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Kokotewa's Guide to Everquest II Mechanics

Public version 1.0

Kokotewa – Chapters 1-5, 6, 7
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An in depth approach to explaining the combat mechanics of Everquest II. Concepts are introduced in order of complexity and relevance to a high end player. The guide introduces concepts with vocabulary, game mechanics, examples, and practice problems. Kokotewa, nor any friends of Kokotewa, own either fully or in part Everquest II. Kokotewa has received no aid from SOE in the creation of this document.

Foreword

This is an instruction of how to fish, rather than a basket of free fish. Players who are expecting the answers to be simple are looking at the wrong guide. The correct answer is dynamic and constantly changing. That is, there is a best answer – but it will have changed before I could tell you.

I strongly advise players to work through the example problems, rather than skip to the solutions. Understanding and ability are not identical – the ability to follow my work and the ability to solve the problem yourself is very different.

How to use this guide

If you are a competitive player looking to become the best player you can, and are willing to put forth the effort required doing so, this is the guide for you. If high end play is the extent of your aspirations, the first few chapters is sufficient.

The use and understanding of Microsoft Excel is highly encouraged. The solver function as well as the ability to quickly and accurately calculate multiple variables simultaneously is necessary in the later chapters.

Characters

The characters in this guide are fiction. Any resemblance to actual players is purely coincidental. Concordantly, all parse and guild relations are fictional. When possible, effort has been made to keep values and decisions realistic. Stat and parse values were chosen for educational purpose only. The decisions made by Sparky and company are not intended to set examples for their peers. The solutions encountered intend to teach a problem solving process instead of the solution itself.

Intro

Starting with the obvious; stats increase damage.

Damage + Stats = More Damage

Keeping with the obvious; not all stats are equal.

$$1\ Potency \neq 1\ Critical\ Bonus$$

Depending on the class and role, some stats are more useful than others. This guide will briefly discuss the effectiveness of stats, primarily focusing on stat placement. While stats can be evaluated with a focus on utility; it quickly becomes difficult for utility, as a role, is required to fill niches more so than damage dealing classes.

Version History

1.0 Released to public

Current works: Ability Mod, Hit Modifiers

Table of Contents

Chapter 1 – Basic Mechanics

Critical Bonus, Potency, and Damage Modifiers

Many traits impact the effectiveness of a character. Carried by traditional Role Playing Game (RPG) dialect, these traits are became known as ***status points*** – or ***stats*** for short. Everquest II is unique in that some of the most powerful stats are easy to work with in simple equations. While far from exhaustive, it is my belief that the understanding of this chapter is of the upmost importance.

Vocabulary

Skill – *Skill*

A *spell* or *combat art*

Base Value – *BV*

The initial value of a *skill* or *auto attack* hit before any modifications

Critical Hit – *Crit*

The base value of a *critical hit* is multiplied by the *innate critical modifier* plus the *critical bonus* value, or Base Value * (Innate Crit Mod + CB)

Innate Critical Modifier – *iCrit*

Base multiplier for a *critical hit*

Crit Bonus – *CB*

Additive to *innate critical modifier*

Potency – *Pot*

Additive multiplier for skill *base values*

All skills initially hit for 100% damage, or have a *potency* multiplier of 1. Because *potency* is an additive multiplier, the equation is Base Value * (1 + potency). However it is often referenced as Base Value * potency, for simplicity

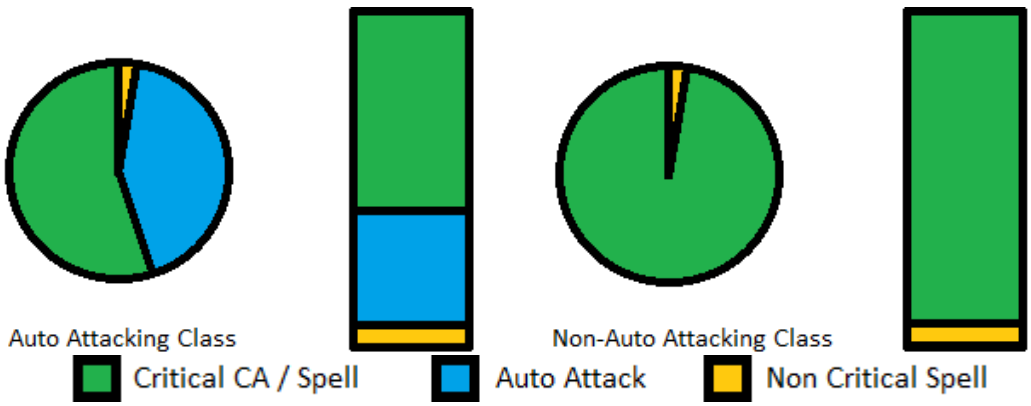
Damage Modifier – *Dmg Mod*

The final multiplier of the *base value*

Example; Skill Damage Modifier = Base Value * Pot * (Innate Crit Modifier + CB)

Types of Damage Classes

Although their placement is disputed, the classes of Everquest II fall into two categories – **skill based** and **auto attack (AA) based**. *Skill* based characters, as their name would imply, deal damage primarily from their skills. *AA* based characters, comparatively, are a mix of *auto attack* and *skill* based damage.



Damage type comparison for AA based (left) vs. skill based (right)

Parse Diagnosis

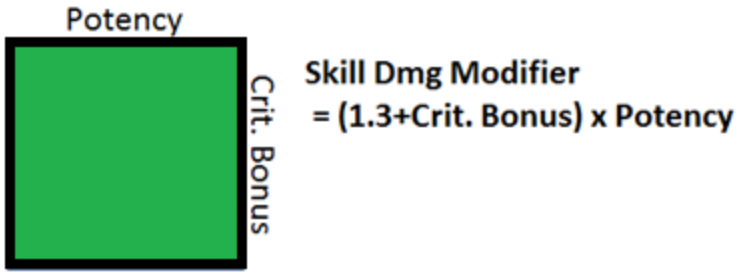
Every parse will not be identical. The randomness of Everquest II is massive; damage variance, hit rates, and proc chances, are few of many uncontrollable variables that will alter any parse. Additionally, controllable variables such as; group/raid composition, skill timing, mob placement, and human error add further complications.

The highest parse is not an ideal candidate for calculation, as conditions are difficult to replicate. On the other hand, the worst parse is not a good candidate either – as the results are unrealistic. Optimizing for 'best case' and 'worst case' scenarios are just that; they will only be optimal in the best or worst case.

Thus the importance of judgment of the player is paramount in deciding which parse values to use. "What am I optimizing for?" "Are these values what I typically expect?" and "Am I leaving anything unaccounted for?" are questions every player should ask themselves prior to making calculations.

Skill Based Classes

Skill based classes maximize dps by optimizing their *skill damage modifier*. This is accomplished by balancing *crit bonus* and *potency* modifiers, which are multiplicative in nature.

