



Professional Baseball

Looking For Guys Who See Fast

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









Looking For Guys Who See Fast

Chris Johnson, Ph.D.

Our brain's capacity for high-speed information processing is both impressive and vulnerable to error. In a matter of milliseconds, information from multiple brain regions is orchestrated to initiate our behavioral response. High-speed visual perception involves much more than just visual clarity, and requires dynamic integration of sensory details, (*"what is it"*, *"where is it"*), as well as working memory, learning, and retrieval (*"where have I seen it before"*), and (*"what happened last time I saw it"*). The complexity of perceptual and sensory-motor demands also invites error, especially in conditions of compressed time and space. During my time running a warfighter performance lab, one of our aims was to better identify special operations forces who possessed unique skills for time-perception and complex decision-making in uncertainty during close quarters combat (CQC). We often referred to the search for these skills as, *looking for guys who 'see fast'*.

Athletes who *'see fast'* can facilitate performance advantages by knowing what is going to happen next, where it's going to happen, and expanding time and options for response. In baseball, cognitive capacity for high-speed information processing is related to hitter decision-making. Individual differences in cognitive capacity among players is an essential metric for identifying hitter skills. Cognitive capacity metrics provide insights into how players might adjust to increasing complexity in pitch recognition, as well as dynamic changes in velocity and break. One hitting metric conceptually related to capacity for high-speed information processing is the ratio of strikeouts to base-on-balls (SO/BB). Fewer strikeouts have traditionally been viewed not only as an indicator of better strike-zone recognition, but also as a measure of pitch recognition and advanced bat-to-ball skills. A hitter with more frequent walks (BB) is often considered to have greater control of the strike-zone by avoiding swinging at hard-to-hit pitches and inducing pitchers to relocate or make a mistake in the hitter's damage zone. Hitters with lower strikeout to walk ratios (SO/BB) also tend to put the ball in play and get on base more frequently, which are foundational to offensive production.

The value of the SO/BB ratio through the MLB 2022 championship season is highlighted below in *Table 1*. World Series winning Houston Astros had the best team SO/BB ratio (2.23) in the league, a full 1.50 better than the bottom ranked Detroit Tigers (3.72). Even more noteworthy is the Astros don't appear in the top 5 rankings for other common metrics of quality or productive plate appearances (PAs), (e.g., *wOBA* = weighted on-base average, *SPA* = successful plate appearance, *WHAV* = well-hit average). This suggests SO/BB ratios may generate unique insight into a hitter's offensive value.

RANK	OPS	wOBA	SPA	WHAV	SO/BB
1					
2					
3					
4					
5					
26					
27					
28					
29					
30					
Top - Bottom Δ	15 %	6 %	475	11 %	1.50

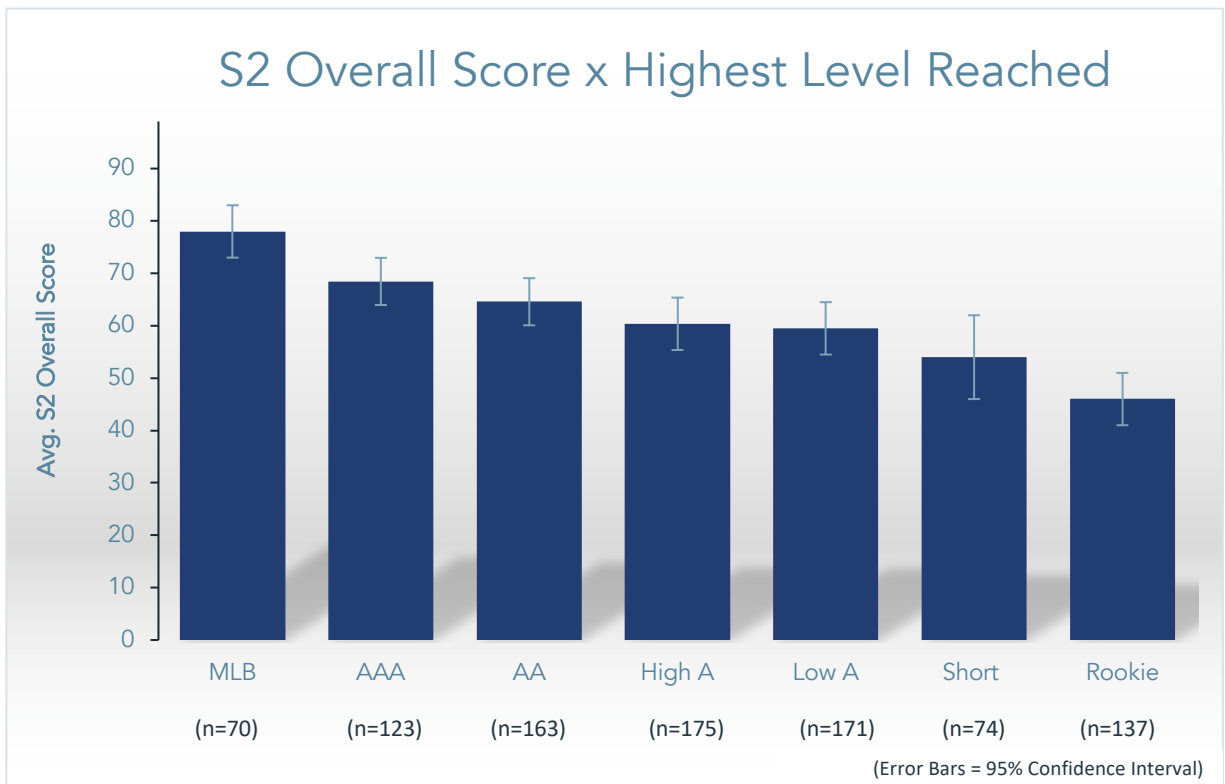
Question 1: If SO/BB ratios provide unique insight into offensive production value, is neurocognitive capacity also associated with individual hitter performance at the major league level?

