

Master Of Magic Combat Mechanics

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1 Introduction

First of all, I'll start by saying that MoM already has 90% of what players want from it. One top thing, is, that, unlike many modern 4X titles like *Planetfall* or *Fallen Enchantress*, it doesn't 'sink' in boring and overwhelmingly time-wasting micromanagement with countless unit attributes, abilities, buffs, perks, nerfs, upgrades and such, 90% of which are very minor, with barely noticeable effects. MoM has the right number of all the above, at the same time furnishing endless possibilities for interesting and meaningful strategic and tactical decisions. What I want to explain here, is that they can be put to an even better use, to make combat more thrilling and varied.

2 Key ideas

1. Starting position: player should be able to choose starting hexes for the army units. This is important for early-combat decisions
2. The limit of 9 units must absolutely be relaxed. Especially when encountering tough high-level creatures like Great Drakes in large numbers, it is practically impossible to win, without losing a large portion of the army, which took many turns to train and upgrade.
3. Starting positions should be determined by the direction of attack on the overland map, as in *Plantefall*. In the original game, the attacker is always at the bottom, the defender on top, limiting strategic and tactical opportunities.
4. More than one army should be able to enter the combat, like in *Planetfall*.
5. Naval units should be able to enter battles fought on the seaside.
6. Battle maps should be larger, spanning a couple of screens at least. Fighting between large armies should be at least 13-17 turns long.

7. Units should have separate movement and action stages, like in *Warhammer 40K: Battlesector*, that could be swapped. That is, the unit can use action and then move, or vice versa. Here's a simple example: skirmish cavalry like the Centaurs first move quickly, then attack the enemy at range. Next turn, they perform a ranged attack first and then retreat.
8. Additionally, like in *Warhammer 40K: Battlesector*, it would be great if units could expend both action points on the movement and vice versa. That is, either use action twice, or move twice as far, see the next point
9. I think units with a movement of 1 are rather underpowered towards mid-game, due to the strength of ranged units and spells, even very strong ones like Golem. They simply get annihilated on the way to the enemy ranks. For the solution see above for the enhanced movement points: they should be able to double the speed by expending their attack points.
10. Again, like in *Warhammer 40K: Battlesector*, Player should be able to choose an exact path for units to move instead of following the one found by the computer. This is to avoid walking into an unwanted terrain, for example, or triggering an unwanted event, like in *XCOM*, when opening doors/breaking windows and such.
11. Units with both ranged and melee attacks, especially advanced ones like Nightmares, should be able to choose between the two. It's a lot easier to scale and buff melee attacks, than ranged magical ones. Elite Nightmares have a melee of at least 10 and ranged magical of just 7. Given a rather fast pace of combat in MoM compared, for example, to *XCOM*, Nightmares will need to resort to melee well before they expend ranged attacks.
12. I think it might be interesting to introduce a type of 'captain' figure in normal multifigure units. What I mean by that, one of the figures (e.g. the first one) would be 'special', for example, have +1 to attack/defence/hp, or give the whole unit a small bonus like +1 to hit. This would make healing spells more important, and in general, upscale multifigure units in the hierarchy.
13. It might be a good idea to extend magical random events from overland map to battlefields, such as mana short (no casting) or conjunction (mana discount for spells of that school)
14. Perhaps some magical weather effects?

3 MoM vs other 4X games

MoM has a very strong advantage vs these games, as it doesn't 'sink' in boring, frustrating, and often meaningless micromanagement at unit, hero or tech level. For example, like in *Plantefall*, I don't need 17 types of attack, 25 unit abs, 35 nerfs, and 100 buffs, each improving or reducing an ab by 5%, because it's

impossible and boring to keep track of them. Instead, I want 5 or 6 important abs, and a few meaningful buffs, all presented and explained in a logical and readable interface like in MoM.

In case of *Plantefall*, 50% of buffs, abs are either completely useless, or have very little use, hence it's hard and tedious to evaluate the unit's real strengths and weaknesses, and make decisions. Hence, the player simply forgets about 90% of them, and just looks at some basic ones, as you can't spend 5 minutes every turn evaluating each unit's strengths/weaknesses, abs, etc. Or, he simply looks at the expected hit chance and damage. Verdict: a lot of efforts for game development were wasted.

Speaking of the unit UI in *Planetfall*, it is one of the most frustrating attributes in the game, as it has 5(!) sections:

1. weapons and actions with up to 7 types of damage
2. buffs/nerfs vs 7 types of damage
3. several abilities
4. origin (or class) of the unit
5. up to 3 mods

All that in addition to hps, 2 types of defence, exp and morale. Each weapon, action or ability also has its own attributes, and quite a few often. All this is packed into a small scrollable textbox with icons. Clearly it's impossible to memorize all this information, so every time you need to move a mouse pointer over the icon.