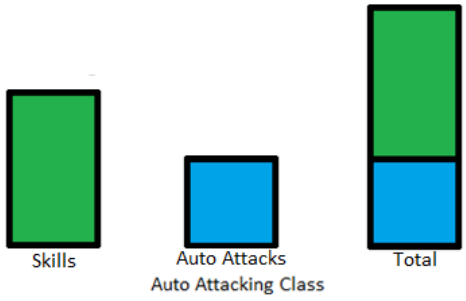


Skill Damage Modifier for an Enchanter 8/13/12

Because of the *initial critical damage modifier*, *potency* is often prioritized before *crit bonus* on skill based classes. Assuming *potency* and *crit bonus* are obtained at equal costs to the player, a skill based class can maximize dps with Potency = (Critical Bonus + Skill Innate Critical Modifier).

Auto Attacking Based Classes

Because of the split damage types, the dps of *AA* based classes is more difficult to optimize compared to skill based classes.



Damage type split of an Auto Attacking Class

Because *potency* only affects *skills* and not *auto attacks*, whereas *crit bonus* affects both skills and auto attacks, AA classes tend to favor *crit bonus* over *potency*.

Whereas *skill* based classes can easily maximize damage by a simple equation, this is not the case for *AA* based classes. In addition, *AA*s receive more multipliers compared to skills, due to their complexity, will be discussed further in later chapters. In determining the ideal ratio of *potency* and *crit bonus*, the damage split ratio between AAs/skills and their respective *innate critical modifiers* become paramount.

% Total Damage = 100% = %AA + %Skill
%AA = AA Base Value * (AA Innate Critical Modifier + CB)
%Skill = Skill Base Value * Pot * (Skill Innate Critical Modifier + CB)

Chapter 1 Problems

1A1. If a skill has a base damage of 1000, and the class has a 150% *skill innate critical modifier*, what is the expected damage of a critical skill?

1A2. If the skill in A1 gained +20 *critical bonus*, what is the expected damage of the critical skill?

1A3. If the skill in A2 gained +20 *potency*, what is the expected damage of the critical skill?

1A4. What is the skill damage modifier of player with 150% *iCrit*, 70 *Pot*, and 30 *CB*?

1A5. What is the expected damage of a 1,000 base damage AA with 130% *iCrit*, 200 *Pot*, and 40 *CB*?

1B1. What is the *base value* of a 10,000 damage skill with 130% *iCrit,* 200 *Pot*, and 150 *CB*?

1B2. A player has 130 *iCrit*, 150 *Pot*, and 100*CB*. What will increase their *skill damage modifier* more, 10 *CB* or 10 *Pot*?

Chapter 1 Solutions

1A1. Damage = Base Value * Skill Innate Critical Modifier
= 1,000 * 1.5 = 1,500 = 1.5k

1A2. Damage = Base Value * (Skill Innate Critical Modifier + Critical Bonus)
= 1,000 * (1.5 +.2) = 1,700 = 1.7k

1A3. Damage = Base Value * (Skill Innate Critical Modifier + Critical Bonus) * (1 + Potency)
= 1,000 * 1.7 * (1 + .2) = 2,040 = 2.04k

1A4. Skill Damage Modifier = (iCrit + CB) * (1 + Pot)
= (1.5 + 0.3) * (1 + 0.7) = 3.06

1A5. Damage = Base Value * (Innate Critical Modifier + Critical Bonus)
= 1,000 * (1.3 + .4) = 1,700 = 1.7k

1B1. Damage = Base Value * (iCrit + CB) * Pot
BV = Damage / [(iCrit + CB) * Pot]
= 10,000 / [(1.3 + 1.5) * (1 + 2)]
= 1190.476 = 1190 = 1.19k

1B2. Skill Damage Modifier = (iCrit + CB) * (1 + Pot)
= (1.3 + 1.1) * (1 + 1.5)
= 6.24, for + 10 CB
= (1.3 + 1) * (1 + 1.6)
= 6.21, for +10 Pot
+10 Critical bonus will increase their skill damage modifier more.

Chapter 2 – Adornments

Applications of Chapter 1

Adornments are augmentations to a character's equipment that offer permanent, or sometimes temporary, bonuses to their stats. While serving primarily to apply information from Chapter 1, adornments' effect on gameplay is significant enough to merit its own chapter.

Vocabulary

Adornment – *Adorn*
: An augmentation to a character's equipment

White Adornment – *N/A*
: Player crafted adornment that fills a 'white' slot on equipment

Yellow Adornment – *N/A*
: NPC purchased adornment that fills a 'yellow' slot on equipment, may also be referred to as heroic adornments

Red Adornment – *N/A*
: NPC purchased or Mob dropped adornment that fills a 'red' slot on equipment, may also be referred to as raid adornments

Adornments

There are many works dedicated to the acquisition and creation of adornments, this is outside the focus of this guide. Only the rules providing the requirements of adorning gear will be mentioned, as well as a brief discussion of their history.

Adornments can be placed in gear of equal or higher level than the level of the adornment. If an adornment is augmented into gear that is already adorned, it will replace an already augmented adornment. The replaced adornment will not be refunded.

Some red/yellow adornments are class restricted. In the event of a class restricted adornment, augmentation of the adornment into equipment registers the equipment only usable by the restricted classes. Likewise for equipment positions; if equipment that can be worn as an earring or necklace is adorned with a necklace only restriction – it will only be usable in the necklace slot.

Adornments were introduced as a method of combating inflation while adding a layer of character customization. The requirements for obtaining white and yellow/red adornments are a crafter and the required transmuting materials or various forms of in game currency respectively.

White Adornments

With the introduction of Sky Shrine equipment is frequently seen with two white adornment slots, although deviation from this number is not uncommon. Although the least powerful in terms of stats gained, white adornments are typically the most expensive because of their dependency on the item market.

Yellow Adornments

Yellow adornments tend to offer a wider variety of stat options, but their slot locations are more restricted than their white counter parts. Yellow adornments are known as 'heroic adornments,' obtained exclusively through NPC purchase with currency gained from instances aimed at groups of players of six or less.

Red Adornments

Red adornments offer the same stat options for armor when compared with yellow adornments, with additional options for other pieces of equipment. They also offer greater gains in terms of stats when compared with their yellow counter parts. Red adornments are known as 'raid adornments,' obtained exclusively through raid or NPC purchase with currency gained from instances aimed at groups of players of twelve or more.

Chapter 2 Problems

2A1. What happens if an adornment is placed into gear which is already adorned?

2A2. Which type of adornment offers the strongest stat gains?

2A3. Which type of purchasable adornment is typically the most expensive?

2C1. Sparky Fingerwiggler is an enchanter applying for a raiding guild, and he wishes to maximize his dps before tryouts. He is new to raiding, and thus severely lacking in gear, but he can compensate for his stat deficiency with proper stat placement.

If he expects to have 70 *critical bonus* and 70 *potency* in raid, what adornment choices should he make to maximize dps? Assume seven available red adornment slots, Sparky plays enchanter as a *skill* class, and only has access to +3*Pot* +3*CB* adornments.

2C2. Sparky did great in tryouts, and he is being considered along with another caster. Raid was cancelled this week because the MT was on vacation, so an alternative test was proposed – log the highest dps parse (boss) and present it before raid next week.

