C.H.E.S.S.B.O.A.R.D.: AN INTERACTIVE CHESS LEARNING AID

USING ACTOR-NETWORK THEORY TO ANALYZE THE MARKET FAILURE OF THE NINTENDO VIRTUAL BOY

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 Electrical Engineering

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November 8, 2024

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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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Introduction

In a study conducted by Ebenezer Joseph, school children undergoing bi-weekly chess training over the span of a year were observed to have significantly increased IQ scores compared to that of a control group (Joseph et al., 2016, p. 3). Another study, performed under the Learning to Think Project, produced results which inspired the Venezuelan government to introduce mandatory chess studies into public school curriculums (Ferguson, 1995, p. 9). These studies support the common conception that chess is a powerful tool to improve critical thinking skills, especially during the vital learning phase children undergo. Designing engaging tools for this demographic will help promote development of these skills for the rest of their lives. To help achieve this goal, we will develop a smart interactive chess board with the children's experience in mind. Such a device will engage and entertain this audience to best retain their attention while promoting an intuitive and casual learning environment.

Due to the sociotechnical nature of designing for children, it is necessary to understand how social factors interacting with technical factors can influence the success of projects designed for children. To better understand these factors' interactions, I will draw on the science, technology, and society (STS) framework of actor-network theory (ANT) to examine the failure of Nintendo's Virtual Boy, a children's game console discontinued only a year after its North American release (Boyer, 2009). Here, I plan to consider the relationships between the Virtual Boy's technical and social factors, such as the console's design and the conflicting views of the console held by the device's stakeholders, which led to the console's discontinuation.

In designing our smart chess board, failing to take into account the factors related to the Virtual Boy's quick discontinuation could result in a product which fails to reach or properly engage the intended audience, limiting the extent to which this audience will develop critical

thinking skills. Because the challenge of designing for children is sociotechnical in nature, it requires attending to both its technical and social aspects to accomplish successfully. In what follows, I set out two related research proposals: a technical project proposal for developing a smart chess board to teach children about chess and an STS project proposal for examining the relationship between the social and technical factors which led to the discontinuation of the Virtual Boy.

Technical Project Proposal

The average chess grandmaster starts learning how to play very early in their life, with Magnus Carlsen, the current best player in the world entering his first tournament at age 8 (Agdestein, 2004, p. 189). Viewing chess as a tool for improving critical thinking, this young age is an important moment to capitalize on the benefits associated with learning the game. Over the past several years, different "smart" chess boards have been developed to improve the in-person play experience, implementing features such as online and computer play, smartphone interface, and LED indicators to help the user move pieces. Two such boards are the Square Off Pro and ChessUp (Square Off Inc., 2024; Bryght Labs, 2024). Both of these products assist the user by implementing the above features, alongside keeping a transcription of the game. A key difference between the two is that ChessUp has built-in chess-bots, meaning it has some functionality without the associated app, while Square Off Pro requires its app to engage with any of the "smart" elements of the board.

Although these products function for their intended audiences, there are issues for younger children interfacing with them, lying predominantly in the requirement of smartphone applications. For a young child who wants to practice the game without a smartphone, with

Square Off Pro, there would be no difference in experience between a standard chessboard. On the other hand, ChessUp does function independently, with some concessions. In standalone mode, the board does not keep track of the entire game, allowing only one undo to be made at once (Bryght Labs, 2022). Reflecting on all available options at any point during the game is crucial to learning the best choices, so its omission compromises the learning experience of those without smartphones. Additionally, ChessUp assumes the user understands some of the basic principles of chess, such as starting piece positions. This information may be inaccessible to a child without a smartphone, hindering play. As these products are being designed with a more mature audience in mind, they fail to consider the needs of a potential young audience who lacks smartphones. In being unable to properly interface with this technology, interest in chess may stagnate among this group, leading to them missing out on the benefits discussed previously.

The goal of this technical project is to design a smart chess board which intuitively teaches this demographic the rules of chess in a manner similar to these other boards, with a greater emphasis on accessibility and the casual play experience. Firstly, our project should assume that our audience knows nothing beyond the fundamentals of how any board game works (i.e. how to swap turns) to cater to the widest possible audience. It is also important however not to inhibit more experienced players who already know how to play to some extent. As such, the LED system from other smart boards will be implemented here, except with programmable RGB lights to indicate as much information through this mode as possible. Without the use of a smartphone interface, many of the more obvious methods of communication are lost to this design. We also plan to use the board itself to indicate the starting position, showing which piece is placed where at the beginning of the game. In addition to this, analog magnet sensors will be used to detect which piece is where at any given board state, giving us the information by which

we can indicate certain things to the user. Other features such as fully functional undo and hint buttons and a timer for more advanced players will also help teach players and give them room for improvement. After completing the prototype and fully testing the design ourselves, we hope to test this among groups of various ages and skill levels, in addition to children. Although specifically catered to children, testing varied demographics can indicate if our approach to the design problem was sufficient.

