Fastball Vertical Approach Angle

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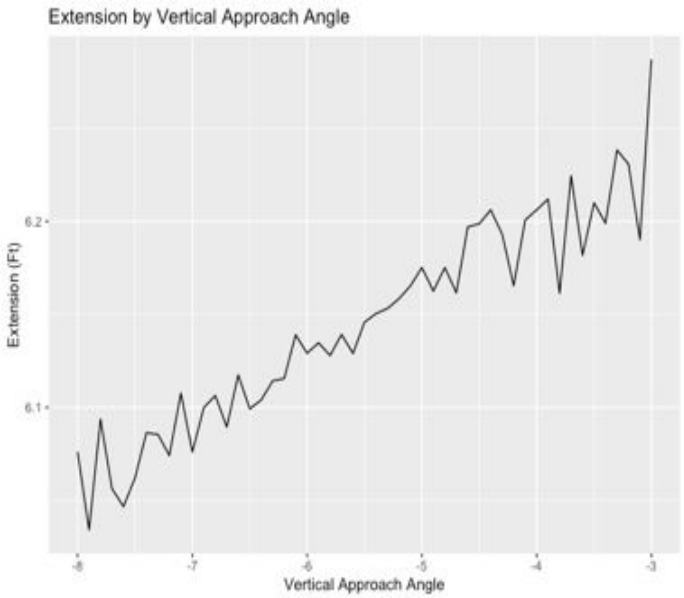
Vertical Approach Angle, in Trackman's Terms, is the angle in which the pitch crosses the plate. It can be viewed as the opposite of launch angle. It should go hand in hand with spin rate as to where a pitcher should primarily locate their fastball.

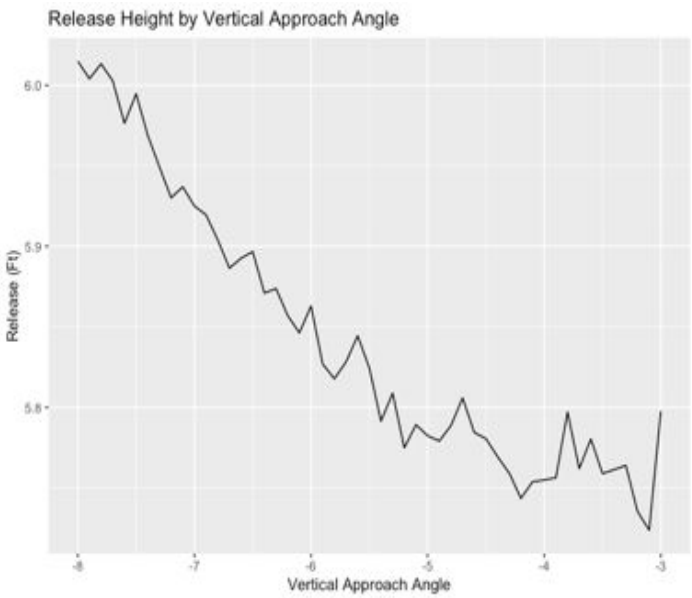
To measure VAA, the range of values goes from 0 to as large as -10 and below. A 0 VAA would be the flattest possible angle a pitch can enter the zone at, and the steeper the angle, the further the number gets from 0. Since technically it’s measured as a negative number, it can’t be referred to as “bigger”, so I will refer to it as “further from 0” to talk about steeper angles.

The pitches with more negative vertical break will typically have steeper VAA, represented by a larger negative number. These are the average Vertical Approach Angles for our most common pitches on the UCSB Baseball Team:

Pitch Type	Avg VAA
Fastball	-5.761438
Changeup	-7.712928
Slider	-8.701168
Curveball	-10.36867