Answer: Yes. Current S2 data show 2,378 hitters have been assessed as amateur draft prospects, minor leaguers, or major league players. Of that sample with S2 scores, 199 hitters have made a major league appearance, and 163 have more than 50 major league plate appearances (PA).

Amateur Draft and Pro Players with S2 assessment
2,378
Hitters with S2 scores MLB
212
Hitters with S2 scores MLB PA > 50
163

Major Leaguers with Overall S2 scores 1-39 were categorized as Lower Cognitive Capacity group. Overall S2 Scores 40-69 comprised the Average Cognitive Capacity Group. Players with Overall S2 Scores 70-100 made up the Higher Cognitive Capacity group.

It's noteworthy that group sample sizes are not equal, with roughly twice the number of major leaguers in the higher cognitive capacity group. This is consistent with the notion that fewer players with lower cognitive capacity that make it to the major leagues. It's also consistent with data from 2018 showing average S2 scores were higher at higher development levels (Figure 1). That said, groups did not differ in age or average PAs.



Aggregate data from the last three MLB seasons is show below in Table 2.

MLB Group	N	Age	S2 Overall	SO/BB *	Miss% FB Up	Miss% FB to Break Ball*	K% on Break Ball*
Lower Cog	28	25.9	22	4.85	37%	35%	59%
Average Cog	50	25.8	55	4.07	35%	35%	57%
Higher Cog	85	26.2	85	3.51	31%	30%	52%

* SO/BB: $F(2,160) = 4.18, p < .05$

* Miss% Fastball to Breaking Ball: $F(2,160) = 2.81, p < .05$

* K% on BreakBall: $F(2,160) = 4.35, p < .05$

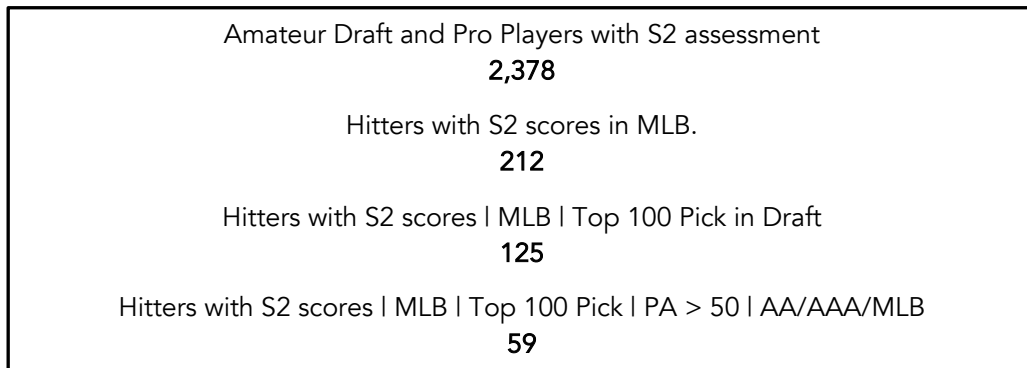
Between groups analysis shows that on average, MLB hitters in the Higher Cog group walked more frequently, struck out less, struck out less on breaking pitches, and had less swing-and-

miss on breaking pitches that followed fastballs. Results also show MLB hitters in the Higher Cog group tended to miss less on fastballs up in the zone. These data further suggest that overall neurocognitive capacity is associated with a major league hitter's ability to control the strike-zone, recognize pitches, and perception of when and where to create swing path for contact.

Question 2: Can differences in cognitive capacity be identified in amateurs, and where do those differences show up in the batter's box?

Answer: Yes, and these differences are more pronounced at the major league level.

