Shell Scripts: How Businesses Can Utilize Shell Scripts to Automatize Database Tasks
(Technical project)

The Influence that Mobile Devices Have on Children K-5
(STS project)

A Thesis Prospectus
In STS 4500
Presented to
The Faculty of the
School of Engineering and Applied Science
University of Virginia
In Partial Fulfillment of the Requirements for the Degree
Bachelor of Science in Computer Science

By
Darnell Khay

December 9, 2022

On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

ADVISORS

MC Forelle, Department of Engineering and Society

Briana Morrison, Department of Computer Science

Introduction

Children K-5, which are students in kindergarten through 5th grade, have grown to become a large portion of the consumer base for mobile devices (Eather & Weir, 2016). These devices offer features that have attracted many children who are impressionable by nature. Capabilities such as playing video games and indulging in media have resulted in children becoming avid users (Hosokawa & Katsura, 2018). The physical habits of the general population have been of a concern recently and it is due to some environmental factors such as living environments (Sarafis et al., 2020). For children specifically, the environment of classrooms may also be cause for the decrease in physical activity (Segura et al., 2021). Regardless, children at this age are at a time where they have the greatest potential to improve their physical abilities but instead are spending too much time on a screen (Mitchell, 2019).

There are currently plenty of research being done on this matter, although, most have not reached complete success yet. With research comes data, and data must be stored in some fashion in order to be analyzed. Data is typically stored in databases that often times are not as efficient as they can be. Perhaps one of the reasons the research being done on this topic is not progressing as far as it can is because of the inefficiency of possible database tasks. Outside of research, a handful of businesses store their data in databases too. They also face the same issue with having to deal with duties that take too long to manually complete. I propose a solution for this, which is to incorporate automation using shell scripts. Scripting has been known to improve the runtime of technical tasks such as handling files, network communication, databases and maintaining security (Cai & Arney, 2018). From my own experiences, I worked alongside a credit card scrum team that dealt with over 20 database applications. The company was going

through a migration process where all applications and their projects had to be updated on a platform called GitHub. The task of updating each application and their projects was necessary to perform continuous integration and deployment without a failure occurring. The DevOps team provided a shell script that was supposed to assist the updating tasks but it contained too many errors and limited documentation. Therefore, I developed a secondary shell script to handle those errors and implement other features that would improve the overall efficiency of the migration process. Shell scripts have a great impact on businesses as they also can help research tasks that may involve data science methodologies (Bruijn, 2021). If shell scripts were to be included in the process, the answer to finding out the true reasons for how mobile devices influence physical inactivity in children K-5 will definitely be reached.

Technical Topic

There is a task that must be completed within several weeks. It involves hundreds of applications and each one needs to be updated the same way. One option is to manually go through each one and update them according to certain company standards. Is this solution feasible given the time frame? The method is possible, but it is certainly not the most efficient.

The data engineering teams that I worked alongside with were put up with this challenge. There were over 20 applications and each one contained roughly six projects each. As part of company requirements, the applications had to go through an annual migration process. Part of the process involved updating a file for each project to have an up-to-date version number. Keeping each project to be as up to date as possible prevented failures when testing and deploying the applications on an external platform. The DevOps team created a shell program to assist the process, however, it resulted in bugs and reworks every week along with limited

documentation. I proposed to create another shell program that would help the initial one with automation.

Shell scripts and their benefits they provide for automating tasks have been previously shown across multiple works. One research included a suggestion for a programming course that teaches students scripting fundamentals because of how useful it truly is. More importantly, it emphasizes the various fields of work that can benefit greatly from the automation that shell and other scripting languages may provide (Cai & Arney, 2018). One of these fields includes SQL databases which was the type of database that I helped managed with my team. Another source gives credit to mainframe programming languages such as Python and Java, but also declares shell scripting to still be very useful for day-to-day tasks which is similar to the task that I dealt with (Padwardhan 2022).

The senior engineers and I got together to discuss the design and implications of this secondary shell program that I suggested as a solution. The process of this program was divided into several subsections: the development server, requirements, automation and documentation. After thorough effort being put in for each step of the process, I ultimately finished developing the program in a few weeks. Upon completion, I tested it to simulate the faster runtimes that updating tasks now took. Running my shell program reduced the runtime of the initial script from approximately two hours to under ten minutes. I demonstrated to the senior engineers in my team to prove this efficiency. All features of the requirements were also tested and proven to function properly with no bugs found. I distributed the program and the documentation to other engineers across other teams so that they could understand and learn for their own future use.