STS Project Proposal

In July 1995, Nintendo released the Virtual Boy in Japan, a novel game console capable of outputting stereoscopic 3D visuals, mimicking depth through the use of two independent monochrome LED displays embedded within a set of goggles. Although ambitious, the product only sold 770,000 units between Japan and North America before being quietly discontinued in August 1996 in America and December 1995 in Japan (Zagal & Edwards, 2024). For comparison, Sony's Playstation, another contemporary game console, sold 7 million units over the same approximate period of time (Zachara & Zagal, 2009).

Commonly considered to have been a failure, many attempt to answer the question of why the Virtual Boy failed to gain traction despite its revolutionary technical aspects for the time. Contemporary writers cite awkward ergonomics, antisocial nature of the product, and lack of portability as reasons for failure ("Nintendo Pins Hopes on Virtual Boy", 1995). Beyond elements of the technical design, others attribute the failure of the device to the discrepancy between the expected experience and the marketed experience, citing the low resolution monochrome display as failing to meet the expectations of virtual reality outlined in some advertising (Boyer, 2009).

Although all of these factors contributed to the poor sales, citing any individual factor as the definitive reason for the console's failure between the technical and social factors would demonstrate an improper understanding of the complete picture, namely the interrelation between these factors. Current discourse largely fails to thoroughly examine the relations between the various stakeholders, including marketers, designers, and consumers, within the development and marketing periods of the Virtual Boy, instead investigating the technical or social factors which most directly led to the device's market failure. Reframing the development of the Virtual Boy as a network in ANT could provide new insight into the individual factors within the concept of the network.

Examining the relationship between these factors is just as important as the factors themselves in gaining a more complete understanding of the Virtual Boy's discontinuation. As such, I argue that the inappropriate marketing, unwieldy design, expensive pricing, and consumer expectations prevented the mass market success of the Virtual Boy. In particular, the high expectations set forth by embellished marketing combined with the underwhelming execution both ergonomically and technologically indicate a lack of proper communication between the marketers, designers, and consumers.

My argument draws upon the STS framework of ANT, developed by STS scholars such as Michel Callon, Bruno Latour, John Law, and Madeleine Akrich. This framework analyzes sociotechnical projects through the lens of the network: a system maintained by a network builder who organizes various human and nonhuman actors into assisting in the accomplishment of a specific goal. This system can then be framed to examine the relations between the various actors, "[describing] how networks come to be larger and more influential than others … and where power comes from and how it is exerted" (Cressman, 2009, pp. 4). To better frame the

Virtual Boy's network, I also plan to utilize Callon's theory of translation, a method of examining the formation of networks, to further explore the reasons behind the failure of the Virtual Boy and justify why actors were misaligned during the console's development (Callon, 1986).

The evidence I draw upon will be taken from interviews conducted with the Virtual Boy's designers, marketers, or other related individuals, such as those conducted for *Seeing Red* (Zagal & Edwards, 2024). These interviews should allow for an inside view on the network which was developed for the Virtual Boy, allowing for examination of the individual factors of the network. Other sources of evidence will include consumer reviews, magazine articles, and Nintendo press releases, which can be leveraged to gain an understanding of the company and consumer expectations.

Conclusion

To best promote the use of chess to bolster critical thinking skills it is necessary to develop an accessible, intuitive, and engaging smart chess board for a young audience. To this end, we will develop a product which has a casual audience in mind, featuring a low barrier-to-entry and opportunities to reflect on previous decisions with hint and undo buttons. To engage the social factors associated with the sociotechnical challenge of developing engaging devices for children, it is important to examine the mass market failings of a similar product: the Virtual Boy. I will use ANT to understand the relationship between the social and technical factors of the Virtual Boy, including how consumer perception differed from that of the designers, allowing me to consider how various stakeholders might approach our chess board and its associated social and technical factors. The technical project will engage children,

satisfying the stakeholders who want critical thinking skills of this group developed. The STS project will produce an analysis of the technical factors that contribute to the failure of designing for children, providing insight to avoid similar mistakes in network development for devices for children.

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