Sparky immediately thought of Forgotten Pools (+500% *potency* room) to win the contest, but to his dismay his competition was there as well – and they now had better gear than him! His competition has 80 *critical bonus*/*potency* from gear, and is mimicking Sparky's adornment choices from last raid (seven *potency* adornments). Can Sparky out perform his competition? If so, what gear choices should he make?

2C3. Sparky's competition is furious at losing the previous contest, and insists he cheated. The guild leader asked for the complete parse of both players, and discovered that their casting orders were identical. In addition, he found that Sparky had slightly higher damage on each spell cast despite having inferior gear.

This confirms his rival's suspicion, and asks Sparky to explain himself. In the middle of Sparky's explanation, he laughs and asks "At what value is *critical bonus* better than *potency*?" Why is this a trick question?

Chapter 2 Solutions

2A1. The old adornment is replaced and is not refunded.

2A2. Red adornments offer the largest stat increase/adornment.

2A3. White adornments are typically the most expensive.

2C1. Sparky should use seven +3% *potency* adornments.
(1.3+70/100)*(1+91/100) = 3.82, or a 382% Skill Damage Modifier.

2C2. Sparky's Competition has 80 *critical bonus* and 601 (80+21+500) *potency*;
(1.3+80/100)*(1+601/100) = 14.721 or a 1472.1% Skill Damage Modifier

Sparky can win the contest with proper adornment placement.
Using seven *critical bonus* adornments;
(1.3+91/100)*(1+570/100) = 14.807 or a 1480.7% Skill Damage Modifier

3C3. *Skill damage modifier* is a two dimensional function; dependent on both *critical bonus* and *potency*. Having explained the mechanics behind his parse, Sparky was admitted to the guild.

Chapter 3 – Auto Attacks

DPS, Haste, Multi Attack, and Flurry

Although the execution of *auto attacks* is simple, maximizing their effectiveness is difficult. *Auto attacks* are subject to the largest number of stat enhancers within the game, most of which have sharp diminishing returns. The most common *auto attack* stats will be discussed here, reserving *strike through*, *accuracy*, *AE auto attack, weapon damage bonus,* and *auto attack multiplier* for later chapters.

Vocabulary

DPS – *DPS*

Grants a % increase in AA damage, Base Value * (1 + % increase)

Haste – *Haste*

Grants a % increase in AA delay recovery, Base Delay / (1 + % increase)

Multi Attack – *MA*

Grants additional AA attempts, Base Value * (1 + # hits)

Flurry - *Flurry*

Grants a chance to *flurry*

Dual Wield – *DW*

The option of utilizing two one handed weapons in exchange for a +33% delay penalty

DPS		Haste	
100*	100%*	100*	100%*
200*	125%*	200*	125%*
300	135%	300	125%, +5% Flurry
500	145%	500	125%, +15% Flurry
700	155%	700	125%, +25% Flurry
900	165%	900	125%, +35% Flurry
Multi Attack		Flurry	
100	+1	0	0%
200	+2	25	25%
600	+6	50	50%
1000	+7	75	75%
1600	+8	100	100%
*denotes previous values cannot be determined by linear interpolation			

Estimated curves for DPS, Haste, Multi Attack, and Flurry 8/1/2012

DPS

In contrast to "damage per second," a common unit (damage dealt per second), *DPS* refers to an *auto attack* exclusive stat. Unlike other stats discussed previously, DPS is subject to diminishing returns – that is the effectiveness of the stat decreases with abundance. It is important not to trick oneself into believing that diminished returns are not valuable, but simply acknowledge they follow non linear curves.

Example: DPS

Base Value: 1000/second

DPS = 100, 1000/s * (1 + 1.00) = 2,000/s = 2.00k/s

DPS = 200, 1000/s * (1 + 1.25) = 2,250/s = 2.25k/s

DPS = 300, 1000/s * (1 + 1.35) = 2,350 /s = 2.35k/s

Haste

Haste, like *DPS*, is a stat subject to diminishing returns. However, unlike *DPS*, is also subject to stat conversion. At values greater than 200, excess *haste* is converted into *Flurry*.

Example: Haste

Single Wield; Base Value: 1000/second

Haste = 100, 1000/s * (1 + 1.00) = 2,000/s = 2.00k/s

Haste = 200, 1000/s * (1 + 1.25) = 2,250/s = 2.25k/s

Dual Wield; Base Value: 1000/second x2

Haste = 100, 2x [1000/s / 1.33 * (1 + 1.00) = 1,503/s] = 3.01k/s

Haste = 200, 2x [1000/s / 1.33 * (1 + 1.25) = 1,691/s] = 3.38k/s

Multi Attack

Multi attack, or *MA*, grants additional hits for each *auto attack*. If insufficient *MA* is held to guarantee an additional hit, a chance of an additional hit will be granted corresponding to the amount of surplus *MA*.

Example: Multi Attack

0 Multi Attack 1 attack

100 Multi Attack 1 attack, + 1 additional attack

150 Multi Attack 1 attack, + 1 additional attack, + 50% chance of + 1 additional attack

200 Multi Attack 1 attack, + 2 additional attacks

Flurry

In this guide: "*Flurry*" will refer to the stat whereas *flurry* will refer to a successful proc. A *flurry* provides one to four additional auto attacks; one being more probable than four. A *flurry* has a 100% chance of providing an additional attack, with a -25% chance for each successive attack.

% Chance	# of additional hits
100%	1
75%	2
50%	3
25%	4

Estimated Flurry mechanics

Chapter 3 Problems

3A1. If a character has a base dps of 2k/s with DPS = Haste = MA = Flurry = 0.
What is their dps with 200 DPS?

3A2. If a character has a base dps of 2k/s with DPS = Haste = MA = Flurry = 0.
What is their dps with 200 Haste?

3A2. If a character has a base dps of 2k/s with DPS = Haste = MA = Flurry = 0.
What is their dps with 200 Multi Attack?

3B1. What is the *AA damage modifier* of a character with 300 DPS, 200 Haste, 400 MA?

3B2. What is the *AA damage modifier* of a character with 200 DPS, 200 Haste, and 1000 MA?

3C1. Sparky is curious at the approximate 'worth' of a single point of *Flurry* compared to *multi attack*. He knows the curves are different, thus he plans on two separate calculations. What is one point of *Flurry* worth in terms of *MA* when *MA*<600? When 600<*MA*<1000?

3D1. Shadow, an assassin, asks Sparky which is superior for her; *critical bonus* or *Flurry* adornments. What additional information does Sparky need to answer her question?

3D2. Shadow reveals a 200k 48AA/52CA dps parse with 150 *critical bonus*, 100 *multi attack*, and 0 *Flurry*. Which shoulder adornment is superior for Shadow, 3% *critical bonus* or 3% *Flurry*? Assume her shoulders are currently unadorned.
[The iCrit Mod for assassins is 150% for AAs and 130% for CAs]

3D3. Shadow finishes Epic Repercussions and is granted +15 *Flurry* [Assassin's Flurry]. Is +3 *Flurry* still the superior adornment choice?