It would be no surprise if such efficiency can be seen with researching the data on children’s sedentary lifestyle as well. I suggest that in order for massive amounts of data to be

properly analyzed, shell scripts could be used to assist the process. Shell scripts are versatile and do not have to be used in a business setting. It would ultimately help fish out the reasons for how mobile devices affect the lifestyle of contemporary children K-5.

STS Topic

One of the current leading causes of mortality is physical inactivity and this is because over half of the illnesses in developed countries are from living a sedentary lifestyle (Muntaner et al., 2016; Spring et al., 2013). Children K-5 are young and as mentioned earlier, they should be engaging in physical activities more often than spending time on the screen. Given what is known about the influence that mobile devices have on children K-5, do the engineers for mobile devices have a duty to make it so that children are not utilizing them in an unhealthy manner? The engineers who are involved in the design of mobile devices would be best to first consider for the influence that the mobile devices have on children becoming inactive, specifically the duties they have for their consumers.

I will be utilizing Martin and Schinzinger's piece, *Introduction to Engineering Ethics* to explore the different ethical duties that mobile device engineers have when designing their product. I am also interested in looking into the potential conflicts that mobile device engineers may encounter when exercising their duties. In the case that I do discover some conflict, I will be referring to Prima Facie Duties to analyze which duties appear to matter more than others. This ethical duty framework and exploration of Prima Facie Duties would be best to use in my research because of the significance that mobile devices have on children K-5. Since mobile devices have a great significance in the lives of children K-5, they also may have a large impact

on children becoming inactive which is why I believe it is necessary to investigate whether mobile device engineers are exercising their duties ethically.

As mentioned earlier, mobile devices are very meaningful to children K-5. For example, tablet usage in children increased by 7% from 2013 to 2014 ("One in Three Children Now Have Their Own Tablet Computer," 2014). To further showcase how impactful mobile devices are for children K-5, one of the top mobile device companies Apple discovered they could rely on children as consumers which led them to target their marketing to cater towards children ("Kids iPad Product' Marketing Plan"). In particular when the first and second generations of the iPad were released in the early 2010s, Apple marketed the device as a valuable learning tool for children (Halpert, 2012). This attracted many parents in purchasing the iPad hoping to enhance their children's education. As a result, many children applications in the app store appeared in the top charts for the most downloads and purchases, which became 15% of the $14 billion revenue for Apple in 2012 (Halpert, 2012).

The significance of mobile devices to children K-5 exists due to the design choices of mobile devices. The design of mobile devices consists of many attractive features with one feature being that they are highly portable, making them very accessible (Hosokawa & Katsura, 2018). The design of mobile devices also includes some shortcomings such as weak security out of the box which most consumers are unaware of (Etaher & Weir, 2016). Due to the limited restriction capabilities on mobile devices, most parents are not knowledgeable of the parental controls that they can utilize to limit their children's usage of these devices. Only 14% of parents have confirmed in one study to consistently check their children's mobile device usage (Brown, 2019). With a variety of features that seem to emphasis freedom and ignorance, it is no surprise that children are spending an excessive time on the screen and not enough on physical activity.

Fortunately, there has been research and studies done in order to mitigate the issue of physical inactivity. One research is looking into incorporating a feature on mobile devices to automatically detect when a child is currently using one (Nguyen et al., 2018). Another study proposed to simply use mobile devices as a platform to promote healthy habits with an educational game (Janko et al., 2017; Molnar & Kostkova, 2016). This commonality is also seen in another group of researchers looking to invent a game that uses physical movements to teach languages for children (McNally et al., 2014). Additionally, some children are already experiencing health issues such as type 1 diabetes. To combat this deeper problem, another research has explored ways to use IoT sensors with mobile health capabilities to minimize the health risks for these children (Zholdas et al., 2022).

