of you will go through “your” half-decks, is the hand size so important? Even if most of the cards, if not all, will go through your hand sooner or later, it *is* important. There are 16 cards (27%) that order units *equal to Command*, as many units as cards you have in your hand. Plus the 2 *Counter Attack*, if they counter those cards. The overall effect on the game may not be so big: if you play 5 of those cards, a hand of 6 instead of 4 means that you will have ordered 10 units more over the whole game. But the instantaneous effect may be much bigger: on one or two key turns, being able to order 6 units instead of 4 can make the difference.

The other aspect is instant choice. Even if sooner or later you will have the cards in your hand, a hand of 6 instead of 4 gives you more visibility over the coming cards, which may let you appreciate better in which section you will be able to sustain a long-term attack. This will be particularly important if you have a lot of unit types, or strong formations on several sections. It may let you alternate the different attacks you can launch too, forcing your opponent to react on several fronts and thus lose initiative. But in scenarios with few unit types or troops mostly in a given section (fewer choices),

this aspect will have a lesser impact.

### Ordering a group

Let us consider one example: a group of 4 units on one section with a Leader attached to one of them. What are the odds of having this formation ordered? Considering the number of cards in the deck that may order it (*Section, Leadership, Troop*, plus *Double Time* and *Line Command* or *Order Mounted* and *Mounted Charge*), with a hand of 5 cards and after 10 turns (15 cards drawn) the probability of having drawn less than  $x$  of those cards is:

$P(<x)$ [%]	$x = \text{number of cards}$						
	1	2	3	4	5	6	7
● foot	<1	<1	3	11	27	51	73
● mounted	<1	1	7	21	44	69	87
▼ foot	<1	1	7	21	44	69	87
▼ mounted	<1	4	16	38	64	84	95
■ foot	<1	2	9	26	51	75	90
■ mounted	<1	5	20	44	70	88	97

The number of cards that may order this formation ranges from 15 for heavy mounted to 22 for light foot (we have included *Move-Fire-Move* for ordering lights). We have not considered *Counter Attack* to one of those cards, nor *I am Spartacus*, *Clash of Shields*, *Rally* or *Darken the Sky*, which could order some of those units but hardly all of them.

If, for example, we wanted at least 4 cards during the first 10 turns (hand of 5) to order a group of 4 MI units with Leader on one section, the probability would be 79%:

- If they were MC, 62%.
- If they were light/heavy, 89/74%.
- Without a Leader, 68%.
- If they were not linked, 15%.
- With a hand of 6/4 cards, 84/72%.
- During the first 15/5 turns, 96/39%.

This particular case helps in quantifying the differences between foot/mounted and troop types, plus the effects of Leaders, cohesion, hand size and duration of the battle on the probability of conducting a long-term attack. In the example given, the strongest effect is cohesion: if

the group splits (we could only use *Section* and *Troop* cards) the probability goes from 79% down to 15%!

## Scenarios

We find some of these examples in the base game scenarios. At Ticinus River (218 BC), there is one Carthaginian Cavalry formation per section of 4 units plus Leader. The Carthaginian hand is 5, so (if units stay grouped and in the same section) the probability of having at least 4 cards ordering them over the first 10 turns is 79% for each of the flank (light) formations and 56% for the center (heavy) one. The same 79% applies to the Carthaginian Cavalry formation on the left at Castulo (211 BC).

At Baecula (208 BC), the Romans have strong formations of 4 MI plus Leader on both flanks, and their victory relies on the advance and attack of these 2 groups on the Carthaginian flanks. With a hand of 6, the probability of having at least 4 cards ordering *each* of them over the first 10 turns is 84%. The same probability for *both* of them is obviously smaller, but less straightforward to calculate!



## 2. Leaders on the Attack

One of the virtues of CCA is that you do not need to go through a CRT every time you fight, the dice tell you the outcome. However, in some key moments of the battle, you would like to know what are your chances to, for example, eliminate that last unit that will earn you glory! And the dice will not tell you.

### Killing probability

We will use this example to illustrate the effect that Leaders may have on the attack. Imagine that you are only one banner away from victory and, on your turn, you can order one infantry unit to attack an enemy unit that cannot evade nor ignore flags and retreats 1 hex per flag (let us make things “simple”). What is the probability to kill that unit? It depends on the number

of blocks in the target unit and on the presence of a friendly Leader:

$P_{kill}(x)$ [%]	$x =$ target blocks			
	1	2	3	4
no Ldr	70	26	4	0
● adj. Ldr	88	50	13	0
▲ att. Ldr	92	67	32	8
no Ldr	80	41	11	1
▼ adj. Ldr	94	69	31	6
▲ att. Ldr	96	81	55	29
no Ldr	87	54	21	5
■ adj. Ldr	97	81	50	19
▲ att. Ldr	98	88	69	47

Assuming you hit on swords (Aux, MI or HI), each die has a probability of 2/6 to hit (symbol+swords) if no Leader supports the attack and 3/6 if a Leader does (+helmets). If the Leader is attached, we have to consider the probability of instant kill *plus* the probability of getting 1 flag followed by the elimination in the bonus CC. Several flag results are not considered because they would push the unit out of reach, and although a neighboring unit could be eliminated in the bonus CC, we are keeping things simple!

