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Anticipation of coincidence in baseball players

Abstract

20 players from Pacific University's baseball team were tested on the Bassin Anticipation Timer to determine if anticipation of coincidence as measured by the Bassin correlates to actual hitting tendencies. Bassin results indicate a non-significant correlation exists between actual batting performance and performance expected from Bassin testing. The Bassin triggering device was also held in three different positions to better mimic bat handling. Analysis indicated that the location and manner in which the trigger device is held and pressed makes no statistically significant difference. However, a significant correlation did exist between Bassin performance and strike percentage. Evidence in this study suggests a new manner in which the Bassin Anticipation Timer may be employed to study, and perhaps improve, baseball players' batting.

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Anticipation of Coincidence in Baseball Players

by

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A thesis submitted to the Faculty of the
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ABSTRACT

20 players from Pacific University's baseball team were tested on the Bassin Anticipation Timer to determine if anticipation of coincidence as measured by the Bassin correlates to actual hitting tendencies. Bassin results indicate a non-significant correlation exists between actual batting performance and performance expected from Bassin testing. The Bassin triggering device was also held in three different positions to better mimic bat handling. Analysis indicated that the location and manner in which the trigger device is held and pressed makes no statistically significant difference. However, a significant correlation did exist between Bassin performance and strike percentage. Evidence in this study suggests a new manner in which the Bassin Anticipation Timer may be employed to study, and perhaps improve, baseball players' batting.

INTRODUCTION

It has been suggested that one of the most difficult perceptual motor tasks in sports is that of hitting a baseball (1,4). Proper anticipation of baseball speed and travel is agreed to be one of the more important facets to this process (2). More specifically, anticipation timing, in baseball, refers to the player's estimation of a stimulus arrival (baseball) over a designated area (home plate). Coincidence-anticipation timing involves not only the ability to predict the arrival of the moving object (baseball) but to co-ordinate a movement response with that particular arrival (swinging a baseball bat) (3,13,17,18,19).

Dunham and Reeve (10) examined the effects of gender, eye preference, and speed of a stimulus on anticipation of coincidence. The methodology involved subjects' estimates of a baseball's arrival at the front edge of a home plate. Their study showed that no significant difference exists for gender or eye preference, but a significant speed effect did occur. In a related study, Dunham and Reid (11) showed that on tasks requiring coincidence-anticipation a significant difference exists between males and females in adults and pre-pubescent children. The study attributed the differences to sociocultural and physiological factors. Yet another study indicated that baseball players were no more accurate than non players in the estimation of a baseball's arrival at the front edge of home plate (9).

It is important to note that an area of concern in the aforementioned studies is that limited laboratory equipment raises questionable applicability of these studies to the anticipatory situations in sport. With the advent of the Bassin Anticipation Timer (BAT) anticipation timing has been better studied (2). Petrakis (16) recently investigated the association of anticipation of coincidence on the BAT versus the batting averages of college level baseball players. Her studied showed that no significant correlation exists between these two variables. Through further use of the BAT, Payne (15) showed that accuracy of anticipation of coincidence does correlate to length of a runway with longer runways resulting in more accurate anticipation trials. Another current study has indicated that expert tennis players perform anticipation tasks on the BAT statistically better than novel tennis players (7). Similarly, Bowers et al. (6) showed that baseball players with different experiential backgrounds (NCAA Division I vs. NCAA Division III) indicate significantly different BAT performances, with Division I players scoring better at higher speeds (9 mph BAT speed simulating an 85 mph fastball approaching home plate).

The results of these recent studies with the BAT indicate that evaluation of anticipation of coincidence should be studied under conditions which closely resemble the actual anticipation situation. It is with this in mind that this study derived it's protocol. Further, although the BAT has been previously used to evaluate coincidence of anticipation in baseball players, the literature review is devoid of direct comparison with actual player batting performance, such as

early or late hitting tendencies, and BAT performance. It is our intention to illustrate that the analysis of BAT performance in baseball players may provide useful insight into actual swinging tendencies.

METHODS

Subjects were 20 male, varsity level, college baseball players at Pacific University. They ranged in age from 19 to 22 years of age. They were all screened for based on visual acuity and stereo acuity. They all had to pass a criterion of 20/40 static visual acuity at 6 meters or better and at least 40 arc secs of stereo at a 40 centimeter distance.

