

Thesis Project Portfolio

Data Visualization: The Crossroads Between Computer Science Curriculum and Baseball

(Technical Report)

Baseball Technology and its Impact on the Player Development Process

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Spring, 2023

Department of Computer Science

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Executive Summary

Player development is the most important aspect of college and professional baseball today. Division 1 college teams are given four years – three for the premier collegiate talent – to maximize their players’ development in hopes of making a postseason run to the College World Series in Omaha. Professional organizations have layers of development as a player progresses through the minor league farm system. Without diving into the specifics of the MLB pay structure, the ability of an organization to effectively use player development to produce affordable major league talent in-house allows teams to spend their money on free-agents to further supplement their roster. My technical project deals with concrete data analysis for player development with structured organizations such as University of Virginia’s baseball program at the collegiate level and USA Baseball’s National Teams at the high-performance amateur level. The STS research paper takes a step back from the technical topic and addresses the cause and potential impacts of data analysis becoming a more available and practiced method of youth baseball player development. Overall, my projects seek to both contribute to the analytical power of organizations such as UVA and USA Baseball while also analyzing how the lower levels of amateur baseball players as well as trainers/player developers are interacting with the technology on a day-to-day basis.

During an internship with USA Baseball in 2022, I was left to explore baseball data visualization and analysis techniques, with free reign on creating any new charts that I felt would be useful. This served as the inspiration for my technical project. Taking the information I had learned over the course of the internship, combined with my two previous seasons of experience with the UVA Baseball program, I created a new data analysis tool for both parties. I was able to use a 5000-line assembly of python code to create a web-based interface, allowing users to access common graphs and metrics that could be used in the analysis of player performance and

as the foundation for player development projects. USA Baseball was able to use the beta-stages of the interface to assist in their player evaluation processes with their national teams. I have used the full-service interface in my work with UVA Baseball this year to get coaches reports and data needed for their player development practices. As of now, working specifically with the pitching staff, the data the interface provides has assisted in the development process of one of the nation's top pitching staffs, currently ranking fourth in the nation in team Earned Run Average (ERA)

The STS research paper worked to understand how baseball technology, like the technology that tracks the data used in the technical project, is both influencing and is influenced by the culture of lower-level amateur baseball. Also, how the availability of the technology has contributed to player development outside of structured organizations such as USA Baseball or college baseball programs. My research found that, despite the risk of overuse injuries to the arm present in popular high intensity/volume throwing programs that promote data incorporation in training, players are pushed towards these technological training methods. The idea of metric optimization is seen as a means to reach higher performance earlier in a career, better setting up players for potential college and professional opportunities at the conclusion of their high school careers. Metric tracking technology has grown in popularity and is now a critical part of most baseball-centric development programs. As a result, the demand from the baseball community for more cutting-edge data tracking technology has increased, as those with the means are continuing to push to be in front of the curve in pursuit of college and professional baseball opportunities.

Overall I am very pleased with the work that I did this year. The STS Research Paper was more complex than I had originally imagined, but I do think I came to a meaningful

understanding as to the mutual shaping of the data tracking technologies and the culture surrounding amateur baseball player development/training methods. The technical project was particularly fruitful. The data interface can serve as a great tool for USA Baseball in their future analysis of players in the coming summers. The same can be said for UVA Baseball. However, the project has been able to take on a more immediate and impactful role with the UVA Baseball program this year. With the completion of the interface I have been able to apply it directly to the analysis that the coaches are looking to perform, and with complete creative control, I have been able to mold the interface to exactly what we here at UVA Baseball want to have at our disposal. For any future researchers that want to pick up where I left off, I highly recommend beginning with looking into biomechanics role in the player development process. While I have not been able to get my hands on this type of data yet, I personally believe it is the next step to unlocking further player development at the collegiate level.