

## **Thesis Project Portfolio**

### **Peg Solitaire: A New Algorithm for an Old Game**

(Technical Report)

### **The Emergence and Obsolescence of Web Frameworks**

(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

**Michael Starego**

Spring, 2022

Department of Computer Science

## **Table of Contents**

Sociotechnical Synthesis

Peg Solitaire: A New Algorithm for an Old Game

The Emergence and Obsolescence of Web Frameworks

Prospectus

## Sociotechnical Synthesis

Advancements in computer science can have a profound impact on the world of puzzles and games. Using computers, solutions to puzzles like the centuries-old board game peg solitaire can be generated in a fraction of a second. New techniques for solving and analyzing these puzzles can shed new light on the mathematics underlying them. Likewise, growth in the field of computing has led to the sudden emergence and rapid expansion of the video game industry. Powerful graphics cards and advanced web browser capabilities have allowed popular games to reach a worldwide audience. This symbiotic relationship between gaming and computing is constantly evolving and has profound impacts on our culture.

The technical report in this portfolio relates to this topic by detailing a search algorithm that solves exceptionally large peg solitaire puzzles. Peg solitaire is a board game that involves a single player and a board full of pegs or marbles. The game starts with one hole empty and the rest filled. A move consists of jumping one peg over another to land in an empty hole, at which point the jumped peg is removed. The objective of the game is to remove all but one peg from the board. A variety of board sizes and geometries exist, such as the triangular one, which is commonly known as the Cracker Barrel Peg Game. The algorithm proposed in this paper is agnostic to the board geometry and makes very limited assumptions about the nature of the underlying puzzle, making it highly generalizable. It is shown to efficiently find solutions to boards including the 15-row triangular board, which has  $2^{120}$  possible board configurations and takes 118 moves to solve.

While the technical paper proposes an algorithm to solve a puzzle, the STS research paper connects to the topic of computing and games in a less direct way: it investigates the sociotechnical interactions that lead to the emergence and obsolescence of a web framework,

which is a set of software tools that provide a reusable design for a web application. While gaming is not the focus of the STS research paper, the emergence and obsolescence of web frameworks can have a significant impact on the development and availability of web-based games. For example, Adobe Flash Player was once the most popular platform for building web-based animated games, and when support for it ended in 2020 all games that relied on it were rendered unusable.

To explore the factors that cause the growth and decline of web frameworks, this paper presents a case study of Adobe Flex, a web framework popular in the late 2000s that experienced a steep decline in usage during the mid-2010s. The theory of technological momentum provides a foundation for understanding the factors that lead to Flex's growth and obsolescence. It reveals that web frameworks like Flex rely on a complex external infrastructure that, if removed, can lead to obsolescence. Also, interviews were conducted with three developers that worked with Flex in a professional setting. These interviews provide insight into the components that make up the external infrastructure of a web framework, notably browser compatibility, support from within a given organization, and documentation. While this paper and the technical report concern seemingly unrelated topics, they both provide insight into the ways that developments in the world of computing can impact the domain of puzzles and gaming.