The Bassin Anticipation Timer (Lafayette Instrument Co.) was utilized for coincidence anticipation timing. It was placed within the batting cage of the Pacific University field house in order to simulate lighting and environmental conditions as close as possible for the subjects in the hitting situation. The six 16-lamp runways (6 meters in length) were located in a direct line from the home plate area towards the pitching machine area. It was elevated three and one half feet above the floor with the nearest end to the subject located at the center of the plate. The speed of the Bassin was set to give the subject the same simulated amount of time as if observing a 70 MPH pitched ball from 60 feet 6 inches.

One inch adhesive tape that is three feet in length was placed on the floor perpendicular to the Bassin device. This tape ran from the end of the timer through the batters box for hitter alignment.

Subjects were tested in pairs with one remaining outside of the testing room until the other was complete. Each will be given 2

demo presentations and 30 total testing trials in intervals of 10 trials at a time. This broke up the testing sequence and prevented any aspect of fatigue. Each interval of ten the batter were asked to hold the push-button in a different location. The first interval, the batter held the push-button directly behind his back, in the second, he was asked to hold the push-button as if it were a bat in his pre-hit position allowing for the push-button to just be seen in his side (peripheral) vision, and in the third interval, the batter was asked to swing at the end light, as if the push-button were a bat and to push the button at the exact moment he thought the light and bat (push-button) would intersect.

The subjects stood in the batters box in their habitual batting stance with the index finger of the bottom hand interlocked with the pinky finger of the top hand. The indicator button, which was attached to a four foot cord and then to the bassin, was located in the palm of the top hand. The subject stance was such that the adhesive tape bisects the body of the subject with the perpendicular distance from the timer determined by the individual as long as the subject remained in the batters box.

The subjects were instructed to try and predict, by depressing the push-button, the exact instant at which the end light on the bassin lane would illuminate. Depression of the push-button stopped the timer and indicated the precise timing of each trial and gave an error correction for early or late. The players were then asked to give there personal impression of their reaction time; were they

early, on time or late? Both objective and subjective responses were recorded and analyzed.

The second batting cage was located within the Pacific University field house on the opposite end to that being utilized for the Bassin testing. This testing site insured that all factors such as lighting and environmental conditions were uniform between testing stations. The actual luminance in the two areas were found to be 108L/m^2 at the bassin and 110 L/m^2 at the batting cage.

The pitching machine was located at the standard distance of 60 feet 6 inches from the front of the plate. The speed was set at 70 MPH to match that set on the bassin.

One inch ribbon was used to partition the cage into hitting zones, divided vertically down the cage. These zones were used to classify the quality of hit. Zone 0 indicated a pitch that was completely missed by the subject. Zone 1 was that zone from the back of the cage to a plane at a point from the front of the plate to the top of the cage. Zone 2 was that zone which is a 75 degree angle from a point, designated as the hitters belt line, (3 1/2 feet above home plate) to a point on the top of the cage and then directly down to the floor. Zone 3 was that zone which is at a 60 degree angle from the hitters belt line to the top of the cage and down to the floor. Zone 4 was that zone which is a 45 degree angle from the hitters belt line to the top of the cage and down to the floor. Zone 5 was a zone that is beyond the 45 degree zone to the end of the cage.

The second region of division of the batting cage was the lateral or horizontal splitting designated to zones with relative comparative value to the baseball playing field (See graphical depiction of home plate). At home plate, the field was divided angularly into four 45 degree regions of the 180 playing field. A zero was awarded for any hit not going past home plate (a foul ball). Zone 1 was that 45 degree region, for a right-handed hitter, determined to be in foul ball territory along the third base side of the field, also determined to be a early or pulled hit. The central 2 forty-five degree regions were further divided into 3 fifteen degree zones each, 3 on the early side (Zone 2,3,4 in a clockwise fashion for a RH hitter) and 3 on the late side (Zones 5,6,7). Zone 8 was that zone along the first base side in foul ball territory. The zones for a left handed hitter are then flip flopped. Zones 1,2,3 were considered to be early hits and zones 6,7,8 were considered to be late hits, while zones 4 and 5 were considered to be "on" hits.

Subjects were tested in pairs with one hitting and one operating the pitching machine. Each subject was given soft toss warm up outside the cage to create a real game like setting where the batter does not get to practice hit off the pitcher and only develops a memory to his pitching style after the first time at bat. After warm up, the subjects were given 15 testing trials in intervals of 5 trials at a time within the cage. The breaks in the testing sequence were to prevent aspects of fatigue.