To contribute to the efforts and research previously made in handling the issue of children becoming inactive, I would like to contribute with the idea that we should be mindful of the ethical implications behind the design choices for mobile devices. The consumers that are of concern is children K-5 and the objective is to find a way for them to remain physically active given the existence of this technology that is difficult to give up. As engineers we should know the consequences which are defined by our interpretations of technology (Pinch & Bijker, 1984). Considering the consequences, I hope that my research enables mobile device engineers to understand that they have the capability and responsibility to exercise their duties and to properly address the problem (Andrews, 2006; Martin et. al, 2010).

Research Questions and Methods

Do mobile device engineers have a duty to design their device in a way that does not influence physical inactivity in children K-5? In order to effectively answer this question, I will

be doing a literacy analysis using a variety of sources. These works will be gathered from news articles, scientific journals, blog posts and other notable sources that can be found first from the library databases and then online. I will be specifically looking for ones that speak about the history of mobile devices and their userbase since it is a necessity to provide context for the background. Research on the physical behavior of children K-5 and how it has changed over time as mobile devices became apparent in their lives will be needed next for thorough analysis and evidence to answer the question. I will also include a few readings from my STS 4500 class that offer relevant STS concepts that I could apply to my topic. Among the sources will contain studies that provide possible solutions to the topic of my question as well. These sources may be technical depending on the field of work that is being done, however, I will be connecting them to the STS concepts that will be discussed in my research. The methodology described will ensure that only essential context will be included and that this research question will be answered optimally. Based on the depth and usage of the resources involved, this research may also be extended to other applicable works in science and technology to present a larger impact that my topic may have.

Conclusion

The technical portion of my research will deliver a template for a shell script that businesses can use to automatize database tasks. However, this general idea of a shell script does not have to be used solely for enterprises. It could also be applied to researching scholarly topics that require looking through a vast amount of data and statistics, similar to how my research could be done. Since the technical portion has already found success, business leaders that

consider my work would now be able to find a way to incorporate shell scripts for their own daily operations.

For my STS research, I do not anticipate discovering any potential duty conflicts that mobile device engineers may experience. Although, I do hope that my results inspire mobile device engineers to reconsider their design choices and understand the duties they have for their consumer base. I also expect my analysis of the duties that mobile device engineers have to allow other engineers in different fields of work to carefully consider the implications and consequences that their product may have on their users. Especially the ethical duties that all engineers inherently must keep in mind when designing their technology. I would like my findings to encourage all engineers to understand that design matters and it is up to them to decide what is truly important for the consumers wellbeing.

Citations

Andrews, C. J. (2006). Practicing technological citizenship. *IEEE Technology and Society Magazine*, *25*(1), 4–5. https://doi.org/10.1109/MTAS.2006.1607713

Brown, E. (2019, July 29). Most parents never check their children's devices. Retrieved October 25, 2022, from ZDNET website: https://www.zdnet.com/article/most-parents-never-check-their-childrens-devices/

Bruijn, L. de. (2021, July 13). Shell scripts for Data Science in Python. Retrieved October 27, 2022, from Medium website: https://towardsdatascience.com/shell-scripts-for-data-science-in-python-c004c9c6a4c5

Cai, Y., & Arney, T. O. (2018). Scripting for Administration, Automation and Security. *Proceedings of the 19th Annual SIG Conference on Information Technology Education*, 147. New York, NY, USA: Association for Computing Machinery. https://doi.org/10.1145/3241815.3241829

Etaher, N., & Weir, G. R. S. (2016). Understanding children's mobile device usage. In B. Cartwright, G. Weir, & L. Y. C. Lau (Eds.), *2016 Ieee International Conference on Cybercrime and Computer Forensic (icccf)*. New York: Ieee. Retrieved from https://www.webofscience.com/wos/woscc/full-record/WOS:000390123800017

Halpert, J. (2012, March 21). iChildren: How Apple Is Changing Kids' Brains. Retrieved October 25, 2022, from The Fiscal Times website: https://www.thefiscaltimes.com/Articles/2012/03/21/iChildren-How-Apple-Is-Changing-Kids-Brains

Hosokawa, R., & Katsura, T. (2018). Association between mobile technology use and child adjustment in early elementary school age. *PLoS ONE*, *13*(7), e0199959. https://doi.org/10.1371/journal.pone.0199959