3D4. Sparky's guild has progressed, and many raid zones are now on 'farm status'. AoEs are timed and boss scripts are known for all encounters, thus Sparky is allowed to melee for extended duration in fights.

Sparky's gear has improved; he now has 80 *critical bonus* and *potency* during raid. How should Sparky adorn if he has an AA parse of 40k and a Skill parse of 60k? Assume Sparky has seven available red slot adornments and can choose between *critical bonus* and *potency*.
[The iCrit mod for enchanters is 130% for AAs and 130% for skills]

3D5. As Sparky's guild progresses, additional adornment choices become available for him. In this example, he has an available red and white adornment slot in his primary and ranged items.

Red
Sparky has the option of 4 *critical bonus*, *potency*, or a flat damage proc. The proc yields 2k dps, and cannot be modified. Red adornments of identical types **do not** stack. Sparky has two red adornment slots available.

White
Sparky has the option of +2 *critical bonus, potency,* or a flat damage proc. The proc yields 800 dps and cannot be modified. White adornments of identical types stack. Sparky has two white adornment slots available.

Assuming Sparky's play style does not change with procs, how should Sparky adorn?

Chapter 3 Solutions

3A1. 2k/s * (1 + 1.25) = 4.5k/s

3A2. 2k/s * (1 + 1.25) = 4.5k/s

3A3. 2k/s * (1 + 2.00) = 6.0k/s

3B1. AA Damage Modifier = (1 + 1.35) * (1 + 1.25) * (1 + 4.00) = 14.6875

3B2. AA Damage Modifier = (1 + 1.25) * (1 + 1.25) * (1 + 7.00) = 40.5

3C1. A flurry has a 100% of 1 additional attack, 75% of 2, 50% of 3, and 25% of 4 – assuming the previous stage was successful.

A calculation of the 'average' number of additional hits from a flurry would be;
100/100 + 100/100*75/100 + 100/100*75/100*50/100 + 100/100*75/100*50/100*25/100
100/100 * (75/100 + 75/100*50/100 +75/100*50/100*25/100)
100/100 *(75/100 * (1 + 50/100 * (1 + 25/100)))
= 2.21875 hits/flurry

Since 100 Flurry is a 100% chance to flurry;
(3.21875 hits/flurry)/(100 Flurry/flurry) = .0221875 hits/Flurry
When MA<600, 100 MA = +1 hits; 0.01 hits/MA
Therefore 1 Flurry ≈ 2.21875 MA when MA<600

When MA>600, 0.0025 hits/MA
Therefore 1 Flurry ≈ 8.875 MA

3D1. Shadow needs to know what her current *critical bonus*, *multi attack* and *Flurry* values, as well as her parse damage split between *auto attacks* and *combat arts*.

3D2. Finding parse base values;
Using the AA/CA parse split;

AA: 200,000 * (0.48)	= 96,000	= 96.0k
CA: 200,000 * (0.52)	= 104,000	=104.0k

Finding pre-critical values;

AA: 96,000 / (1.5 + 1.5)	= 32,000	= 32.0k
CA: 104,000 / (1.5 + 1.3)	= 37,143	= 37.1k

Finding base value for AA;

AA: 32,000 / (1 + 1)	= 10,666	= 10.6k

Modified with +3 *Flurry*
Finding post hit modifier AA [Flurry valued at 0.0221875 hits on average];

AA: 10,666 * (1 + 1.066563)	= 32,710	= 32.7k

Finding post-critical values;

AA: 32,710 * (1.5 + 1.5)	= 98,130	= 98.1k
CA: 37,143 * (1.3 + 1.5)	= 104,000	= 104.0k
Total		
104,000 + 98,130	= 202,130	= 202.1k

Modified with +3 *critical bonus*
Finding post hit modifier AA;

AA: 10,666 * (1 +1)	=32,000	=32.0k

Finding post-critical values;

AA: 32,000 * (1.5 + 1.53)	=96,960	= 97.0k
CA: 37,143 * (1.3 + 1.53)	= 105,114	= 105.1k
Total		
96,960 + 105,114	= 202,074	= 202.1k

+3 Flurry is slightly better for Shadow.

3D3. Using the same method as 3D2;
Shadow's parse with (15+3) *Flurry* and (150) *critical bonus*;
AA: 106,650, CA: 104,000, Total: 210,650

Shadow's parse with (15) *Flurry* and (150+3) *critical bonus*;
AA: 107,717, CA: 105,114, Total: 212,831

+3 *critical bonus* is now the superior adornment choice. In addition, [Rage of Ichor] will increase Shadow's CA/AA parse ratio – further increasing the comparative effectiveness of *critical bonus*. However, without additional information, it is impossible to determine the expected change.

3D4. Finding base parse;
Modified Skill = Skill Base * [1.3 + (CB/100)] * [1 + (Potency/100)]
Modified AA = AA Base * [1.3 + (CB/100)]

Substituting in;
60k = Skill Base * [1.3 + (80/100)] * [1 + (80/100)]
40k = AA Base * [1.3 + (80/100)]

Skill Base = 15,873
AA Base = 19,047

Finding modified values;
Modified Skill = Skill Base * (iCrit + [{CB + CB Adorns}/100]) * (1 + [{Pot + Pot Adorns}/100])
Modified AA = AA Base * (iCrit + [{CB + CB Adorns}/100])
Total = Modified Skill + Modified AA

Substituting in;
15,873 * (1.3 + [{80 + 21}]/100) * (1 + [{80+0}/100]) = 66,000 = 66k
19,047 * (1.3 + [{80 + 21}]/100) = 43,999 = 44k
Total = 66k + 44k = 110k (7x +3 *critical bonus*)

3D5. The easiest approach to this question is by addressing several smaller questions in steps;

a. What is the maximum output without proc effects?
   15,873 * [1.3 + ({84 + 25})/100] * [1 + ({84+0})/100] = 69,803 = 69.8k
   19,047 * [1.3 + ({84 + 25})/100] = 45,523 = 45.5k
   Total = 69.8k + 45.5k = 115.3k
   7x +3 CB (armor), 2x +2 CB [white] (Weapon/Ranged), +4 P/+4 CB [red] (Weapon/Ranged)

b. If losing *critical bonus*/*potency* for a damage proc is superior, where is it most likely to occur?
   The red adornments offer a 500dps/1CB compared to the 400dps/1CB rate of return of the white adornments. In addition, by inspection, the loss of *potency* is less impactful than the loss of *critical bonus* (an option for red adornments, but not for white). If the damage proc is superior, it will be most significant in red adornment substitution.

c. Is losing 4 *potency* for 2k dps superior?

   Losing 4 *potency*;
   15,873 * [1.3 + ({84 + 25})/100] * [1 + ({80+0})/100] = 68,285 = 68.3k
   19,047 * [1.3 + ({84 + 25})/100] = 45,523 = 45.5k
   Total = 68.2k + 45.5k + 2k = 115.8k

   115.8k > 115.3k, yes the damage proc is superior to the Potency choice. Since red adornment substitution is superior, we must check if the same holds true for white adornments.

d. Is losing 2 *critical bonus* for 800 dps superior?