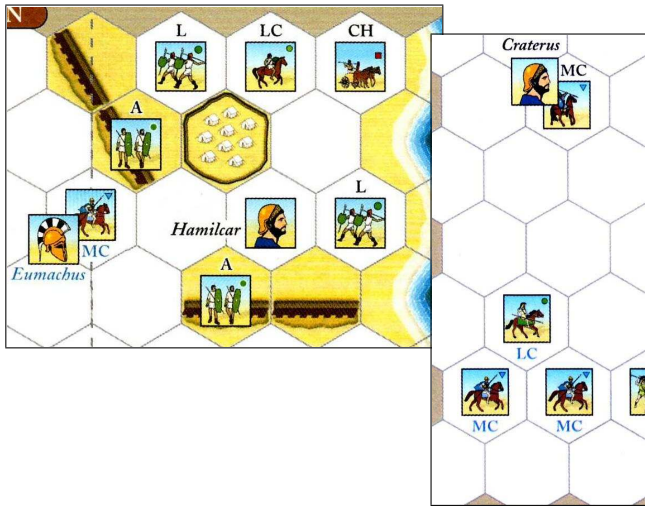
Against many-block units, the strongest effect of the Leader is when attached. For example, a HI against a full infantry unit has  $P_{kill}(4)=5-19-47\%$ , the bigger contribution coming from the bonus CC. Therefore, you should avoid attacking supported units (or units that cannot retreat!) if you want to make the best use of the attached Leader.

However, against few-block units, already being adjacent is enough,  $P_{kill}(1)=87-97-98\%$ ; if you have the choice, attaching the Leader will not increase your probability significantly, while keeping him adjacent may spread his effect over several units.

## Scenarios

In some scenarios of Expansion #1 there are opening moves interesting to calculate. At Himera (480 BC), the Syracusans substituted their own cavalry for some Carthaginian reinforcements, and quietly entered the Punic camp “raising havoc and killing Hamilcar”. With a hand of 5 and 31 cards directly activating the MC, the probability of entering the camp in the first turn is 98%!

If the MC moves 1 hex and attacks Hamilcar,  $P_{kill}=42\%$ , and its turn ends. If the MC wants to “raise havoc” before attacking Hamilcar, it could attack the LI on the shore from behind, with  $P_{kill}=20\%$  (2-3 flags *or* 2 hits plus 1 flag), or the LC from the shore with  $P_{kill}=20\%$  too (2-3 flags *or* 3 hits). If the MC enters the camp using *Mounted Charge* it kills Hamilcar/LI/LC with 52-44-44%, but the probability of having one of those 2 cards in the deck from the start is only 16%.



At Hellespont (323 BC), “Craterus charged at the onset but was killed”. With a hand of 5 and 21 cards directly activating the MC, the probability of charging at the onset is 89%. The probability of killing the LC is the same as in Himera, 20%. In the bonus CC, attacking the MC on the left, now unsupported, gives  $P_{kill}=49\%$  (2-3 flags or 3 hits or 1 flag plus 1-2 hits). As in Himera, the probability of starting with *Mounted Charge* is 16%, and then Craterus would kill the LC and then the MC with 44 and 81%, respectively.

### 3. Strike First or Not?

Two lines are going to clash and, on your turn, you have the ability to activate your units, make contact and strike. Should you? When would be better to let the enemy strike first?