In other words, as is often the case, bigger \neq better, and MoM does it best: units have at most 5 main attributes (melee, ranged, defence, hps, resistance), 3 base abs (movement points, movement type, attack/defence success chance) at most a couple of unit-specific abs of buffs (cast spell, +N to attack, special attack, etc), and at most a couple of enchantments or curses. There are a total of 34 unit enchantments across all schools of magic, and 10 unit curses, and 54 special unit abs. The order of melee stack resolution (thrown \rightarrow breath \rightarrow first strike \rightarrow melee) is always the same, as well as attack/counterattack protocol.

The reason I'm writing out all these low-level details is to make a point that my AI and combat mechanics suggestions for MoM should be feasible, thanks to a limited set of input variables, and, in Section 4, I introduce two ideas that merely employ the existing combat or unit mechanics.

4 Unit maneuvering

This is an in-depth discussion of the unit maneuvering ideas introduced first in the AI file.

4.1 Splitting and merging units

This is a fairly obvious trick that already has a multitude of implications, without affecting any MoM combat rules. This does exactly what it says: multifigure units can be split into separate units, or merged into one, as long as the total figure count is less or equal to the max figure count of the unit. For example, you can split Phantom warriors (6 figures) into 3 units 2 each ($3 \times 2 = 6$), but you can't merge 3 detachments, two with 2 figures, and one with 3 ($2 \times 2 + 1 \times 3 = 7 > 6$). Any player familiar with MoM melee stack rules immediately spots how this can greatly affect tactical combat. Here's a couple of them:

1. A 6-figure unit with low defence/hp count, is facing a powerful single-figure unit, that almost certainly will annihilate the whole defending unit. Once it splits into 3 2-figure ones, occupying nearby tiles, the chances of survival increase tremendously. Since melee resolution stack stays the same, the attacker in a single attack can only eliminate one of them, while the others have the chance to retreat.
2. Same as above, except that the original 6-figure unit has high enough attack to destroy the attacking unit in their counterattack. In normal situation they just annihilate each other, but, since the multifigure unit is strong enough, some of the damage it deals is simply wasted. Instead, after splitting the unit into 3 smaller ones, the first unit deals damage and dies in the first counterattack (the attacker stays alive). Then, the second one is under attack, but also deals sufficient damage in return, so that either the attacker is annihilated, or, they both kill each other. This leaves us with one more 2-figure unit. Hence, the defender repeals the attack and keeps some figures alive.

See Figure 1a for the illustration of unit splitting:

1. A 6-figure Dark Elf Swordsmen (S) unit occupies 1 tile.
2. S is split into 3 separate units with 2 figures each (S_1, S_2, S_3), positioned in a column
3. S is split into 3 separate units with 2 figures each (S_1, S_2, S_3), positioned in a row
4. S is split into 2 separate units with 3 figures each (S_1, S_2) positioned in a row

In Section 5 I present a rigorous proof that splitting a unit into several smaller ones can have a serious effect on the combat mechanics and unit survival chances.

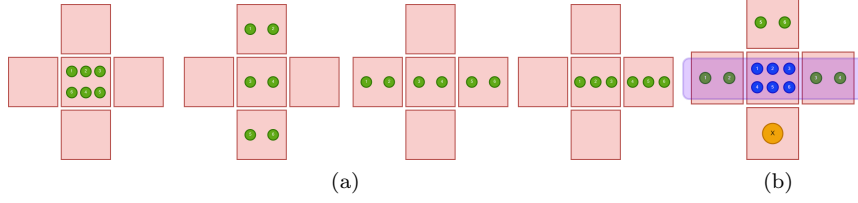


Figure 1: Illustration of unit splittings and formation. Figure 1a: splitting a 6-figure swordsmen unit in 4 different ways. Red squares: tiles. Green circles: figures. Far left: current implementation. Mid-left: split into 3 different units (detachments) 2 figures each, positioned in a column, mid-right: split into 3 2-figure units positioned in a row. Far right: split into 2 3-figure units positioned in a line. Figure 1b: union of two two-figure Swordsmen units from Figure 1a and a 6-figure Halberdier unit (blue circles) into a formation, facing an arbitrary enemy (X).

4.2 Unit formation

This idea is somewhat related to the one in Section 4.1 above, but this time around, we combine in one formation several different units, of different types, regardless of the number of figures in each unit. This will have a tremendous effect on melee combat too. This is not a rigid formation like in *Empire: Total War*. Units can move independently, as long as (for example) they stay within 1 tile of all other units in the formation. A unit can always be released from the formation, or the formation can be disbanded.

Units in the formation attack, defend and counterattack together, in the order defined by the player or the AI, which is the main idea. Total attack, defence, and damage are computed for the formation, rather than the separate unit, which has a minimal effect on the melee resolution stack (again, up to the order in Disclaimer in Section 4 in the AI file + First Strike). What makes a tremendous difference, is the application of the final net damage (hitpoints) to the units in the formation. It is done in the predefined order, greatly affecting the units' chances of survival.

