

Software Analytics for Digital Games

Thomas Zimmermann, Nachiappan Nagappan

Microsoft Research
One Microsoft Way, Redmond, WA 98052, USA
tzimmer@microsoft.com
nachin@microsoft.com

Abstract: In this talk, we will summarize our effort in the area of software analytics with a special focus on digital games. We will first introduce software analytics and show important information needs for data scientists working on software data. Next we will present, several examples of how analytics can be used on digital games such as how players are engaged in Project Gotham Racing and how skill develops over time in Halo Reach. We will also point out important differences between games development and traditional software development.

1 Software Analytics

Software Analytics is a subfield of analytics with the focus on software data. Davenport, Harris, and Morison [DHM10] define analytics “*as the use of analysis, data, and systematic reasoning to make decisions.*” Software data can take many forms such as source code, changes, bug reports, code reviews, execution data, user feedback, and telemetry information. Analysis of software data has a long tradition [MT13] in empirical software engineering, software reliability, and mining software repositories communities.

Since its inception in 2005, the mission of the Empirical Software Engineering (ESE) group at Microsoft Research is to “*empower software development teams to make sound data-driven decisions by deploying novel analytics tools and methods based on ESE’s empirical research on products, process, people, and customers*” [ESE13]. The work by ESE includes specific guidelines and recommendations for analytics tools [BZ12] and data scientists [AB13]. In this talk, we focus on analytics for digital games: player engagement in Project Gotham Racing [Hu12] and skill development in Halo Reach [Hu13].

2 Skill in Halo Reach

As an example of analytics for digital games, we describe a project on characterizing the skill of players in Halo Reach. We selected a cohort of 3.2 million players who started playing the game in the release week. To quantify the skill of each player we used the TrueSkill rating. We analyzed the skill time series for different groups of players in the cohort, focussing on play intensity, *play breaks* (summarized below), other titles played, as well as skill change and retention. The complete findings are in a CHI paper [Hu13].

Figure 1 shows behaviors that players exhibit after breaks. The change in skill from before the break to after the break is illustrated by the 4 lines representing the next 1, 3, 5, and 10 matches after the break. When players are not taking breaks (breaks of 0 days), skill generally increases, as evidenced by the climbing intercepts on the y-axis. Breaks of 1–2 days correlate with a small drop in skill in the next match played after the break, but have little long-term effect. Longer breaks correlate with larger skill decreases, but the relationship is not linear. More concretely, a 30 day break correlates with a skill drop of 10 matches of play; this is shown by the intersection of the 10 games later line with the x-axis. Thus, the amount of time required to regain skill following a 30 day break is only about 3 hours of gameplay (matches are typically 15 minutes). Insights like this can be used to improve matchmaking algorithms as well as retention of players.

Acknowledgements. Thanks to Tim Menzies, Emerson Murphy-Hill, Ken Hullett, Sauvik Das, Jeff Huang, Thomas Debeauvais, and Gifford Cheung as well as our collaborators at Xbox and IEB.

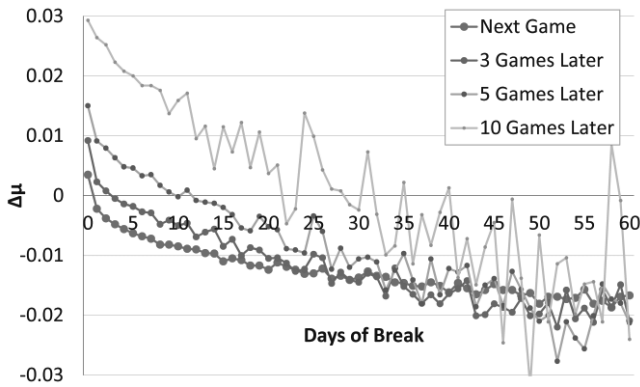


Figure 1. Skill change after different lengths of breaks for the next match, 3 matches after, 5 matches after, and 10 matches after the break.

References

- [DHM10] Thomas H. Davenport, Jeanne G. Harris, Robert Morison. Analytics at Work: Smarter Decisions, Better Results. Harvard Business Review Press, 2010.
- [MT13] Tim Menzies and Thomas Zimmermann. Software Analytics: So What? IEEE Software, 30, 4 (July 2013), 31-37.
- [Hu12] Kenneth Hullett, Nachi Nagappan, Eric Schuh, and John Hopson, Empirical analysis of user data in game software development, in Proceedings of the International Symposium on Empirical Software Engineering and Measurement (ESEM), 2012.
- [Hu13] Jeff Huang, Thomas Zimmermann, Nachiappan Nagappan, Charles Harrison, and Bruce Phillips, Mastering the Art of War: How Patterns of Gameplay Influence Skill in Halo, in Proceedings of the Intl. Conf. on Human Factors in Computing Systems (CHI), 2013.
- [ESE13] Empirical Software Engineering Group (ESE), <http://aka.ms/esegroup>
- [BZ12] Raymond P.L. Buse and Thomas Zimmermann, Information Needs for Software Development Analytics, in Proc. of Intl. Conf. on Software Engineering (ICSE), 2012.
- [AB13] Andrew Begel and Thomas Zimmermann, Analyze This! 145 Questions for Data Scientists in Software Engineering, Tech. Report, no. MSR-TR-2013-111, 28 Oct 2013.