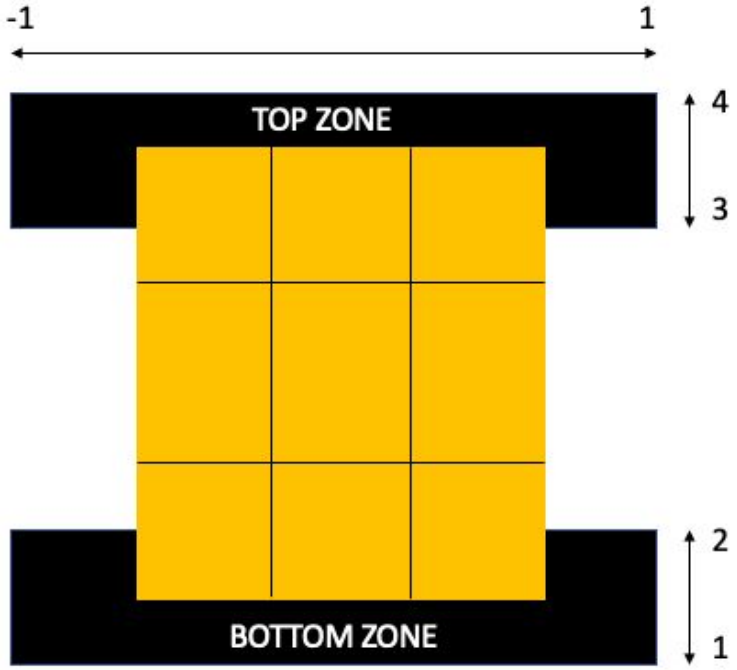
VAA is mostly influenced by 2 factors: extension and release height. A simple regression with those variables as dependent variables returns an R-Squared value of about .946, which indicates that it is a great predictor of VAA. More extension leads to a flatter VAA, and a higher release height shows a steeper approach angle as shown below.





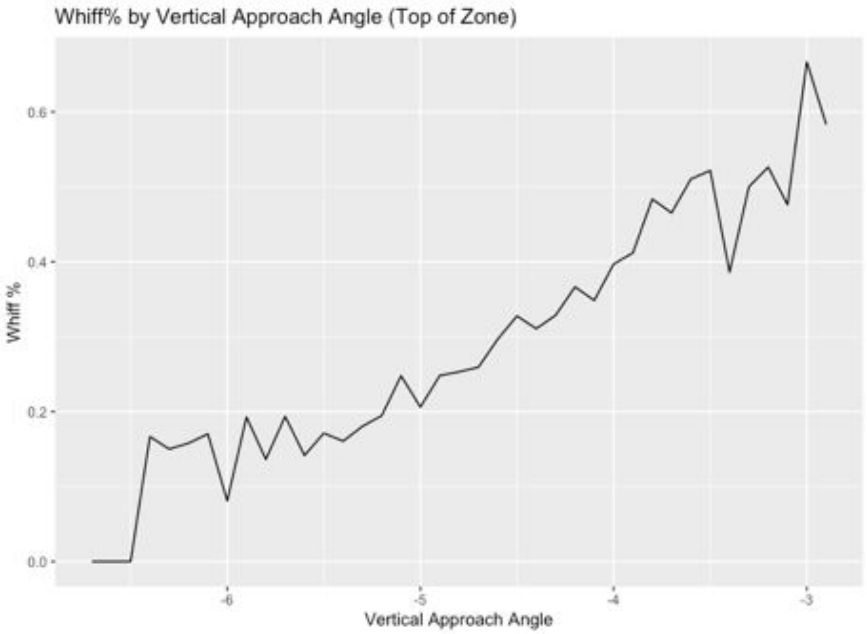
For this analysis of VAA, finding each pitcher's average VAA and making recommendations for improvement based on that doesn't give the full picture. The ball

doesn't look or move the same at the top of zone compared to the bottom of the zone. It was the most logical to split up the measurements into the top and bottom of the zone. The top of the zone consists of all fastballs between 3 and 4 feet off the ground, and -1 and 1 feet horizontally. The bottom of the zone is 1 to 2 feet off the ground, and the same measurements horizontally.



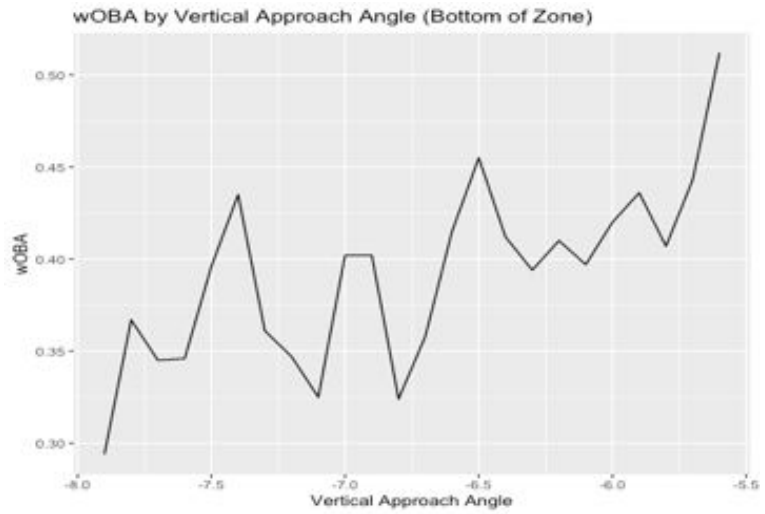
So what we want to figure out and answer is: Why does the Vertical Approach Angle of a Fastball matter?