Each subject was instructed to stand in the batters box with his back foot on a strip of tape perpendicular to the back of the plate in order to maintain the same pitch distance. All remaining aspects of the subjects hitting position were determined by each individual as part of their habitual hitting stance.

The subjects were asked to direct attention to the pitched ball and make contact as well as possible within "the sweet part" of the bat. Quality of contact was the only instruction given. Scoring was done by recording the numbered zone and degree of field in which the ball initially struck.

RESULTS

Collegiate baseball players were to anticipate the arrival of the BAT light in a manner simulating "standing in the batting box" (see methods). Players were asked to do this in one of three manners; with the trigger mechanism behind the player's back out of view, the trigger mechanism off to the side in the player's view simulating a held bat when waiting for a pitch, and the trigger mechanism in motion as if the player were a swinging bat. Each player was to take ten trials in each of the three different positions. The Wilcoxin signed-rank statistical test was employed to determine if the BAT showed a statistically relevant correlation between any of these three positions and BAT reaction time. Although not statistically significant, figure 6 illustrates coincidence-anticipation (reaction time) data with the different triggering methods described above. Interestingly, according to the BAT, the trigger mechanism with the trigger device in view appeared to provide the poorest coincident-anticipation timing.

Figure 1 illustrates that the BAT indicates that most players triggered early in their BAT anticipation of coincidence. As discussed in the methods section of this paper, all 20 players additionally took 15 trials each at actual baseball pitches in the batting cage with the set up similar to the BAT trials. Figure 2 shows most players were "on" with their hits meeting our qualifications of a "well struck baseball".

Figures 3 and 4 compare players opinion of their BAT trial runs to their actual performance. Most players perceived their anticipation of coincidence accurately, with the ability to discriminate between an erroneously early BAT reaction better than a late one.

It has not been previously examined if BAT performance correlates with actual field performance in a matter other than batting averages. Figure 5 indicates that players late more than 50% of the time on the BAT had a significantly higher strike percentage than those players late less than 50% with their BAT triggering.

Figure 7 compares the coincidence-anticipation of players who met our qualification for an "on" hit versus those who did not. In considering a players reaction time (coincidence-anticipation) he must have hit greater than 50% of the time in his 15 batting cage trials in the "on" hit category. If this was the case, then the players summed reaction times would be compared to the reaction times of those players who did not meet this criteria (less than 50% of their hits were "on" hits). Pooled together figure 7 indicates that those players with more "on" hits had a 0.010 sec. better BAT coincidence-anticipation timing. This is not statistically relevant according to the Wilcoxin signed rank test.

DISCUSSION

The results in this study suggest that anticipation of coincidence on the BAT is not completely indicative of a baseball player's performance at the plate. This has been studied and shown previously (16) in a study with BAT performance and batting averages. Indeed, in this study BAT results suggest that most players would have "pulled" their hits into a location approximating left field, and as the results here have shown, this was not the case. In fact, most players struck the ball within the zone marking a straight hit. In other words, within the zone that would have most likely been a result of good anticipation of coincidence. This implies that the task-specificity of swinging a bat to meet a baseball can also be attributed to the differences between the actual swinging act and the BAT activity (6, 15, 16). It has been previously stated that the anticipation of a pitched ball is a spatial-temporal task in a dynamic environment that cannot be successfully compared to the temporal task in a static environment offered by the BAT (16).

While one may not easily refute this hypothesis, the information offered by the BAT may be of considerable importance. The simple fact that most players were statistically correct in their anticipation of being early or late on the BAT offers a means of feedback in practicing the crucial act of anticipation of coincidence at the batting mound. Further, it was shown in this paper that players consistently late on the BAT suffered more strike outs in the batting