To understand how hitters with higher cognitive capacity might differ from hitters with lower capacity, we examined players with similar industry value as amateurs. S2 has tested 125 position players that were selected on Day 1 of their respective MLB Amateur Drafts. Those top picks with S2 Overall scores ≥ 70 were labeled the higher cognitive capacity group (Draft S2 High, n = 66). Top picks with S2 Overall scores < 69 comprised the average cognitive capacity group (Draft S2 Average, n = 59). Within those groups, 59 hitters had at least 50 major league PAs, and advanced through both AA and AAA.

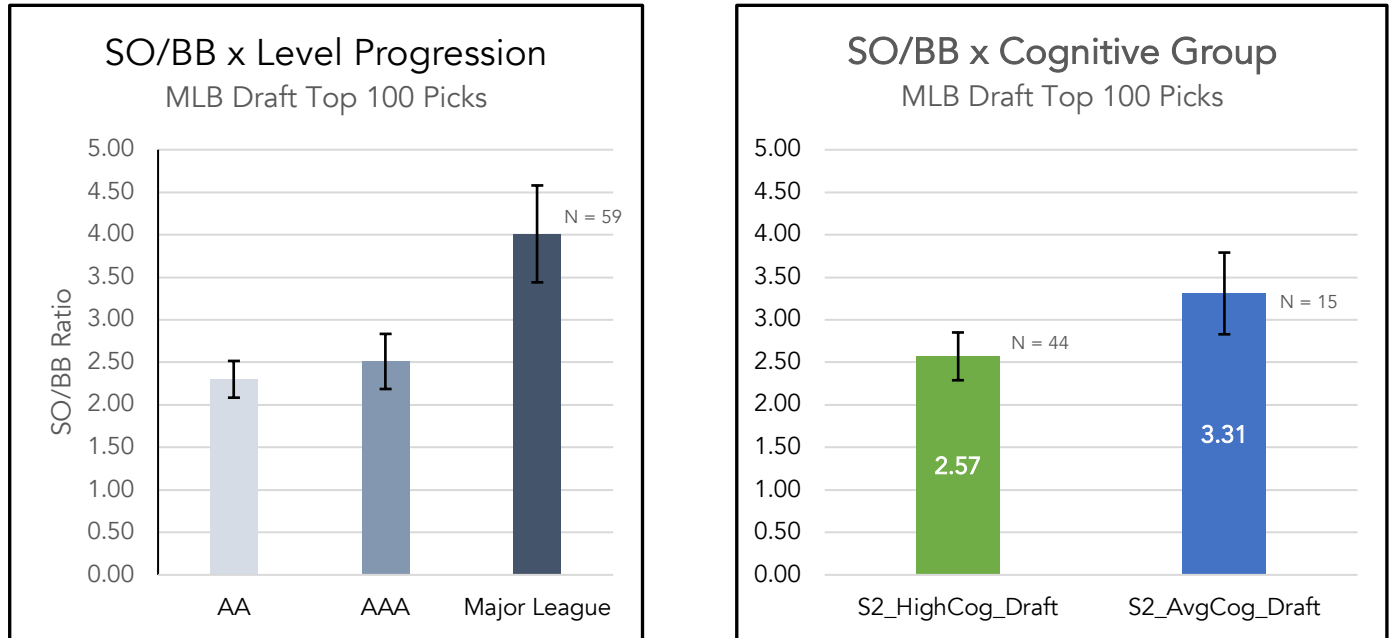


Group characteristics are shown in *Table 3*. All hitters analyzed were selected on Day 1 of their respective draft years from 2012-2021. Average pick numbers for each group (#42, #48) correspond to players selected at some point shortly after Round 1, during a Competitive Balance round, or early in Round 2. Groups did not differ on age, Top 100 pick number, or range of picks. Both Draft S2 High and Draft S2 Avg groups included players selected as high as 1st pick of the draft (1-1) and as low as 97th pick overall.

Draft Group	S2 Range	N	S2 Overall	Draft Pick# Avg.	Draft Pick# Range	S2 Perception Speed	S2 Timing Control
Draft S2 High	70-100	66	88	42	1-97	69	69
Draft S2 Avg	1-69	59	42	48	1-97	44	49