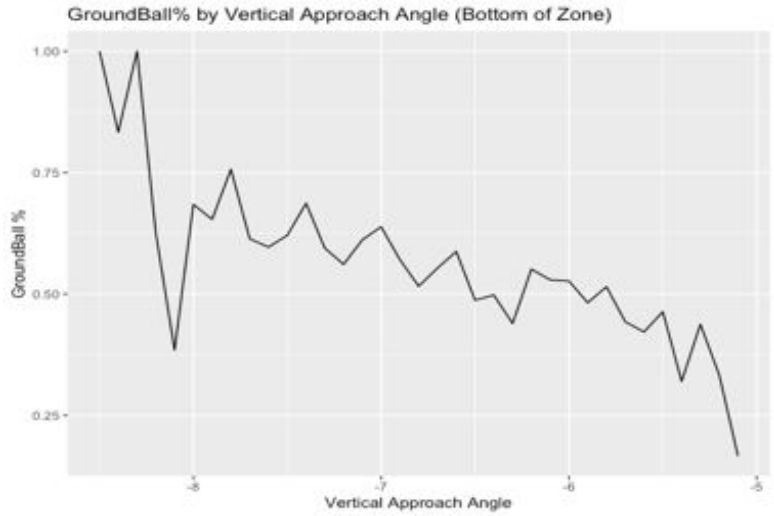
The data is very clear, with a VAA closer to 0, fastballs should be focused higher in the zone.

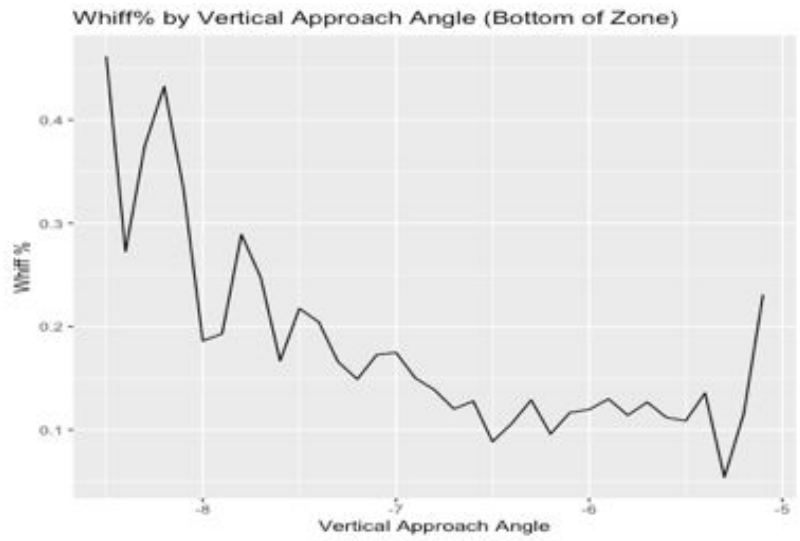


This graph above shows a very clear correlation between a flatter VAA in the top of the zone and a higher whiff rate. Very similar to a high spin rate fastball, it has a rising effect, which leads it to be much harder to get the bat to while at the top of the zone.

On the flip side, the bottom of the zone shows that a steeper VAA yields far better results. Not only does whiff rate go up, ground ball rate and wOBA both show a trend in the right direction as well.







It's pretty simple: if the fastball VAA is flatter, the primary location should be high in the zone. If the pitch has a steeper VAA, it should be located lower in the zone.

These numbers are helpful but we want to know where our pitchers stack up against each other and the rest of the players in college. We will figure out and calculate a scale to show where each player sits regarding their VAA.

I took all of the data we have on our own team and other teams as well and created a scale for both the top and bottom of the zone. It shows where each of our pitcher's rank among other pitchers across the nation.

The distribution of average pitcher VAA in the top and bottom of the zone both lead to a normal distribution. These numbers are calculated using the Normal Curve and Z-Scores.