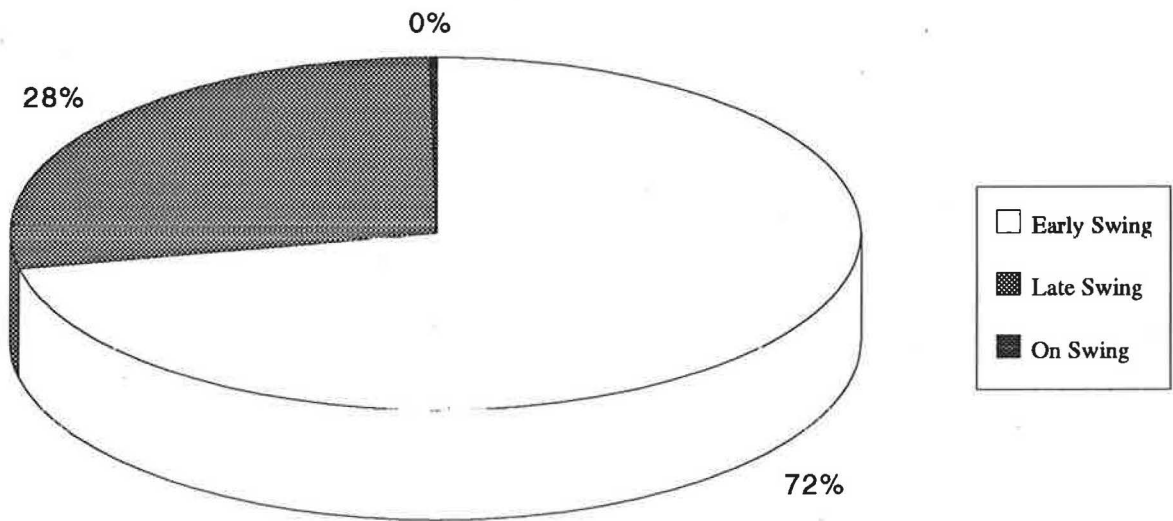
age. This implies that practice on the BAT could result in better ball contact for such players.

Interestingly, players fared worse on their anticipation of coincidence when the BAT trigger device was held in such fashion as to simulate a held bat in anticipation of a pitch. The reasons for this may be interpreted in several different manners, but visually it appears to indicate that the trigger device held in the eye's peripheral field may be enough to distract attention from the incoming target (baseball). Increasing BAT trigger device size to mimic standard bat size and better demarcating held parameters might lead to some interesting results.

It is of further interest to note that players whose performance was superior at the plate, in terms of ball placement, had a better anticipation of coincidence on the BAT. Although not staggering statistically, from this one may infer some relevant facts. In dealing in thousandths of a second with respect to timing, as is required in higher level baseball, it is difficult to ascertain what is statistically relevant by any means. The observation here that these players appeared to have better BAT timing might suggest that it is necessary to either increase the velocity of the BAT, increase test sample size, or simply change the BAT target parameters to better determine if this finding may become statistically more applicable. Indeed, viewing times must be made exactly equal for the BAT and the pitched ball. Perhaps, future work will better correlate these two variables.

We have thus seen how the BAT may be employed to provide the collegiate baseball player with valuable information that might improve his/her game. As discussed earlier, when comparing BAT results to batting averages the correlation was not statistically relevant (16). It would be of interest to see what would happen to player's batting averages over a period of time after substantial BAT training. Further, adjustments to the protocol discussed herein might provide for studies offering further valuable information when comparing BAT activity to the actual activity of anticipating a ball's arrival and making proper contact.

Figure 1. Timing of swing according to the Bassin Anticipation Timer.



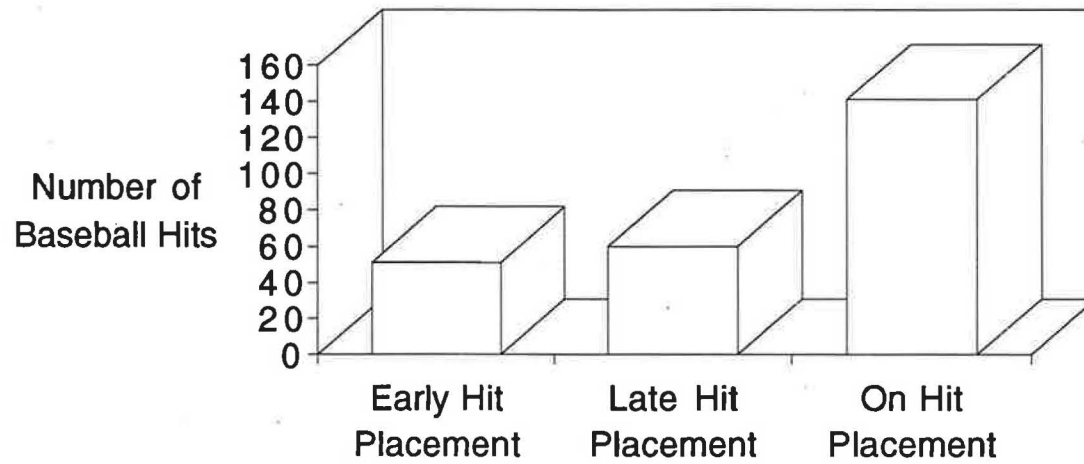


Figure 2. Actual ball location after being struck. Note that most players hit the ball within the criteria for being a straight hit. See text for specific criteria.