#### Surviving probability

Again, let us consider a simple problem. One of your Aux/MI/Hi is being attacked by an unsupported 4-block MI without Leader. The probabilities of your unit, depending on its number of blocks, surviving the attack and then being able to battle back if unsupported (takes all flags), supported (ignores 1 flag), or with a Leader attached (ignores 2 flags) are:

▼ MI	target blocks			
	1	2	3	4
$P_{survive}$	20	59	89	99
-0 flags	6	23	40	47
$P_{back}$ -1 flags	15	48	76	86
-2 flags	19	58	87	97

If your unit survived and can battle back, on your turn you could continue attacking the MI and eventually making a momentum advance and bonus CC. Depending on your type of unit, the probabilities to finish off the attacking unit are:

$P_{kill} [\%]$	BB	+ AT	+ CC
● no Ldr	0	10	–
● att. Ldr	0	34	48
▼ no Ldr	1	24	–
▼ att. Ldr	6	59	68
■ no Ldr	5	39	–
■ att. Ldr	19	69	74

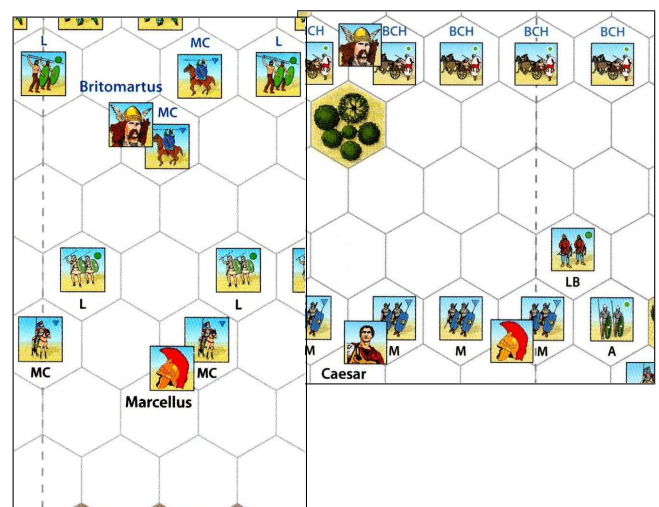
We considered attack after battle back if you rolled less than 2 flags, and bonus CC after attack if you rolled 1 flag. We have not considered being attacked by a unit of other type, or with fewer blocks, or with Leader attached, but all these parameters would complicate the example unnecessarily. A 4-block MI without Leader makes for a good average enemy!

For example, your unit was a 4-block supported Aux with Leader. If you attack first the MI, you have  $P_{kill}=8\%$ . However, if the MI attacks first, it will have  $P_{kill}=1\%$  only and you will have  $P_{kill}^{back}=0.97 \times 0.48=47\%$  distributed among your battle back, your attack and the bonus CC.

If your unit was a 2-block unsupported HI, attacking the MI leads to  $P_{kill}=5\%$ . If you let the MI attack first, it will have  $P_{kill}=41\%$ , while you will have  $P_{kill}^{back}=0.23 \times 0.39=9\%$ . You increase your probability from 5 to 9% but take an important risk!

#### Scenarios

In Expansion #2 there are some examples of charges and battle backs. At Clastidium (222 BC), “Marcellus rushed upon king Britomartus and slew him”. What are the chances of charging for each of the two leaders in their first turn? There are 25 cards directly activating the MC (note that the 2 *Order Heavies* would do in this scenario). With his hand of 6 Marcellus has 97% of charging, while Britomartus has “only” 89% with his hand of 4.



Even if both leaders ride a MC, the probabilities of eliminating the other unit/leader are not completely symmetrical because of the 1-hex longer retreat path

of Marcellus. If Marcellus attacks, he will kill the Gaul unit/leader with  $P_{\text{kill}}=19.6/4.7\%$ , and lose the Roman unit/leader with  $P_{\text{kill}}^{\text{back}}=10.1/3.4\%$ . If Marcellus does not move and Britomartus attacks, he will kill the Roman unit/leader with  $P_{\text{kill}}=18.6/5.3\%$ , and lose the Gaul unit/leader with  $P_{\text{kill}}^{\text{back}}=10.6/3.5\%$ . Surprisingly, Marcellus has (slightly) a better chance of eliminating the other MC but a worse chance of eliminating the other leader! Of course *Mounted Charge* would change these probabilities...

At River Stour (54 BC), the Briton leader can charge 3 hexes straight and choose to attack the MI, MI with Leader or LB (attacking the LB from above would cut the Briton retreat path). What would be the best choice? We have included the probability of bonus CC, the fact that the BCH ignores 1 sword, and calculated the attack with/out *Mounted Charge*:

● BCH	unit		Leader		
	$P_{\text{kill}}$	$P_{\text{kill}}^{\text{back}}$	$P_{\text{kill}}$	$P_{\text{kill}}^{\text{back}}$	
3 dice	LB	<1	0	2.6	1.6
	MI	3	12	3.0	4.0
	MI+L	0	14	1.6	4.4
4 dice	LB	12	0	3.7	1.4
	MI	11	11	4.1	3.7
	MI+L	7	13	2.7	4.1

Without *Mounted Charge*, the attack is suicidal. Only the LB cannot kill the unit back, but it will be hardly eliminated. With *Mounted Charge*, the probabilities get better and the attack can be threatening for the Romans, but not overwhelming. Mounted units should not be used against supported lines of infantry, unless these have already lost some blocks.

