Finding a Needle in a Haystack: New Ways to Search and Browse on Scratch

by

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Submitted to the Department of Electrical Engineering and Computer Science
in partial fulfillment of the requirements for the degree of
Master of Engineering in Electrical Engineering and Computer Science

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

September 2012

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Abstract

With Scratch, young people can program their own interactive stories, games, animations, and simulations — and share their creations with one another. Since the launch of Scratch five years ago, over 2.5 million projects have been shared on the website and it is has become increasingly difficult for Scratchers to find projects that connect to their interests. This thesis discusses the design and implementation of the Searching and Browsing toolkit, which will enable project discovery on the new Scratch 2.0 website. Scratchers will be able to find projects through the new Search page, the Explore page and the Related Projects strip. The Searching and Browsing toolkit was designed with the goal of helping users find projects that are more meaningful, serendipitous and inspirational, while also making projects more discoverable overall.

Thesis Supervisor: Mitchel Resnick
Title: LEGO Papert Professor of Learning Research, MIT Media Lab
Acknowledgments

First of all, I would like to thank Mitchel Resnick for being an incredible advisor, mentor and a source of inspiration. Thank you for giving me the opportunity to join the Lifelong Kindergarten group and to work on Scratch—the most meaningful, inspirational, and rewarding project I have worked on. I have learned so much and gained invaluable experience from this year in LLK.

Also, I would like to thank John Maloney, for being a great mentor and teaching me so much about Scratch. Thank you to Paula Bonta for the great design discussions and for being an inspiration with her design sensibility and ability to think outside the box. Also, I would like to thank Natalie Rusk and Amos Blanton for helping me understand the different facets of the Scratch community and always being available to provide their insight and feedback on my work.

Thanks to Champika Fernando, Ricarose Roque, and Sayamindu Dasgupta for being mentors and friends, and for helping me out in so many different ways throughout the year. Thank you to Champika for always being available to brainstorm ideas and for providing valuable feedback on my designs. Thanks to Ricarose for helping me gain a deeper understanding of the Scratch community and for guiding me through my year as an MEng student. Also, thank you to Sayamindu for his endless patience and for always being ready to help me when I had a problem with my code.

Special thanks to the other LLK grads: Abdulrahman Idlbi, Amon Millner, Eric Rosenbaum, Karen Brennan, Jay Silver, Tiffany Tseng, and Tony Hwang. They welcomed me into the LLK family and made this a truly amazing year. Also, thank you to the other members of the Lifelong Kindergarten Group: Chris Garrity, Michelle Chung and Stephanie Gayle, for being so helpful and caring.

Finally I would like to thank my friends and family for giving me the support that has helped me get through MIT. I wouldn’t have made it without all of them. I would especially like to thank my mom and dad, and my brother Francesco, for always being supportive and giving me the opportunity to come to MIT to do what I love.
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Chapter 1

Introduction

1.1 Introduction to Scratch

Scratch is a visual programming language that allows users of all ages and backgrounds to easily create their own interactive stories, animations, games and more, simply by snapping together puzzle-shaped blocks [16]. After creating a project, users can upload their creation to the Scratch website (http://scratch.mit.edu), where they can give each other feedback, remix each other’s projects and form collaborations [14]. Developed by the Lifelong Kindergarten group at the MIT Media Lab, Scratch aims to engage young people with designing and creating interactive media. As children create and share programs with Scratch, they learn to express themselves creatively, solve problems systematically and work together collaboratively, while also learning important computational concepts [16].

The creation of Scratch was inspired by a tradition of programming languages for children, which originated from Seymour Papert’s constructionism theory and his work with the Logo programming language. Papert advocated the importance of teaching children how to program as a way to teach them about problem solving and computational concepts, such as debugging and abstraction [15]. Papert also expressed the importance of designing programming languages with a low floor, so that novices can easily get started, and a high ceiling, so that expert users can develop complex programs [16].
While Scratch inherits many key ideas from Logo, it is also different in several ways. First, in addition to a low floor and a high ceiling, Scratch has *wide walls*—allowing users to create many different types of projects from interactive greeting cards to physics simulations. In addition, Scratch allows users to create projects that are more personally meaningful by integrating their own images, backgrounds and sounds. Finally, sharing is a fundamental part of the Scratch experience and the website provides a place where young creators can find inspiration, learn new techniques and collaborate with each other [16].