Janko, V., Cvetković, B., Gradišek, A., Luštrek, M., Štrumbelj, B., & Kajtna, T. (2017). e-Gibalec: Mobile application to monitor and encourage physical activity in schoolchildren. *Journal of Ambient Intelligence & Smart Environments*, *9*(5), 595–609. https://doi.org/10.3233/AIS-170453

Kids iPad Product' Marketing Plan | Business Essay Example. (n.d.). Retrieved December 6, 2022, from EssayBizLab website: https://essaybizlab.com/kids-ipad-product-marketing-plan/

Martin, M. W., Schinzinger, R., & Schinzinger, R. (2010). *Introduction to engineering ethics* (2nd ed). Boston: McGraw-Hill Higher Education.

McNally, B., Guha, M. L., Norooz, L., Rhodes, E., & Findlater, L. (2014). Incorporating peephole interactions into children's second language learning activities on mobile devices. *Proceedings of the 2014 Conference on Interaction Design and Children*, 115–124. Aarhus Denmark: ACM. https://doi.org/10.1145/2593968.2593982

Mitchell, J. (2019). Physical Inactivity in Childhood from Preschool to Adolescence. *ACSM's Health & Fitness Journal*, *23*(5), 21–25. https://doi.org/10.1249/fit.0000000000000507

Molnar, A., & Kostkova, P. (2016). Ubiquitous Bugs and Drugs Education for Children Through Mobile Games. *Proceedings of the 6th International Conference on Digital Health Conference*, 77–78. Montréal Québec Canada: ACM. https://doi.org/10.1145/2896338.2896366

Muntaner, A., Vidal-Conti, J., & Palou, P. (2016). Increasing physical activity through mobile device interventions: A systematic review. *Health Informatics Journal*, *22*(3), 451–469. https://doi.org/10.1177/1460458214567004

Nguyen, T., Roy, A., & Memon, N. (2018, August 5). *Kid on The Phone! Toward Automatic Detection of Children on Mobile Devices*. arXiv. Retrieved from http://arxiv.org/abs/1808.01680

One in three children now have their own tablet computer. (2014, October 9). Retrieved October 25, 2022, from Ofcom website: https://www.ofcom.org.uk/about-ofcom/latest/media/media-releases/2014/media-lit-audit-oct2014

Patwardhan, B. (2022, April 1). Focus: Shell Scripting is Still Going Strong. *Open Source for You*. Retrieved from https://www.proquest.com/advancedtechaerospace/docview/2655026351/citation/6741DC78962F45DDPQ/1

Pinch, T. J., & Bijker, W. E. (1984). The Social Construction of Facts and Artefacts: Or How the Sociology of Science and the Sociology of Technology might Benefit Each Other. *Social Studies of Science*, *14*(3), 399–441. https://doi.org/10.1177/030631284014003004

Sarafis, I., Diou, C., Papapanagiotou, V., Alagialoglou, L., & Delopoulos, A. (2020). Inferring the Spatial Distribution of Physical Activity in Children Population from Characteristics of the Environment. *2020 42nd Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)*, 5876–5879. Montreal, QC, Canada: IEEE. https://doi.org/10.1109/EMBC44109.2020.9176246

Segura-Martínez, P., Molina-García, J., Queralt, A., del Mar Bernabé-Villodre, M., Martínez-Bello, D. A., & Martínez-Bello, V. E. (2021). An Indoor Physical Activity Area for Increasing Physical Activity in the Early Childhood Education Classroom: An Experience for Enhancing Young Children's Movement. *Early Childhood Education Journal*, *49*(6), 1125–1139. https://doi.org/10.1007/s10643-020-01125-6

Spring, B., Gotsis, M., Paiva, A., & Spruijt-Metz, D. (2013). Healthy Apps: Mobile Devices for Continuous Monitoring and Intervention. *IEEE Pulse*, *4*(6), 34–40. https://doi.org/10.1109/MPUL.2013.2279620

Zholdas, N., Mansurova, M., Postolache, O., Kalimoldayev, M., & Sarsembayeva, T. (2022). A Personalized mHealth Monitoring System for Children and Adolescents with T1 Diabetes by Utilizing IoT Sensors and Assessing Physical Activities. *International Journal of Computers, Communications & Control*, *17*(3), 1–14. https://doi.org/10.15837/ijccc.2022.4558