   Losing 2 *critical bonus*;

   15,873 * [1.3 + ({84 + 23})/100] * [1 + ({80+0})/100] = 67,714 = 67.7k
   19,047 * [1.3 + ({84 + 23})/100] = 45,142 = 45.1k
   Total = 67.7k + 45.1k + 2.8k = 115.6k

   115.6k < 115.8k, white adornments should remain *critical bonus*.

We can now answer the initial question; Sparky should adorn with
7x +3 *critical bonus* (armor), 2x +2 *critical bonus* (weapon/ranged), 1x +4 *critical bonus* (weapon/ranged), 1x 2k damage proc (weapon/ranged)

Chapter 4 – Temporary Effects and Non-Linear Multipliers

Temporary beneficial skills, steroids, and buff procs

Temporary effects have the potential to have a large effect on parse values, but calculating this potential tends to be very difficult. In this chapter, temporary effects will be introduced saving in depth calculations for a later chapter.

Vocabulary

Temporary Beneficial Skills – *Temps*

A beneficial skill with finite duration, often includes *steroid* skills

Steroids – *N/A*

A self-targeted beneficial skill with finite duration, does not include *temps*

Buff proc – *N/A*

A beneficial effect without user controlled timing

Buff Proc Stacking

A common error in comparing temporary to static effects is the attempt to equate one to the other, rather than realizing they are different effects. While on average +10 *CB* ½ of the time is equal to an increase of 5 *CB*, temporary effects add variance.

Variance is cumulative. As multiple effects take part, the min and max values deviate where the average stays the same.

Example: Buff Stacking

One dimension;
Base Value = 1,000, iCrit = 1.3
1,000 * (1 + 0.05) * (1.3 + 0.00)
= 1,365 **+5 Pot**
(1,000 * [1 + 0.10] + 1,000 * [1 + 0.00])/2 * (1.3 + 0.00)
= 1,365 **+10 Pot/2time**

Two dimension;
(1,000 * [1 + 0.10] * [1.3 + 0.10] + 1,000 * [1 + 0.00] * [1.3 + 0.00])/2 proc together
= 1,420 **+10 *Pot*/*CB*/2 time**
(1,000 * [1 + 0.10] * [1.3 + 0.00] + 1,000 * [1 + 0.00] * [1.3 + 0.10] proc sequentially
= 1,415 **+10 *Pot*, *CB*/2 time**
Average = 1417.5
1,000 * (1 + 0.05) * (1.3 + 0.05)
= 1417.5 **+5 *Pot*, *CB*/time**

Multiplicative Effects

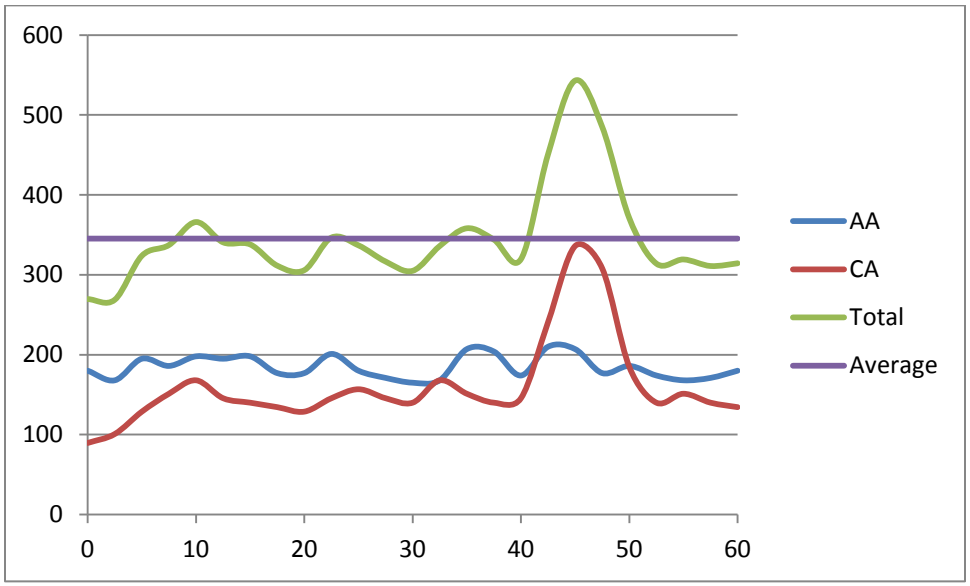
As seen in through the previous example, *potency* and *critical bonus* buffs are best used simultaneously due to their multiplicative nature. Other buffs tend to follow this same trend, often lending players to believe it is always best to "temp together". While this is often beneficial, great caution must be used when dealing with absolutes.

On Demand vs. Random Procs

All calculations performed so far assumed stats to be static; however this is far from the case. These calculations assume that the play style of players does not change with stat boosts. While this is often accurate for buff procs, it is inaccurate for *temps* in general.

DPS is not constant over time, skills do not hit for constant damage. Players opt to use their highest damaging skills while *temps* are active, as they receive the greatest benefit. While this is ideal, it is difficult to calculate.

Below is Shadow's 363k parse; 150 *CB*, 100 *Pot*. If Divine Recovery (+10 *potency* for 24 seconds) is cast during the peak of Shadow's parse, her dps is increased by 3.8k (345.3k to 349.1k) compared to 3.3k (random 24 out of 60 seconds).



Assassin's parse over the interval of 60 seconds

Chapter 4 Problems

4C1. Assuming the casting time and recovery of skills is negligible, do *temps* which offer flat bonuses to *critical bonus* and *potency* get better or worse when compared to flat damaging skills when the initial values of *critical bonus* and *potency* become larger?

4D1. Assuming Shadow's parse looped after 60 seconds, would it be better for the priest to cast Divine Recovery immediately when available or to hold the skill until the start of Shadow's chain (37.5 -> 60s).

Because Shadow has 100% ability recovery speed [Repeated Stabbing], and 100% casting speed through re-forge/adornments, the assumption that Divine Recovery provides only +10 *potency* is valid. Assume Divine Recovery has a 150s cool down. Below is Shadow's parse information.

