Balancing the Damage Threshold (DT) Paradox in Pillars of Eternity (POE)

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This short document is meant to show how increasing DT in Pillars of Eternity increases critical hit damage. A proposal to fix this will then be presented. Most of the understanding of the mechanics of POE here are gained from lurking the forums of a game in beta. IE they're not guaranteed to be correct.

1 Attack Resolution

Pillars of Eternity(POE) uses a novel method to simulate combat. Attacks are resolved by first a percentile role to determine whether or not a hit occured. The roll is compared against a sliding set of probability intervals. The four possible outcomes are: miss, graze, hit, critical hit. The accuracy (ACC) of the attacker, opposed by the deflection (DEF) of the opponent, determines the percentile range of each outcome. When accuracy is equal to deflection, the percentile roles are 0-5:miss, 5-50:graze, 50-95:hit, 95-100:critical hit. These base percentiles are modified by subtracting the difference of ACC - DEF, keeping everything capped in the [0,100] interval. For example, accuracy exceeding dexterity by 35 yields the following ranges: 0-0:miss, 0-15:graze,15-60 hit, 60-100 critical hit. For simplicity, we will consider grazes as a miss.

On a hit, damage (DMG) is calculated by taking a weapons based damage roll (BASE), multiplying it by a standard damage multiplier (MGHT) based on, among other things, the might stat. A critical hit adds another multiplier to the damage (CRIT).

Damage Calculation On Hit

$$DMGHIT = BASE \times MGHT$$

Damage Calculation On Critical Hit

$$DMGCRIT = BASE \times MGHT \times CRIT$$

It should be noted, that in comparison to critical hits in other role playing systems, critical hits in POE are intended to be relatively frequent, and increas-

ing accuracy to obtain them is an essential part of maximizing damage. One could ask whether it is more advantageous to maximize damage by increasing MGHT and therefore, multipliers on hits and critical hits, or to maximize the frequency of critical hits. The answer is that if one looks at a single point of optimization, they both give a linear increase in damage. The one we should optimize becomes a question of which gives more gain per cost which we could calculate if given those values[1] . There is,however, some non-linear inflection points as one increases accuracy. Increasing accuracy from low to high, we proceed first to introduce the probability of critical hits, then eliminate the probability of misses and then eliminate the probability of grazes. Increasing Accuracy past these inflection points gives increased value to either MGHT or critical hit chance. These inflection points raise the value of maxing ACC over MGHT.

2 Damage Reduction Paradox

Armor in POE comes into damage calculation as a reduction of damage (DT) after initial damage calculations.

Damage Calculation On Hit

$$DMG = BASE \times MGHT - DT$$

Damage Calculation On Critical Hit

$$DMG = BASE \times MGHT \times CRIT - DT$$

What affect does raising DT values relative to BASE damage have? If we increase DT, then we must increase MGHT to overcome it on a standard hit. We've now increased the relative difference in damage between a standard hit and a critical one (as long as CRIT ¿1) . Also, we've now increased the value of getting past inflection points to maximize hit damage. We can thus state our paradox; In POE, increasing DT (and keeping standard hits relevant) increases damage done by critical hits overall and increases the value of optimizing ACC over MGHT. To reverse this, we could instead decrease DT, but that limits the meaning of armor to the game, which is undesirable.

3 Proposed Solution

To remedy the fact that increasing DT causes higher CRIT damage, it's proposed that the damage calculation be modified accordingly

[1] If we considered only two possibilities, hit and critical hit, and equal cost for increasing might modifier as accuracy, as long as $MGHT * (CRIT - 1) > 1$, increasing critical hit frequency gives higher payoff per increase

Damage Calculation On Hit

$$DMG = BASE \times MGHT - DT$$

Damage Calculation On Critical Hit

$$DMG = (BASE \times MGHT - DT) \times CRIT$$

These new calculations give a couple of interesting changes to the relationship between MGHT and CRIT. The qualifier on which modifier is more important is dependent on two separate problems, increasing damage to bypass DT, and maximizing critical hits frequency to get the extra modifier. These two regimes allow high MGHT strategy to operate effectively against high DT, while maximizing CRIT according to the old rules is still valid when DT is low or zero.

Balancing the game becomes easier, since might need only be balanced against overcoming DT instead of both CRIT and MGHT. CRT can then be balanced off of the expected damage from a standard hit. This will make it easier to get a bound on crit ranges.

It has already been mentioned on the POE forums that light weapons will get a min damage pierce against high DT, This gives a thematically appropriate primary optimization strategy for light weapons against DT to increase the CRIT modifier and critical hit frequency by increasing accuracy.