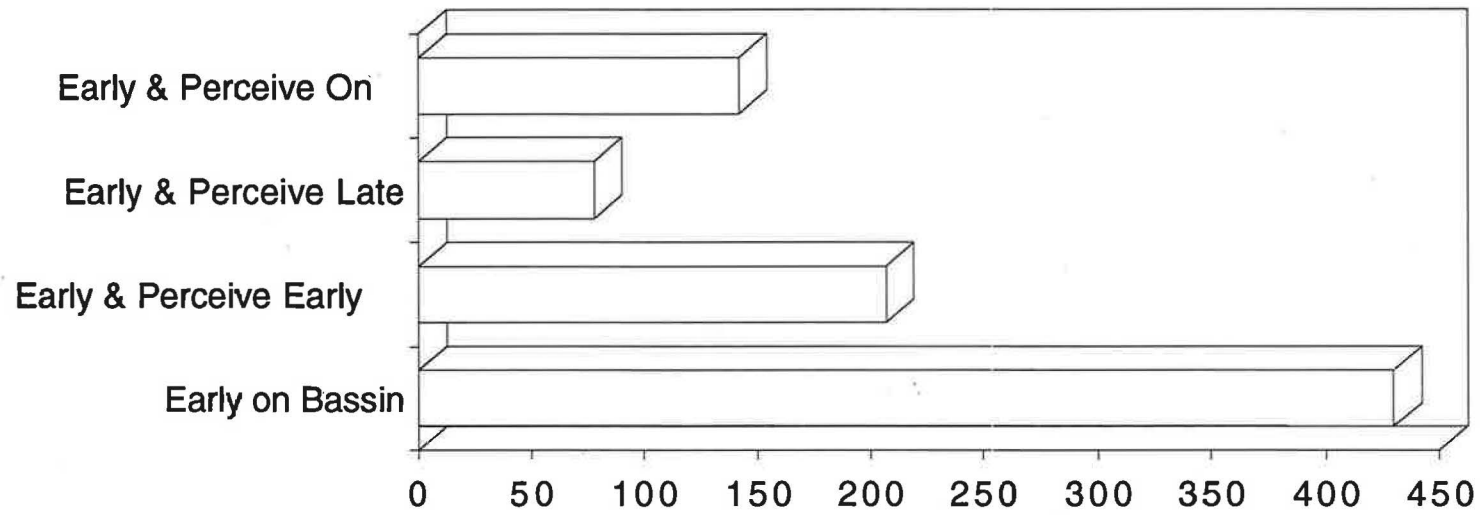


Figure 3. Players perception of their Bassin hit versus actual Bassin Timer reading.

