

Undergraduate Thesis Prospectus

UVA-Themed Pinball Machine
(technical research project in Mechanical Engineering)

Profit Desires of Digital Media Companies vs. Advocates of Childrens' Wellbeing
(sociotechnical research project)

by

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October 27, 2023

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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.

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General Research Problem

How have critics of digital media promoted alternative forms of entertainment?

In the late 90s, many forms of digital media like video games and nascent social media sites were created. In the early 2000's they became widespread and integrated into American society, particularly among the youth. Consequently, many adults critique digital media and its negative impacts on youth development.

A particular concern with digital media is that it limits social and in-person interaction, things that “[benefit] your mental and physical health. (Williams, 2022). Thus, both critics of digital media and healthy lifestyle advocates promote socially engaging and in-person entertainment alternatives.

UVA-Themed Pinball Machine

How can a University of Virginia (UVA)-themed pinball machine be designed to appeal to students?

How can the creation of a UVA-themed pinball machine improve the mental health of university students? I am in Gavin Garner's mechanical engineering capstone group. Eighteen students, Dr. Garner, and I will design and manufacture a UVA-themed pinball machine that features mechanical and electrical components with a budget of \$200 per student.

Existing pinball machines are high-cost and complex, featuring many synergistic mechanical and electrical components. Because of this, there are limited themes. Custom designs that are not manufactured at a large scale are uncommon (Pinball Castle). With UVA's thousands of students, faculty, and alumni, there is no existing UVA-themed pinball machine. Additionally, some pinball machines have suboptimal designs. For example, leading pinball machine manufacturers

like Stern use solenoids as actuators to power flippers (Sternpinball). A solenoid is a coil of wire that draws current to induce a magnetic field and push a ferromagnetic plunger linearly.

Although solenoids act as powerful and quick actuators, they draw a lot of power. An alternative to this would be designing and manufacturing two-phase solenoids that limit power consumption by splitting the flipper motion into a high-power initial drive and a low-power secondary drive.

Such inefficiencies in pinball machines drive up operating costs and often lead to mechanical or electrical failure. Innovating mechanical and electrical redesigns could improve the pinball industry.

To reinvent the pinball machine we will use a combination of mechanical prototyping, electrical design, and software development. Mechanical prototypes will be drafted in SolidWorks, a Computer-Aided-Design software, and manufactured using a variety of methods like 3D printing and laser-cutting. Electrical designs will be drafted on paper and tested at smaller scales. Software development will be done through one or more Parallax Propeller 2 microcontrollers.

If successful, our team will have a functioning, energy-efficient, and low-maintenance UVA-themed pinball machine that will be installed at the UVA student center, 1515, in mid-December.

Profit Desires of Digital Media Companies vs. Advocates of Children's Wellbeing

How have advocates of children's well-being promoted physical games as a substitute for digital entertainment?

As digital games and entertainment have become common for kids in the US, physical games with social aspects have become less popular. Critics of digital media claim that it has

affected children's development. Researchers at the University of Michigan, Central Michigan University, and Iowa State University created the Problematic Media Use Measure (PMUM), a survey for parents of children ages twelve and under. The survey measured both the child's screen usage and problems that arose with it such as screen dependence, anger issues, and effects on friendships. The PNUM study concluded that there is a correlation between screen time over two hours a day and difficulties in psychosocial functioning (Domoff et al., 2019). With free-to-play video games such as Fortnite Battle Royale (Fortnite) becoming popular, children are gaming more than ever, and children with attention difficulties are especially prone to digital media addiction. There is evidence that screen addiction leads to “short attention span, poor language development, difficulties with time management and organizational skills, poor impulse control and frustration tolerance” (Sen, 2019).

As a result of digital media's negative effects on youth development, physically interactive games like board games have been encouraged by parents and concerned advocates of children's development. Even simple board games can reinforce social skills at a young age. First-grade teacher Kristine Carithers, in collaboration with Dr. Kathleen Collins and undergraduate researchers at The Pennsylvania State University, developed a rainforest-themed, socially interactive game for Carithers' students. The game allowed for the students to be creative and "express themselves through all of their available expressive, communicative, and cognitive languages” (Collins et al., 2011). Substitutes for digital media such as the rainforest game may be better for the social development of children.

As a response to the comeback of physical games, digital media companies have advertised video games and other products to be more social and interactive. For example, the physically active game Dance Dance Revolution (DDR) was an arcade game created in Japan in

1998. In 2001, a version of DDR was released by Konami Group Inc. on an early gaming console, the PlayStation 2, in North America and advertised as an active game that could be played at home. Because Konami Group Inc. is a for-profit company, it is in their best interest to carefully advertise games to maximize profits. Games like DDR that are advertised as physical and social will appeal to children and, more importantly, to the parents buying them. Many video games are designed to be addictive. University of California Berkeley doctoral student in film studies, Iriene Chien, claims that “even the relegation of home-console gameplay to ‘home’ is problematic, since in addition to the remote spaces that the Internet opens up to them” (Chien, 2006).

Participants include parents and advocates of children’s physical and mental health who try to limit children’s video game playing (The Nemours Foundation), advocates of active lifestyles (Active Towns), digital media companies that have responded to the resurgent interest in board games by promoting their video games as socially interactive (Epic Games), and consumers and advocates of digital media (International Game Developers Association (IGDA)). The Nemours Foundation advocates for children’s physical and mental health by recommending parents limit daily digital media consumption. They claim that violent video games are linked to aggressive behaviors, and most video games are not as physically and mentally stimulating as outdoor activities and sports (The Nemours Foundation, 2022). Active Towns is an advocacy group for active lifestyles that explores how “the built environment influences human behavior related to active living and especially active mobility” (Home, 2023). Epic Games is a for-profit company that has surged in popularity due to its release of the video game Fortnite in 2017. Game Developing companies have advertised their addictive video games as interactive and playable with friends. Epic Games introduced a “Social Overlay” to their games including

Fortnite that allows players to integrate their gaming experience with other gamers (“Social Overlay Overview”, n.d.). Such a feature seemingly fulfills the absent social aspect of many video games. Finally, the IGDA supports digital media companies, claiming that video games bring communities together and foster a sense of belonging. Moreover, the IDGA helps “represent the interests of developers during important conversations that affect our industry and communities” (*Core Values*, n.d.).

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