Avg. DPS	CA DPS	AA DPS	Mod CA	Mod AA	Total	Time
345.3	16	60	89.6	180	269.6	0
345.3	18	56	100.8	168	268.8	2.5
345.3	23	65	128.8	195	323.8	5
345.3	27	62	151.2	186	337.2	7.5
345.3	30	66	168	198	366	10
345.3	26	65	145.6	195	340.6	12.5
345.3	25	66	140	198	338	15
345.3	24	59	134.4	177	311.4	17.5
345.3	23	59	128.8	177	305.8	20
345.3	26	67	145.6	201	346.6	22.5
345.3	28	60	156.8	180	336.8	25
345.3	26	57	145.6	171	316.6	27.5
345.3	25	55	140	165	305	30
345.3	30	56	168	168	336	32.5
345.3	27	69	151.2	207	358.2	35
345.3	25	68	140	204	344	37.5
345.3	26	58	145.6	174	319.6	40
345.3	43	70	240.8	210	450.8	42.5
345.3	60	69	336	207	543	45
345.3	55	59	308	177	485	47.5
345.3	33	62	184.8	186	370.8	50
345.3	25	58	140	174	314	52.5
345.3	27	56	151.2	168	319.2	55
345.3	25	57	140	171	311	57.5
345.3	24	60	134.4	180	314.4	60

Chapter 4 Solutions

4C1. As the initial values become higher, flat bonus become *worse* in comparison.
Assuming *potency* = 0, Divine Recovery would yield a +10% increase in skill damage
However if *potency* = 400, Divine Recovery would offer a (410/400) or a 2.5% increase
As the effects of the *temps* diminish, the effects of the damaging skills remains constant

4D1. This is the first problem that requires Excel. The key is to isolate a method to grant the *potency* bonus when Divine Recovery is active and deny the bonus at all other intervals. There are numerous solutions to this problem; one of the possible solutions is shown.

Skill Modifier = CA * (iCrit + CB/100) * (1 + [DR + Pot]/100)
DR is 0 or 10, depending on whether it is active or on cool down

Divine Recovery cool down is the most complicated part of the problem;
As it appears in an Excel spreadsheet
CD = IF (Time = 37.5, IF (prev CD = 0, 247.5, prev CD -2.5), IF(CD=0, 0, CD-2.5))
To help with visualization, an image is provided

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Avg. DPS	CA DPS	AA DPS	Mod CA	Mod AA	Total	Time	Timed DR	CD	150	CB		
2	345.3	16	60	89.6	180	269.6	0	0	0	100	Pot		
3	345.3	18	56	100.8	168	268.8	2.5	0	0				
4	345.3	23	65	128.8	195	323.8	5	0	=IF(G4=37.5,IF(I3=0,247.5,I3-2.5),IF(I3=0,0,I3-2.5))				
5	345.3	27	62	151.2	186	337.2	7.5	0	IF(logical_test, [value_if_true], [value_if_false])				
6	345.3	30	66	168	198	366	10	0	0				

Divine Recovery +10 *potency* can be based off of cool down, as long as CD>227
DR = IF (Cool Down > 225, 10, 0)
Because the parse data is only in intervals of 2.5 seconds, this is the closest approximation
Again an imagine is provided

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Avg. DPS	CA DPS	AA DPS	Mod CA	Mod AA	Total	Time	Timed DR	CD	150	CB		
2	345.3	16	60	89.6	180	269.6	0	0	0	100	Pot		
14	345.3	25	55	140	165	305	30	0	0				
15	345.3	30	56	168	168	336	32.5	0	0				
16	345.3	27	69	151.2	207	358.2	35	0	0				
17	345.3	25	68	140	204	344	37.5	=IF(I17>224, 10,0)					
18	345.3	26	58	145.6	174	319.6	40	IF(logical_test, [value_if_true], [value_if_false])					
19	345.3	43	70	240.8	210	450.8	42.5	0.1	242.5				

Because of a finite starting point, the encounter average dps will differ with encounter duration.
However, as encounter duration increases the variance decreases.
Excel yields 346.2k dps at encounter duration = 125 minutes

With Divine Recovery cast upon refresh, 10 *potency* * 24s/150s = 1.6 *potency*
Solving for the initial minute yields 346.6k dps

Chapter 5 – Hate Mechanics

Hate modifiers, Hate Positions, and Threat

The information in this chapter is speculative. The exact mechanics are either unknown, debated, or have been recently changed. The proposed model is believed to be accurate, but is not the final or complete model.

Vocabulary

Threat – *N/A*

Commonly referred as hate; a function of healing, damage dealt, and other skills used

Threat Value – *N/A*

Threat measured on a 100 point scale

Hate Position – *N/A*

The current tier of threat the player is located within the target's hate list

Hate List – *N/A*

The target's targeting order

Hate Transfer – *Hate T%*

Transfers threat generated by a percentage

Hate Gain – *Hate %*

Increases or decreases threat generated by a percentage

Recklessness % – *N/A*

100% or 50%, depending if the Recklessness stance is active

Threat and Positions

Everquest II's targeting is determined by a *threat* system. Every action performed by a character produces *threat*. It is common belief that Threat = damage dealt + healing performed. Although players have commented that their hate position increased after casting skills without healing or damaging components, the threat values associated these skills is considered negligible.

Threat is measured on a 100 point scale. If a character produces more threat relative to others, his threat value will increase. If a character produces the most threat during a period, the character will assume the 100 point position and become the current target.

Theoretical raid threat model

The number of *hate positions* is determined by the number of unique targets with hostile effects. This is often the number of friendly characters in the encounter. Threat generated recently is more predominate compared to threat generated prior in the encounter.

Several skills modify a character's placement on the threat model by *hate positions*. A character that receives +1 hate position will be placed one threat above the next highest character within the threat model. Similarly, -1 position places the character one threat below the next lowest character.

If a character is removed from combat, they also are removed from the threat model. This is effect is frequently encountered as characters are downed in combat.

Example: Hate Positions

Vivi -1 position

Vivi will lose little threat; placed 1 threat below Shadow

Shadow -1 position

Shadow will lose significant threat; placed 1 threat below the ranger

Berserker Axinheld +6 positions

Axinheld will gain significant threat from the 1st, minimal gain from the 2nd, 3rd and 4th, and significant gain from the 5th and 6th positions; placed 1 threat above Shadow

Threat Modifications

Character threat values are not equal to hate generated.

Threat = ([Threat Generated + Transfer] * Hate Gain %) * (Recklessness)

Transfer = %Transfer * Threat Generated

%Transfer =<50%

-50% =< Hate Gain <= 100%

Recklessness = 100% or 50%

Example: Threat Values

Fighter McGee has a 15% *transfer* on Vivi and 70% *hate gain*. Vivi has -30% *hate gain*.

Fighter McGee generates 200k threat/s, where Vivi generates 600k threat/s.

What are their *threat values*?

Transfer = 15% * 600k = 90k

Fighter McGee's Threat = ([200k + 90k] * [1 + 0.7]) * 1 = 493k

Vivi's Threat = ([600k - 90k] * [1 - 0.3]) * 1 = 357k

Chapter 5 Problems

5A1. What is the *threat value* of Shadow? Assume Shadow has -30% *hate gain*, no active *transfer*, and a 500k dps parse.

5A2. If Shadow uses a 24% *transfer* on Fighter McGee, what are their respective *threat values*?

5B1. With both *transfers*, can Fighter McGee maintain the highest *threat value* in Recklessness?

Chapter 5 Solutions

5A1. Shadow's Threat = (500k * [1 – 0.3]) * 1 = 350k

5A2. Transfer = 24% * 500k = 120k
Fighter McGee's Threat = ([200k + 90k + 120k] * [1 + 0.7]) * 1 = 697k
Shadow's Threat = ([500k – 120k]* [1 – 0.3]) * 1 = 266k

5B1. Fighter McGee's Threat = ([200k + 90k + 120k] * [1 + 0.4]) * 0.5 = 287k
Fighter McGee's *threat value* is lower than Vivi's.