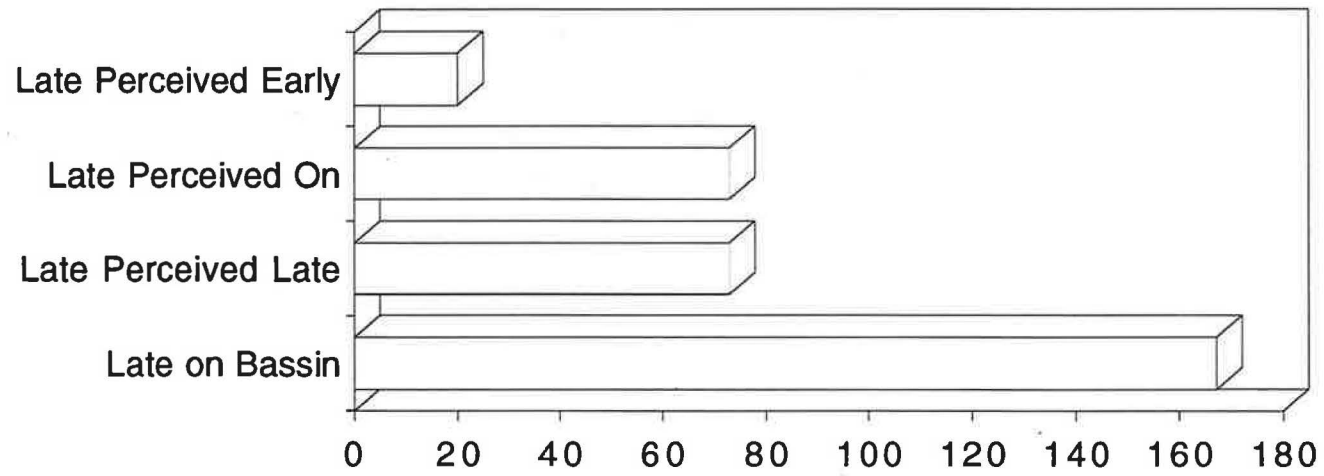


Figure 4. Players perception of their Bassin hit timing versus actual performance on the Bassin Anticipation Timer. Values and interpretations pertain to a late swing.

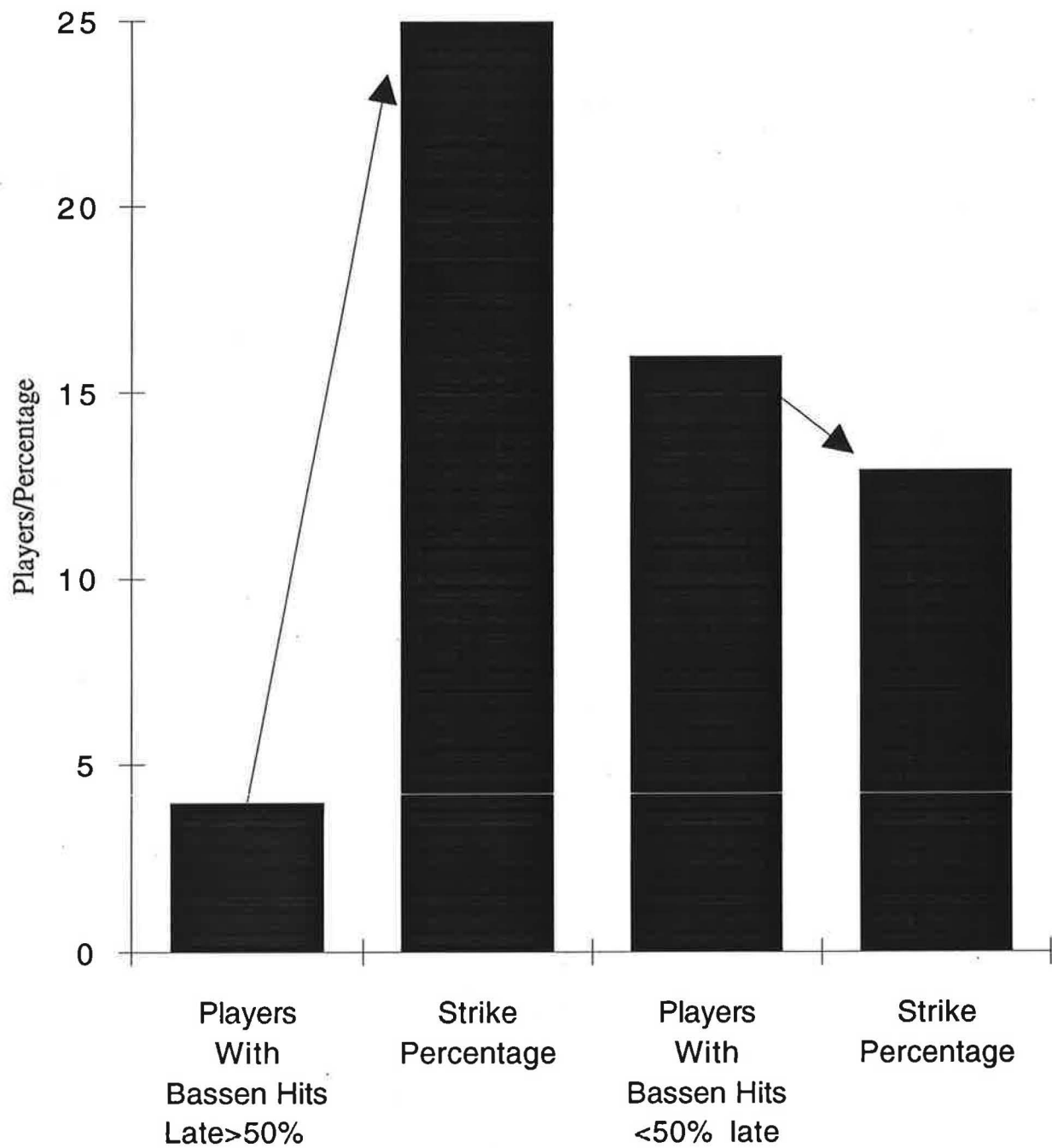


Figure 5. The strike frequency as related to the swings of players who were late on >50% of the trials on the Bassin. For comparison purposes, the frequency of strikes for those players late on <50% of the trials on the Bassin is also illustrated.