## 4. Penetrating Power

Sometimes you do not have all the cards you would need to launch an attack, but only the ones that force you to split one formation and leave weaker units behind. The target may seem tempting, but it is easy to overestimate the penetrating power of your strongest units: even those will suffer losses over a several-hexes attack.

### Armor versus Javelin

One exercise may illustrate this: a heavy unit attacks a light unit that evades up to its baseline, where it will no longer evade. Will it be too late to kill it? Does the light unit have a chance to win?

Let us consider the “duel” between a HI unit in row 1 and a LI/LB in row 3 or 4. We have already seen that, in battle, it will be easier to activate a light unit than a heavy unit, but let us consider that they can always be activated and that they can only move forward or backward. The light unit will always try to fire and will

evade when attacked, until reaching row 9 where it will have to CC. The HI, after suffering from hits and flags, will always try to catch the light unit and CC. This sequence will be repeated until one of them is eliminated.

■ HI	target		HI		
	$P_{\text{kill}}$	$\langle \text{row} \rangle$	$P_{\text{kill}}^{\text{back}}$	$\langle \text{row} \rangle$	
row 3	LI	91	6.7	9	5.4
	LB	54	8.0	46	5.2
row 4	LI	95	6.8	5	5.9
	LB	51	8.4	49	5.2

We have calculated the probabilities for LI and LB starting on rows 3 and 4, and we have computed the average row in which the target or the attacking unit are eliminated. The attacking unit is eliminated around the middle row (almost row 6 for a LI starting at row 4), while the light unit is eliminated toward the furthest row (only row 7 for the LI).

The probabilities for a HI versus a light foot are about 90/10 for LI and 50/50 for LB. The 1-hex-only longer range of bows has a huge effect on the probability! The light units have a better chance when they start at their range, row 3 for LI and row 4 for LB. Note that these numbers should be considered as upper limits, since in battle light units will be activated more often and can avoid the attacking unit toward the sides too.

A significant contribution of the unexpected light unit success comes from the difficulty of the HI to catch it. In order to check this, we have repeated the calculation considering that the HI has a Leader attached *and* is supported: it ignores all flags (helmets will not contribute much to the result because they do not hit on an evading unit):

■ HI <sup>(supp.)</sup> <sub>(+Ldr)</sub>	target		HI		
	$P_{\text{kill}}$	$\langle \text{row} \rangle$	$P_{\text{kill}}^{\text{back}}$	$\langle \text{row} \rangle$	
row 3	LI	98	6.9	2	6.0
	LB	83	8.3	17	5.8
row 4	LI	99	6.4	1	6.9
	LB	82	8.6	18	5.8

The bow advantage over javelin still shows up, but overall the HI will have a much higher chance of success, 99/1 for LI and 80/20 for LB. A formation of medium/heavy units (with Leader if possible) will always be more efficient than isolated ones against light foot units. They will be activated by more command cards, they will stand better the enemy fire, and they will cover the field better against an enemy drift toward one side.

## 5. Concluding Tips

The above should be considered as illustrative examples in which one might be curious of what the odds of the

different outcomes are. But my aim is definitely far from turning this wonderful game, where intuition plays a decisive role, into a calculating contest of numbers! Moreover, the game situations are usually far more complex than the simplifications calculated here: groups form, split and change section, units do not fight one-on-one, retreat/evade paths can get blocked...

I will not give very specific tips, that would require a more detailed analysis of different troop types (cavalry, elephants, chariots, warriors...), or more complex calculations involving multiple unit attacks and retreat/evade blocking, or the effects of terrain, for example, and that would deserve an article on their own. But some overall advices may follow from the examples above.

The first one is patience. Do not be afraid of spending some turns re-organizing your line (many historical setups were not optimal at all!), or waiting for cards that will let you launch a better supported attack. In the first section, we have seen some probabilities for drawing cards. It was a 4-unit group in one section, but the relative numbers may let you grasp the order of magnitude for your particular group of units. On the other hand, being aggressive right from the start might be a good way to refuse this re-organization to your opponent.

Keep cohesion when possible. In this first section, we have seen that cohesion is the strongest effect on the ordering probability for several units. Sometimes you can order one or two units out of your line for an attack. Do not forget that they will be harder to order in the coming turns. And of course that they may end exposed to a multiple attack from several enemy units.