Rank	VAA
Elite	-7.72 and under
Great	-7.71 to -7.31
Above Average	-7.30 to –6.90
Average	-6.89 to –6.36
Below Average	-6.35 to –5.95
Poor	-5.94 to -5.55
Awful	-5.54 and over

Rank	VAA
Elite	-3.70 and over
Great	-3.71 to -4.04
Above Average	-4.05 to -4.42
Average	-4.43 to -4.93
Below Average	-4.94 to -5.31
Poor	-5.32 to -5.69
Awful	-5.70 and under

Top of the zone (Left), Bottom of the zone (Right)

Now that the importance of VAA is explained we can tackle how these numbers can help a baseball program. Finding each pitcher's average VAA in both zones was the first step. From there, it was about finding and analyzing important metrics to determine how each pitcher was performing relative to their VAA.

One very nice point of this metric is sample size is mostly irrelevant when finding a player's VAA. Whether he throws 2 or 200 pitches in each zone, the average VAA doesn't need a large sample to even out in order to give an accurate view.

This chart was the one created to give a brief overview of where our guys are, plus an easy metric to analyze, whiff rate, to show how well each pitcher is missing bats in each zone.

Pitcher	TopWhiff	TopCount	TopVAA	BotWhiff	BotCount	BotVAA	Release	Extension	TopLocation	BotLocation
Adamson, Charlie	0.166666666666667	30	-4.38722185301986	0.2	5	-6.53581294406955	5.98864398243919	5.89685990560706	Above Average	Average
Arellano Jr., Jorge	0.310810810810811	74	-4.7692268779466	0.210526315789474	38	-6.59858997076583	6.04521876705229	6.23645379610517	Average	Average
Beer, Trevor	0.255813953488372	43	-5.95170719914266	0	19	-7.98016124630646	7.09183376450641	5.17859320093844	Awful	Elite
Benbrook, Carter	0.193548387096774	31	-5.14115080018204	0.117647058823529	17	-7.18974041921263	6.11354612675813	5.31668182254991	Below Average	Above Average
Boone, Rodney	0.379487179487179	195	-4.69509930674259	0.222222222222222	45	-6.70602094842228	6.19459449211045	5.81543723582505	Average	Average
Callahan, JD	0.3125	32	-4.38172627167369	0.133333333333333	15	-6.41512323003931	5.8187590352898	6.6842496621638	Above Average	Average
Dand, Conner	0.265822784810127	79	-4.59397286561309	0.08	25	-6.64563130570271	5.96786359699609	5.23426007066012	Average	Average
Harvey, Ryan	0.310679611650485	103	-4.45311599831286	0	14	-6.41829771151955	6.02069572928448	6.23477064133471	Average	Average
Lewis, Cory	0.195121951219512	41	-4.96788651853553	0.25	16	-6.94008598851645	6.4289033638172	5.91673578779661	Below Average	Above Average
Lyons, Kevin	0.28169014084507	71	-4.97055320447846	0.136363636363636	22	-7.15608110951207	6.4302634442134	5.63268497089158	Below Average	Above Average
McGreevy, Michael	0.238636363636364	88	-4.91275951984009	0.194805194805195	77	-6.83537756100005	6.07770532646101	6.04571892909174	Average	Average
Owen, Noah	0.115384615384615	26	-4.84765433008526	0.416666666666667	12	-6.67706379661342	6.3581418214304	5.65012698381388	Average	Average
Roberts, Conner	0.175	40	-4.74637908916384	0.208333333333333	24	-6.75396418859785	5.34587023903838	5.40939061719378	Average	Average
Schrier, Alex	0.333333333333333	18	-3.69374183505117	0.214285714285714	14	-5.78817096897207	4.75277963316034	5.39376013834639	Elite	Poor
Torra, Zachary	0.338983050847458	59	-4.28650825657067	0.166666666666667	24	-6.1774993981745	6.09744901295481	5.6920695318141	Above Average	Below Average
Troye, Christopher	0.445652173913043	92	-4.64969495952248	0.181818181818182	22	-6.52159767150521	6.47914821332824	6.24769862893548	Average	Average
Whiting, Samuel	0.666666666666667	6	-4.4568948808466	0	4	-6.372651589997	5.72345562349915	6.13576498326156	Average	Average

VAA should be kept in mind both when considering how to develop pitchers, but also with in game decisions. If a double play is needed, a pitcher with a steep VAA would be a more logical choice. High strikeout guy at the plate that can't layoff the chest-high fastball? Probably look for a flatter VAA to come out of the bullpen.