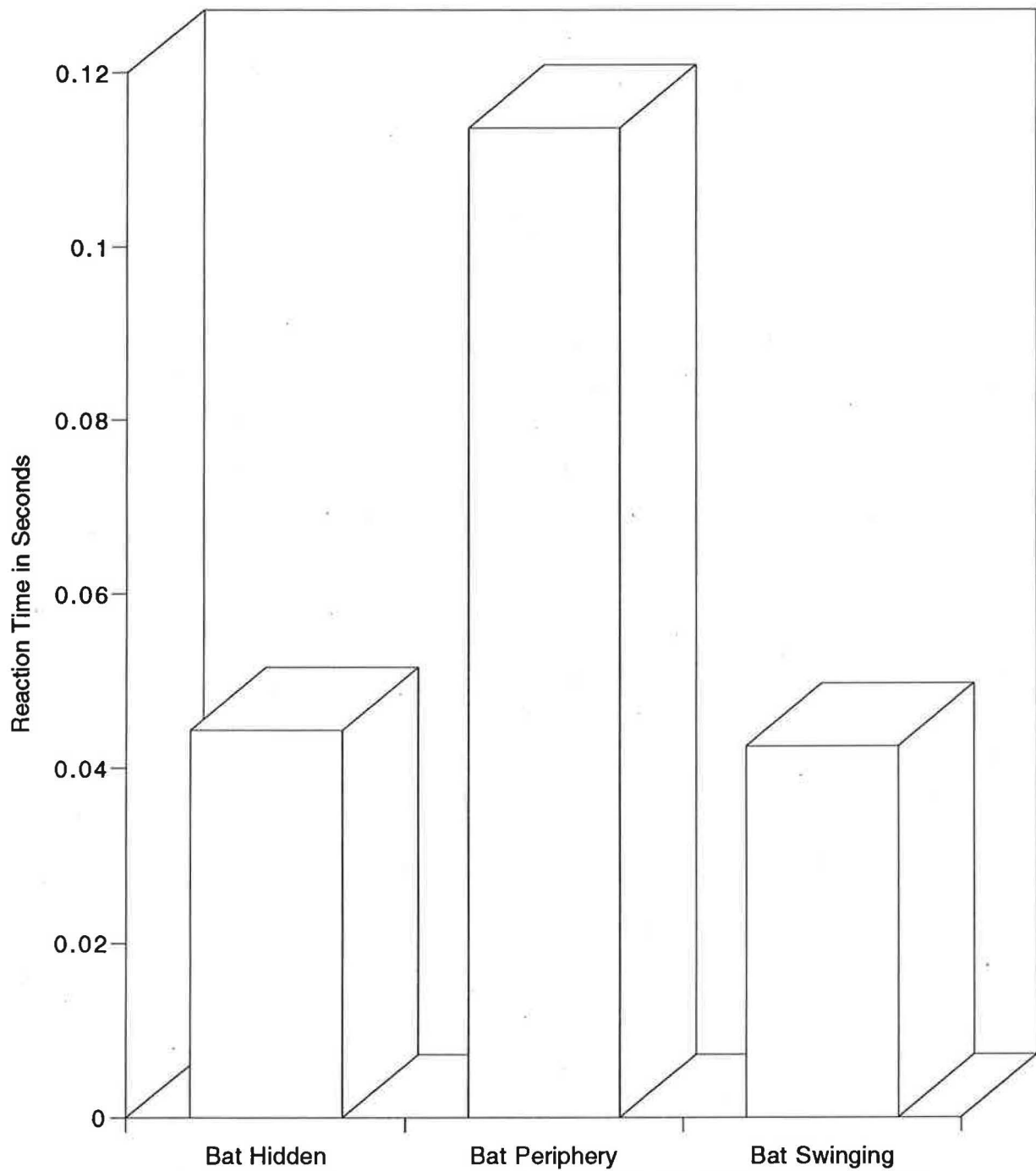


Figure 6. Overall player reaction time on the Bassin Anticipation Timer. Please note that the closer to "zero" the reaction time approaches, the better the player's reaction time.

