Precursor Investigation Into the Choice Between ATT% and BossDamage%

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Abstract

It is conventional wisdom in MapleStory that potential lines ATT% are superior to all alternatives and the ideal WSE combination is 9-0-0 i.e. 9 ATT% lines, 0 Boss% lines and 0 damage% lines across the three pieces of equipment (Main weapon, sub weapon, and Emblem). This wisdom, however, does not appear to be mathematically correct on some levels; this write-up attempts to examine further and yield an intuitive understanding of the interplay between BossDamage% and ATT%.

1 Introduction

1.1 Damage Formula

Source: StrategyWiki

$$\text{Damage on Boss} = K \times \left(1 + \frac{\text{ATT\%}}{100}\right) \times \left(1 + \frac{\text{Boss\%}}{100}\right) \tag{1}$$

where K is the rest of the formula including Stats, Final Damage%, Damage%, etc.

ATT% is the total amount of +ATT%,

Boss% is the total amount of +BossDamage%

1.2 Setup

The setup takes into account a typical Reboot player who has some negligible amount of ATT% from *Hero's Echo*, *Familiar Badge* effect, and *Weapon Soul* effect. Let's call this quantity [**base ATT**] or A_b symbolically. In most cases, this quantity is small enough to be considered negligible.

Similarly, there is an existing amount of BossDamage% that cannot be exchanged for ATT% (e.g. from Gollux set effect, from Weapon's innate stats, etc.) Let's call this quantity [**base Boss**] or B_b symbolically.

2 The Algebra

Expanding equation (1), we have:

$$
\begin{aligned}
\text{Damage on Boss} = D &= K \times \left(1 + \frac{A_b + A}{100}\right) \times \left(1 + \frac{B_b + B}{100}\right) \\
&= \frac{K}{10000} \times (100 + A_b + A) \times (100 + B_b + B)
\end{aligned}
$$

Taking a closer look at the quantity of added ATT%:

$$
\begin{aligned}
\frac{\partial}{\partial A} D &= \frac{K}{10000} \times \frac{\partial}{\partial A} (100 + B_b + B)A \\
&= L \times (100 + B_b + B)
\end{aligned}
$$

Similarly for the quantity of added BossDamage%:

$$
\begin{aligned}
\frac{\partial}{\partial B} D &= \frac{K}{10000} \times \frac{\partial}{\partial B} (100 + A_b + A)B \\
&= L \times (100 + A_b + A)
\end{aligned}
$$

Intuitively, this result makes sense. For every point of ATT%, the damage goes up by a quantity that is dependent on the existing total amount of BossDamage% and vice versa, indicative of the multiplicative interplay between these two values.

3 Opportunity Cost

However, the choice that the player has to make is not between one point of ATT% and one point of BossDamage%. Specifically, each unit of "opportunity cost" is one potential line out of six: three on Main Weapon, and three on Sub Weapon (the Emblem cannot have BossDamage%). Each of these potential lines can take on a value of:

1. 12% ATT
2. 9% ATT
3. 40% Boss Damage
4. 30% Boss Damage

Or, roughly speaking, for every 1 point of ATT% acquired, 3 points of Boss% was lost; in other words: each point of ATT% has a cost value of 3 and each point of Boss% has a cost valu of 1. Let's name this quantity C for [**cost**]. We thus obtain the modified versions of the derivatives as:

$$
\frac{\partial}{\partial A} D = L \times (100 + B_b + B) = 3C \tag{2}
$$

and

$$
\frac{\partial}{\partial B} D = L \times (100 + A_b + A) = 1C \tag{3}
$$

Thus it appears that, all else being equal, the player should always choose **Boss Damage%** over **ATT%**.

4 The Breakpoint

Yet not all else is equal. The base amount of **ATT%** A_b, for instance, is very small (around 10% for most players) while the base amount of **Boss Damage%** B_b is easily much higher (well over 100% for most players). At which point, then is it worth considering choosing ATT% over Boss Damage%?

We simply set the derivatives equal to each other.

$$\frac{\partial}{\partial A}D = \frac{\partial}{\partial B}D$$
$$L \times (100 + B_b + B) = 3L \times (100 + A_b + A)$$
$$100 + B_b + B = 300 + 3A_b + 3A$$

or

$$B + B_b = 200 + 3(A + A_b) \tag{4}$$

4.1 Special Case 1

For simplicity's sake, assume $A_b = 0$ and that the player should go all in on one option between **ATT%** and **Boss%**, since one of them is objectively superior in each given circumstance. In this case, if the player chooses not to invest any potential lines into **ATT%**:

$$B + B_b = 200 \tag{5}$$

then they are free to invest into **Boss%** until the total amount reaches 200, at which point the derivatives equalize and **ATT%** is now more valuable **per point**. This value serves as the starting goal for players before further considerations are warranted.

4.2 Other Considerations

For each individual circumstances, the player should input their stats into equation (4) to find their own combination of **ATT%** and **Boss%**.