In Figure 1b, two 2-figure Swordsmen (S) and 1 6-figure Elven Halberdier (H) unit are combined into a formation. S have a defence of 2, and H has a defence of 3. Obviously, H have a higher chance of surviving the counterattack. Note that the melee stack itself remains the same. If we choose the order of F as H, S_1 , S_3 (note both S_j are identical in every way), the total raw damage, total raw counterattack damage, raw defences and net damage are the same. For example, in this case the raw defence of F is $0.3 \cdot 3 \cdot 6 + 2 \cdot 0.3 \cdot 2 \cdot 6 = 2 \cdot 0.3 \cdot 2 \cdot 6 + 0.3 \cdot 3 \cdot 6$, the order doesn't matter.

The difference here is the application of the net damage. Again, it always applies to the top figure, but in which unit? If we put the units in this order: S_1, S_3, H , it will first apply to S_1 , then to S_3 , and then to H . This makes a tremendous difference, because AI and Player have to consider a variety of factors to define the order. For example, the total net damage to the formation is $\lfloor 8.5 \rfloor = 8$. This kills S_1 , and S_2 , and 4 figures in H , efficiently halving its strength. Now, instead, we flip the order to H, S_1, S_2 . Net damage is the same, it kills the whole Halberdier unit, and S_1 , leaving S_2 intact, which is very different to the previous case.

I recon I explained the idea of a formation and its implications rather clearly. From the coding and implementation point of view, it should not add much overheads, because the units' attributes, etc, as well as melee resolution stack stay pretty much the same. Only very superficial additional calculation are added.

5 Mathematics for unit splitting

Here's the rigorous derivation for the case of multi-figure unit attacking a single-figure one, and both exterminate each other.

Total number of figures in the unit is n . Effective raw damage of each figure is a_k , effective damage blocked by the defender is d , and total hp of the defender is h . Figures deal damage in the MoM order, i.e., starts with top figure, and keeps going down. First, we define the following variable:

$$S_n = \sum_{k=1}^n a_k$$

$$r = S_n - d - h$$

Wlog $a_k > 0 \forall k$. Keep in mind in general $a_k \neq a_m$ for any k, m . In case $r = 0$, all figures have to contribute to the raw damage, in order to eliminate the defending unit, and for $r < 0$, the defender stands. For $r = 0$, the attacked dealt the exact amount of damage. But what about $r > 0$? Some damage dealt by the attacker is obviously wasted, but how does this justify splitting away some figures? Again, a_k are not in any particular order, which complicates things a little bit. For example, if $d + h = 4$, and raw damage (3 figures) is 1,2,7, then we need all 3 figures to kill the unit, but $r = 7 - 1 = 6$ damage is wasted. If, instead, damage is ranked in decreasing order, i.e., 7,2,1, only 1 unit is necessary. In this case, $r = 7 - 4 + 2 + 1 = 6$ damage is wasted, and two separate figures.

I consider only the former (no ranking). The case $1 \leq r < a_n$ is identical to $r = 0$ in terms of figure number, but in this case $a_n - r$ damage is wasted. But, if the second inequality is weak, i.e. $1 \leq r \leq a_n$, we can notice, the the

whole damage of a_n is wasted. Had we split away this figure, it would have reduced $r = 0$, and a whole figure would have stayed alive after the counterattack.

Therefore, to generalize, we introduce index j , s.t. $j \leq n$

$$S_j = \sum_{r=1}^{j-1} a_r \quad (1)$$

$$\delta_j = S_n - S_j = a_j + a_{j+1} + \dots a_n \quad (2)$$

$$= a_n + a_{n-1} + \dots a_j \quad (3)$$

$$(4)$$

The last equation immediately implies $a_j = \delta_j - \delta_{j+1}$. Clearly, the following equality holds, with $0 \leq \Delta < a_j$

$$r = \delta_{j+1} + \Delta \quad (5)$$

Clearly, it means that each and every damage point of figures contributing to δ_{j+1} is wasted, meaning all figures with indices greater or equal to $j + 1$ are not necessary for the destruction of the defender. Yet, all of them will also be eliminated at the counterattack stage.

This was a rigorous proof that splitting an attacking unit into smaller detachments can save some figures in the unit, while achieving the task of eliminating the defender.

6 Conclusions

OK, so I wrote up a few ideas that I recon MoM tactical combat can benefit from. I thoroughly recognize, that all of them cannot be implemented, at least not in the main release. But, I hope of course, that they will perhaps inspire the devs to create something along these lines, perhaps in a DLC or as a choice. I tried keeping them realistic, that is, use the current unit and game settings the way they are, as much as possible, to avoid annoying micromanagement.