Do not waste your Leaders. Try to place them from the start there where they will have the strongest effect on the battle. On the defense, they can protect your flank by ignoring a flag, or make a cavalry unit much less fragile. On the attack, they do not add much against very weak units, but their effect is very big against strong ones. In any event, do not forget that one of their advantages is the possibility of continuing the attack if the enemy is pushed out of its hex, so try not using them against blocked units!

Learn when to wait. In the third section we have seen the potential use of battle back, eventually coupled with an attack on your next turn. If you have the choice to strike or let the enemy do it first, check the defensive strength of your line. Will it stand the first contact? Is it strong enough and well supported? Something people forget quite often is that fragile units, that see their fragility compensated by the possibility to evade, cannot evade the battle back. So letting these units attack you first is a good way to destroy them. In fact, cavalry charges against well supported, strong infantry units is one of the most common first mistakes in CCA!

Do not underestimate the lights. In the fourth section we have seen how a light unit can win a duel against a

heavy one. These are the units, however, with the least obvious use. You can use them to weaken the enemy line before contact with fire (we have seen in section 2 that one block less may change the killing probability a lot), hold the enemy advance with evade, block retreat/evade paths, fill gaps or reinforce one section thanks to their mobility (*Move-Fire-Move* may let you move light infantry/cavalry up to 4/8 hexes)... So, if you find them too weak/useless, just know that they are not. Play the game more and you will find out yourself!

Handle retreats. The enemy will try to block your retreat/evade paths, so do not help him blocking them yourself! Specially light units and cavalry should have open paths, and long enough. So bringing the battle close to your enemy's baseline will at the same time put his lights/cavalry in danger and make yours safer. This aspect, however, has not been treated in the present article, which only pretended to give an overall first approach to the game.

And finally, play the game a lot! Specially if you find it at first too luck-driven or simplistic, and you think that many factors explicitly present in more complex wargames are missing. The game incorporates many aspects, like morale, cohesion, flanking, armor... inside its apparently simple mechanics. Give it some more tries as it is, before trying to change/fix it. Of course you may lose some games against newbies because of the dice/cards, but over a series of games you will see how the most experienced players win more often. Not always, but we do not want that, do we?

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## Want to do it yourself?

*We have seen some examples and calculated their probabilities, but eventually you may be interested in another situation and may want to calculate it yourself. If you do not know combinatorial probability, this is the way some of the cases can be calculated.*

*Note, however, that pen and paper are not recommended for most of the calculations described, they have been done running a small code on a computer...*

### Drawing cards

*In the Himera example, how do we know that the probability of Eumachus entering the camp in the first turn is 98%? We need the formula:*

$$C_{n,k} = \frac{n!}{k!(n-k)!}$$

*to calculate the number of combinations of  $k$  cards taken from a set of  $n$ . We only need to know how many cards*

allow for a direct activation of Eumachus, 31. The probability of having  $x$  of those cards in the starting hand of 5 (and thus  $5 - x$  of the other 29 cards in the deck) is:

$$P_x = \frac{C_{31,x} C_{29,(5-x)}}{C_{60,5}}$$

Summing up  $P_1 + P_2 + \dots + P_5 = 98\%$ . Or even easier, the probability of not drawing none of those cards,  $1 - P_0 = 98\%$ .

## Throwing dice

A HI without Leader benefit has a hit probability of  $2/6$ . What is the probability of scoring exactly 2 hits?

$$P = \left(\frac{2}{6}\right)^2 \left(\frac{4}{6}\right)^3 C_{5,2} = 33\%$$

i.e., the probability of 2 dice hitting, times the probability of 3 dice not hitting, times all the combinations of the 2 dice hitting among the 5 dice thrown.

If you want to calculate the probability of several dice outcomes, it is slightly more complex. For example, the probability of scoring exactly 2 hits and 1 flag:

$$P = \left(\frac{2}{6}\right)^2 \left(\frac{1}{6}\right)^1 \left(\frac{3}{6}\right)^2 \frac{5!}{2!1!2!} = 14\%$$

i.e., the probability of 2 dice hitting, times the one of 1 flag, times the one of 2 other results (helmets and the other symbols), times the number of ways to roll 2-1-2 of three different outcomes with a set of 5 dice.

## Thousands of dice!

In cases where the analytical calculation of the probability leads to complex paths, or if you do not want to deal with combinatorial probability at all, you can ask a computer to throw the dice and repeat the attack sequence a huge number of times. This is known as a Monte Carlo calculation.

If you do it long enough, for example 100,000 times (this is why a computer is much better than throwing the dice yourself!), the results will be very close of the exact probabilities. The River Stour example, the sequence BB + attack + bonus CC, or the HI versus LI/LB duels, were calculated this way.