Chapter 6 – Non Traditional Nomenclature

% Healing, % Spell Damage, and Skill Specific Bonuses

The mechanics of this chapter were previously introduced in Chapter 1; however the methods of integrating the stats are different. The mechanics either follow unknown formulae or use misleading nomenclature.

Vocabulary

% Healing – *Heal%*

Additional modifier for healing type skills

% Spell Damage – *Spell%*

Additional modifier for damage type spells

Skill Specific Bonuses – *N/A*

Potency or *critical bonus* that applies specifically to a single skill

Heal and Spell %

Current tests have shown *heal* and *spell%* to behave as additional multipliers after *potency* and *critical bonus* effects. However, the promised and returned values are not equal.

Base		+Heal % Values				Actual % Increase			
Min (0%)	Max (0%)	Min (2%)	Max (2%)	Min (5%)	Max (5%)	Min (2%)	Max (2%)	Min (5%)	Max (5%)
Back Into the Fray III									
2457	3003	2503	3060	2572	3144	1.0187	1.0190	1.0468	1.0470
4915	6007	5007	6119	5144	6288	1.0187	1.0186	1.0466	1.0468
Regrowth VIII (HoT)									
1403	1715	1426	1743	1459	1784	1.0164	1.0163	1.0399	1.0402
1194	1460	1217	1487	1250	1528	1.0193	1.0185	1.0469	1.0466
Nature's Salve IX									
2171	2653	2211	2703	2272	2777	1.0184	1.0188	1.0465	1.0467
Nature's Elixir VIII									
3629	4435	3697	4518	3799	4643	1.0187	1.0187	1.0468	1.0469
Sylvan Touch (HoT)									
2277	2784	2310	2824	2360	2884	1.0145	1.0144	1.0365	1.0359
996	1218	1011	1235	1032	1262	1.0151	1.0140	1.0361	1.0361

Fury sample single target heal values (approximately 70% potency, 0 ability modifier)

Heal% increase does not impact healing skills in the same fashion, however some trends can be assumed. For example; *heal%* increase tends to benefit Heal over Time (HoT) less than flat healing skills. Due to the complications of this mechanic, its skill specific nature, and unknown formulae, it will not be used in problems or examples. Although untested, *spell%* is expected to follow the same unusual trends.

Skill Specific Bonuses

Skill specific bonuses are not additional multiplicative effects – rather modifications to *critical bonus* and *potency* for the specified skill. Extensive testing has shown this to be accurate within rounding errors.

Example: Fury's Thunderbolt VI

Effect	Wis	Wis %	Min	Max	Avg	Adj Avg
Base Value	33	1.18	1799	1805	2398.5	2370.523
Base Value	37	1.55	1805	3009	2407	2370.26
Stormcaller's Control	37	1.55	1986	3310	2648	2370.53
[Increases the base damage of spells by 10%]						
Focus: Thunderbolt	39	1.73	2261	3768	3014.5	2370.59
[Improves the base damage of Thunderbolt by 15%]						
Nature's Storm	39	1.73	2641	4371	3506	2376.812
[Improves the damage of Thunderbolt by 20%]						
Essence of the Stormcaller	39	1.73	2823	4672	3747.5	2376.626
[Improves the damage of magic based spells by 10%]						
Expertise	207	15.98	3440	5693	4566.5	2386.25
[+10% *potency*]						

Chapter 6 Problems

6A1. If a character has: +35% damage to skill A and 110% *potency*. What is the final multiplier for skill A?

6A2. If a character has: +15% to healing skill B and 200% *potency*. What is the final multiplier for skill B?

Chapter 6 Solutions

6A1. Skill Multiplier = (0.35 + 1.10) * Critical Modifier = 1.45 * Critical Modifier

6A2. Skill Multiplier = (0.15 + 2.00) * Critical Modifier = 2.15 * Critical Modifier

Chapter 7 – Additional Mechanics

Accuracy, Strikethrough, Double Cast, AE Auto Attack, & Weapon Damage Bonus

These mechanics are considered more complex than those mentioned in Chapter 2. Although understanding their implications is simple, calculating their effects is difficult. Hit modifiers, due to limited information regarding their mechanics and the difficulty in calculating their effects are to be included within a later release.

Vocabulary

Accuracy – *Acc*

Decreases a character's *auto attack* miss rate [character fails to hit target]

Strikethrough – *SrkT*

Decreases target's chance to block character's *auto attacks* [target succeeds in blocking player]

Double Cast – *N/A*

Grants select skills a chance to cast twice

AE Auto Attack – *AE AA*

Grants chance of hitting up to four additional targets with each *auto attack*

Weapon Damage Bonus – *N/A*

A linear multiplier to *auto attack* damage, stacks multiplicatively with *auto attack multiplier*

Auto Attack Multiplier – *N/A*

A linear multiplier to *auto attack* damage, stacks multiplicatively with *weapon damage bonus*

Hit Modifiers

TBD

Weapon Damage Bonus and Auto Attack Multiplier

Two multiplicative modifiers for *auto attacks* in addition to *DPS*; *weapon damage bonus* and *auto attack multiplier* are unrestricted by diminishing returns. *Weapon damage bonus* is shown as a percentage, whereas *auto attack multiplier* is unaltered from its equation state.

Example: Weapon Damage Bonus and Auto Attack Multiplier

Base Value: 1000/hit

Weapon Damage Bonus = 20, DPS = 0

1000/hit * (1 + 0.20) * (1 + 0.00) = 1,200/hit = 1.2 k/hit

Auto Attack Multiplier = 0.20, DPS = 0

1000/hit * (1 + 0.20) * (1 + 0.00) = 1,200/hit = 1.2 k/hit

Weapon Damage Bonus = Auto Attack Multiplier = 0.20, DPS = 100

1000/hit * (1 + 0.20) * (1 + 0.20) * (1 + 1.00) = 2,880/hit =2.9 k/hit

Weapon Damage Bonus = 20, Auto Attack Multiplier = 0.30, DPS = 300

1000/hit * (1 + 0.20) * (1 + 0.30) * (1 + 1.35) = 3,666/hit =3.7 k/hit

Double Cast

Skills that are *double cast* are treated as two separate skills, with slight modifications. Damage over Time (DoT) effects which would not normally stack from the same character stack. Healing abilities cannot trigger *double cast*. Although some *combat arts* can trigger a double cast, the triggering of this stat is usually reserved to spells.

AE Auto Attack

Each *auto attack* has a chance of hitting up to four nearby targets. The success chance is linearly equivalent to a character's *AE auto attack* stat value. Each hit is calculated individually using each target's respective mitigation, avoidance, and active defensive abilities. Additional hits performed by *AE auto attack* cannot trigger additional hits by *flurry* or *multi-attack*, but will trigger on hit effects such as those granted by Inspired Daring or Stampede skills. Furthermore, *AE auto attack* can trigger proc effects granted by skills, adornments, and equipment.