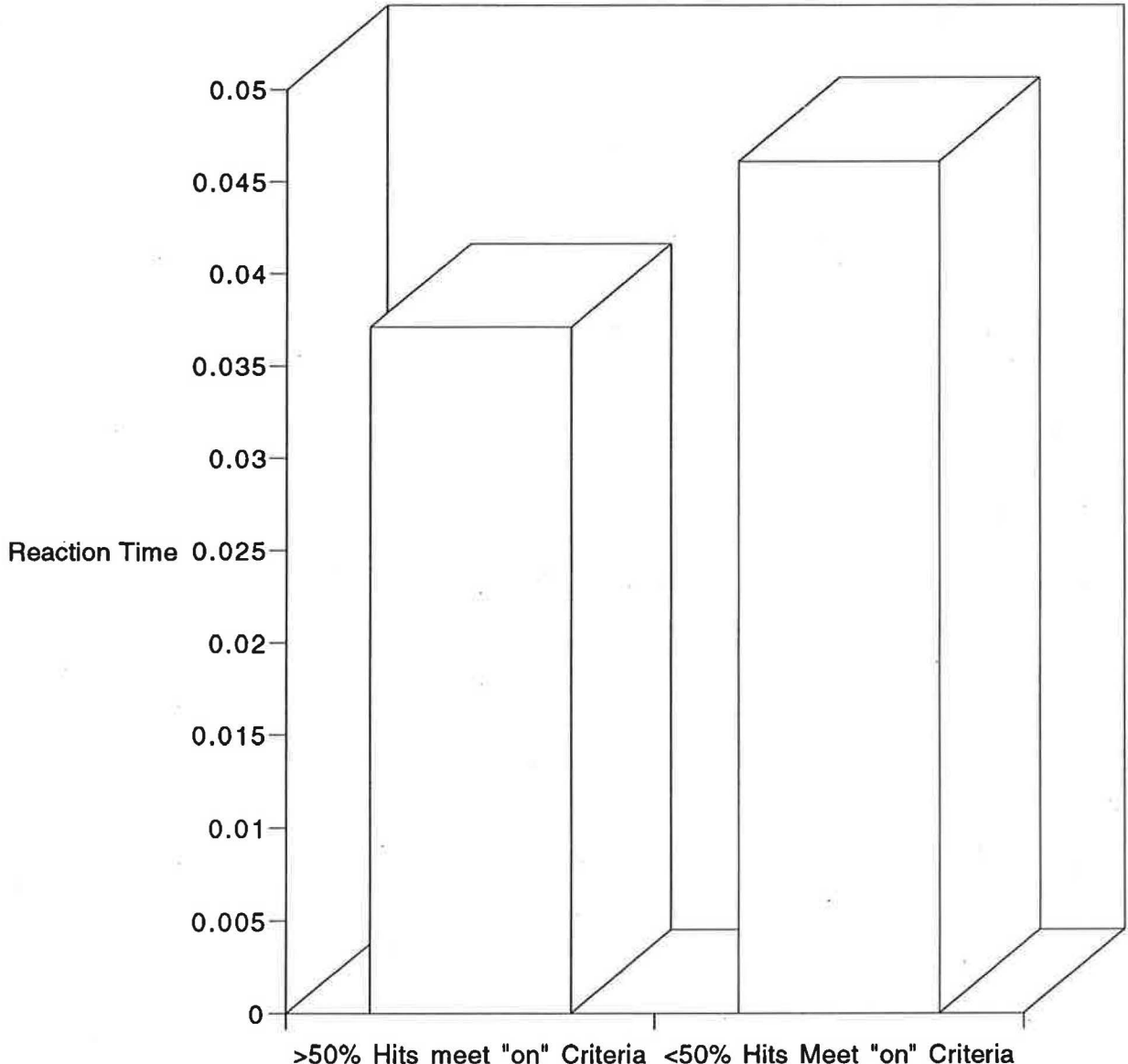


Figure 7. Reaction times of those players who hit on greater than 50% of their swings in the "on" location vs those who failed to meet this criteria at least 8x out of their allotted 15 swings. Reaction times noted are for trials with the bat in motion.

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