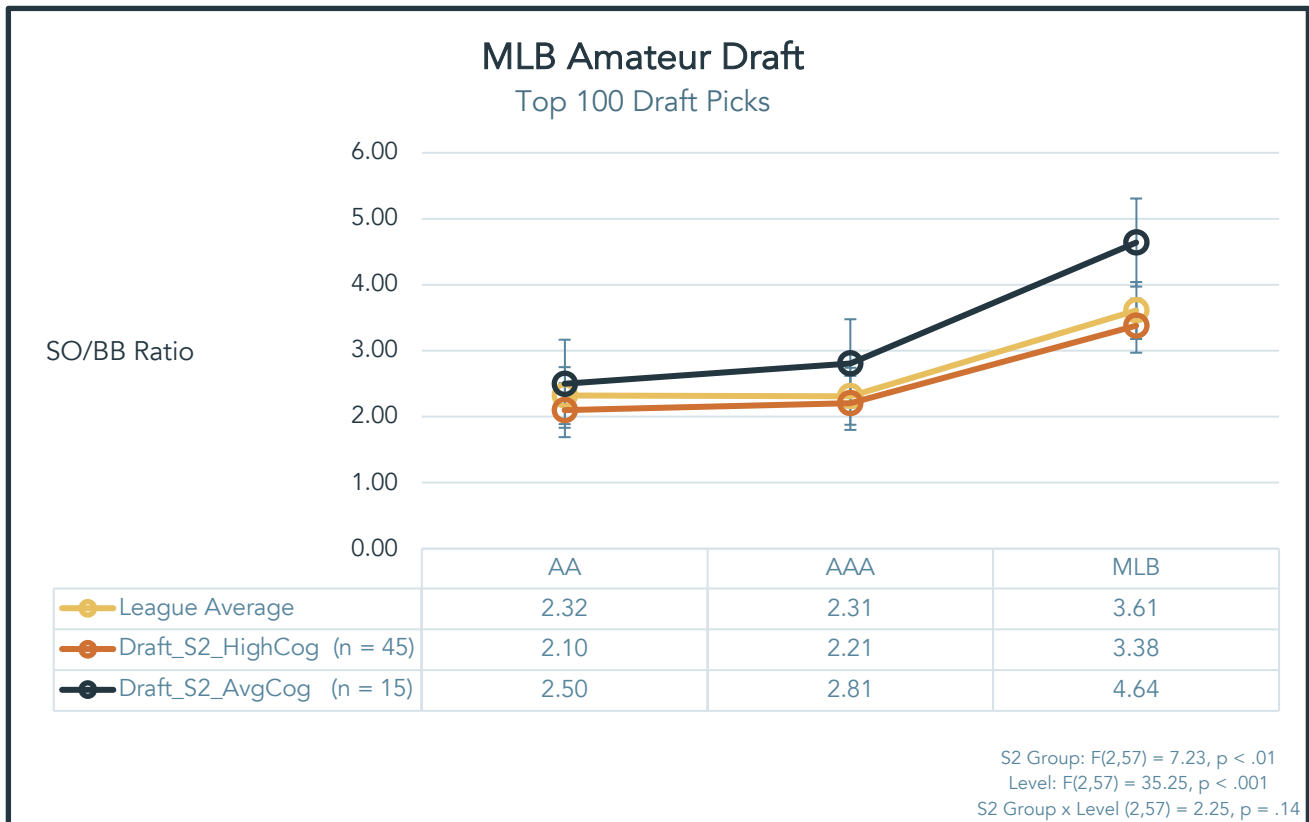
Cognitive Capacity and Hitter Adjustment

The left panel in *Figure 2* below shows average SO/BB Ratio for Top 100 hitters as they progressed through the minor leagues (AA-AAA) to MLB. It is not surprising that SO/BB ratios increased sharply at the major league level. The right panel shows average SO/BB ratio collapsed across all three levels of play, with hitters split between high and average S2 Overall scores. Here we see that relative to the Draft S2 Average group, hitters in the Draft S2 High group struck out less and walked more, regardless of level of play.



However, these findings don't tell the full story of individual differences in cognitive capacity among top draft picks. Similarities in valuation of top-tier draft talent within the industry make it unsurprising that a proportion of hitters from both cognitive groups reached the major leagues. Likewise, it's unsurprising that SO/BB ratios increase at the major league level.

However, not all top prospects develop the same way, and not all of them successfully adapt to the steep demands of major league pitch quality. *Figure 3* shows that Draft S2 High and Draft S2 Average hitters' ability to control the strike zone and their bat-to-ball skills were most different against major league pitching. Considering the implications of these findings, it's important to reiterate these hitters were all selected in the top 10% of an already selective group of draft prospects. These hitters were then evaluated against their own performance as they progressed from AA to MLB level using within-subjects repeated measures analysis.



A key point of emphasis is that Draft S2 High and Draft S2 Average hitters were not significantly different at lower levels in terms of SO/BB ratio. However, these differences were amplified at the major league level. This underscores the difficulty in discerning observable differences in a select group of talent that is already at the far right-hand side of a performance distribution. That said, despite the similarity of these two groups starting on draft day, performance difference between the groups was most significant at the major league level.

Key Point #1: Individual differences in cognitive functions such as perception speed and timing are measurable, significantly related to hitting, and a separator factor even within top tier draft talent.

Key Point #2: You might not see guys who 'see fast' until you measure how fast they see.