Chapter 7 Problems

7A1. What is the dps of problem 3A1 with a *weapon damage bonus* of 20?

7A2. What is the dps of problem 3A2 with a *auto attack multiplier* of 0.30?

7A3. What is the dps of problem 3A3 with a *weapon damage bonus* of 50?

7B1. What is the *AA damage modifier* of problem 3B1 with a *weapon damage bonus* of 20?

7C1. If Sparky had access to 2.5% *double cast* red adornments in problem 2C2, would his maximum *skill damage modifier* change? If so, what is the new *skill damage modifier*? *Double cast* adornments are only available in the shoulder slot.

7C2. Who has a higher *auto attack modifier*, inquisitors or dirges? Inquisitors have an auto attack multiplier of 0.32 + 0.15 [Severe Judgment, Persecution] and a weapon damage bonus of 20 [Battle Prowess]. Dirges have the ability to dual wield. Assume that dps, haste, multi attack, and Flurry are equal.

7D1. Does the solution to problem 3D4 change with *double cast* adornments available? If so what is the new solution?

Chapter 7 Solutions

7A1. 2k/s * (1 + 1.25) * (1 + 0.2) = 5.4 k/s

7A2. 2k/s * (1 + 1.25) * (1 + 0.3) = 5.85 k/s

7A3. 2k/s * (1 + 2.00) * (1 + 0.5) = 9.0 k/s

7B1. AA Damage Modifier = (1 + 1.35) * (1 + 1.25) * (1 + 4.00) * (1 + 0.2) = 17.625

7C1. Yes, his maximum skill damage modifier does change.
Using six *critical bonus* and one *double cast* adornments;
(1.3+88/100)*(1+570/100) * (1 + 0.025) = 14.97115 or a 1497.115% Skill Damage Modifier.

7C2. Inquisitors
Auto Attack Modifier = (1 + 0.32 + 0.15) * (1 + 20/100) = 1.764
Dirges
Auto Attack Modifier = (1 + 0.00) * (1 + 0.00) /1.33 * 2 = 1.504

7D1. Refer to 3D4 Solution to find base parse values
Skill Base = 15,873
AA Base = 19,047

Finding modified values;
Modified Skill = Skill Base * (iCrit + [{CB + CB Adorns}/100]) *
(1 + [{Pot + Pot Adorns}/100]) * (1 + Doublecast%/100)
Modified AA = AA Base * (iCrit + [{CB + CB Adorns}/100])
Total = Modified Skill + Modified AA

Substituting in 1x 2.5 *double cast* into previous solution;
15,873 * (1.3 + [{80 + 18}]/100) * (1 + [{80+0}/100]) * (1 + 0.025) = 66,771 = 66.7k
19,047 * (1.3 + [{80 + 18}]/100) = 43,427 = 43.4k
Total = 66.7k + 43.4k = 110.2k (6x +3 *critical bonus*, 1x +2.5 *double cast*)

Chapter 8 – Primary Attributes

Primary Stat and Ability Modifier

The *primary stat* is rarely used in selection, but its blanket multiplicative effect is significant in damage calculation. Gear, beneficial spells, and character builds' primary concern are the stats previously discussed. This is not to state that primary stats are insignificant; rather players have limited control compared to other stats.

Ability modifier mechanics are currently being tested.

Vocabulary

Primary Stat – *agi*, *int*, *wis*, *str*

Attribute determined by character archtype (scout, mage, fighter, priest) that determines blanket multiplier for damage

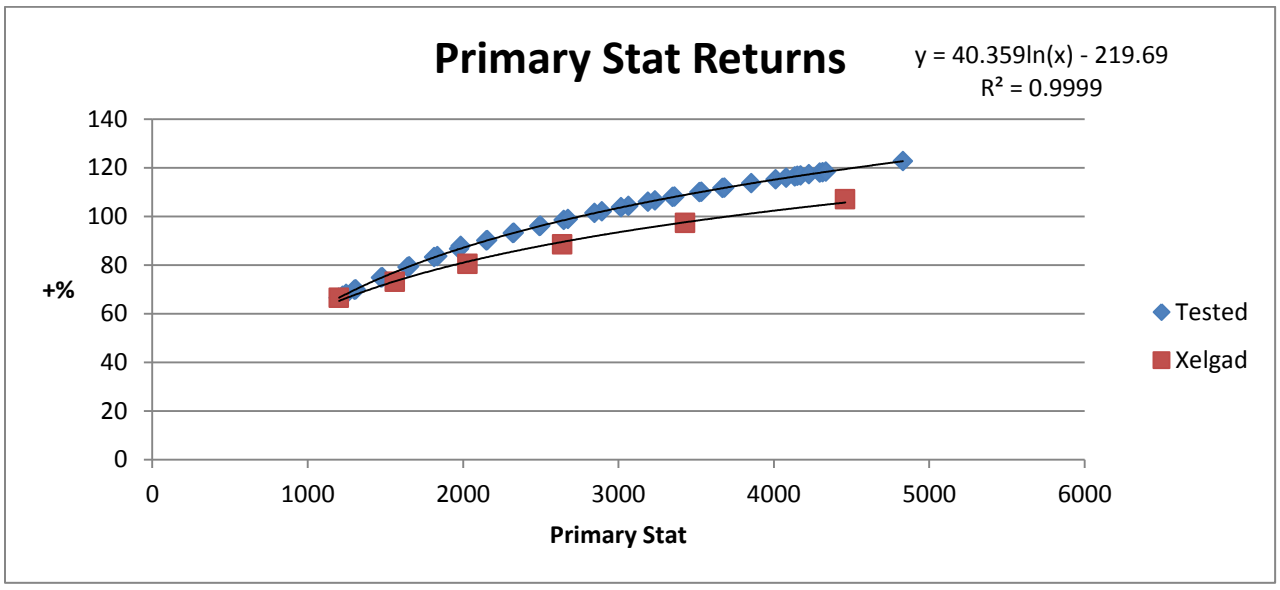
Ability Modifier – *amod*

TBD

Primary Stat Curve

Like many previous discussed stats, the primary stat is subject to diminishing returns. Xelgad, a game designer for Sony Online Entertainment, posted on the Everquest II discussion boards 6/7/10 that "after 1200, a ~30% increase to your stat will gain ~10% damage boost."

This proposed curve tests to be nearly correct, but the exact formula is unknown. Due to the client's limited display of two digits past the decimal, a perfect curve is impossible. Below is a curve fit of recorded values from the EQII client in comparison with Xelgad's approximation.



Primary stat returns; tested values vs. Xelgad's approximation

The proposed curve is for level 92 characters with primary stat values greater than 1200. After 1200 points, the curve shifts drastically as shown.

% Damage Increase vs. Primary Stat near 1200	
1199	63.24
1200	63.25
1201	66.44
1202	66.47

Curve shift as primary stat > 1200

Ability Modifier

TBD

Chapter 8 Problems

TBD

Chapter 8 Solutions

TBD