1.2 Motivation

Scratch was officially released in May 2007 and less than a year later over 100,000 projects had been shared on the website by approximately 20,000 community members. When Scratch was first launched, the community was small and many users knew each other by their username. By 2010 however, over 1 million projects had been shared by 500,000 users [10].

Today, over 2.5 million projects have been shared on the Scratch website. This is both good and bad news. On one hand, it is great news because it indicates that so many young people around the world have been creating and sharing using Scratch, with thousands of projects uploaded every day. In addition to the high number of uploads, the website exhibits a wide ranging diversity of projects, including replicas of popular video games, interactive art, music videos, stories, holiday greeting cards, physics simulations, news reports, virtual instruments, petitions and much more (Figure 1-1). On the other hand, the community has grown to the point where it is becoming increasingly difficult for *Scratchers* to find projects that connect with their interests. So many different types of creations have been shared on the website, yet there is no effective way to search and browse them.

As the Lifelong Kindergarten group works to design and develop the new version of Scratch, known as Scratch 2.0, it is necessary to explore new ways for users to find and browse projects. In fact, enabling project discovery is very important for
several reasons both from the perspective of a creator and that of a user browsing the website. First, finding projects that connect to their interests can help Scratchers feel more connected to the online community and encourage them to continue sharing their creations. If a user cannot relate to the content seen on the website, he or she may feel alienated and decide to stop participating in the community.

Second, putting up projects in front of an audience and getting feedback from others is a strong motivation for many Scratch users. While projects on the Homepage or those made by famous Scratchers have thousands of views, the majority of projects on the website remains undiscovered. New ways to explore the website will make projects more discoverable and thus allow creators to get more visibility and feedback from the community.

Third, by exploring projects on the website, Scratchers learn about new programming techniques and get inspiration for their creations. The projects that have been shared on the website represent a valuable literature of examples for the Scratch pro-
gramming language. However, there needs to be an easy way to browse the examples in order to be an effective resource for creators.

Finally, some of the most successful forms of collaboration on the website have derived from Scratch users discovering each other’s projects and then working together. Facilitating project discovery could thus be a way to encourage more collaboration between users who share similar interests.

1.3 New ways to Search and Browse on Scratch

This thesis discusses the design and implementation of some new ways in which Scratch 2.0 will enable project discovery through searching and browsing. Scratchers will now be able to find and browse projects through the new Search page, the Explore page and the Related Projects strip.

The new Search page allows users to find the projects they are looking for in a more intuitive and flexible way. Results can be sorted and filtered based on the date, project type and social metadata associated with projects. The search results are also highly interactive as users can preview projects directly in the results, without having to navigate away from the page. In addition to projects, the Search page can be used to find galleries, users, forum posts and support material.

The Explore page aims to present Scratchers with serendipitous content that might interest them. After several iterations, the current version of the Explore page displays a project player surrounded by eight project thumbnails. The seed project is initially loaded in the player, while the other thumbnails display related projects. Clicking on a thumbnail, loads the corresponding project in the player, resulting in a playful and interactive experience. Users also have the option of loading more projects related to the seed or changing to a completely new project in the network.

The Related Projects strip is an expandable bar at the bottom of the Project page that allows Scratchers to explore projects related to the one they are viewing. Users can select from four different relationships to the current project: creator, remixes, location or galleries. Selecting a thumbnail from the strip loads the page
associated with that project, so that users can easily move between related content in the network.

Overall, these tools were designed with the goal of helping users find projects that are more meaningful, serendipitous and inspirational, while also making projects more discoverable.

1.4 Thesis Overview

This thesis presents new ways to search and browse the Scratch website. Particularly, the thesis is organized in the following way. Chapter 2 presents background information on browsing and searching, and an overview of some related trends in content discovery. Chapter 3 presents some background on the Scratch website and discusses the current ways of discovering new projects. Chapter 4 presents the goals and design principles that influenced the new searching and browsing tools. Chapters 5 and 6 describe the iterative design process of creating the Searching and Browsing toolkit, as well as feedback from the Scratch Team and the community. Finally, Chapter 7 presents some conclusions and offers recommendations for future work.
Chapter 2

Background: Searching and Browsing

This chapter presents some background information on searching and browsing, as well as recent trends in content discovery.

2.1 Searching and Browsing

Searching and browsing are the two major paradigms for information discovery. Users generally search for content when they are looking for something in specific, while they browse when they are interested in seeing what is available and discovering new content. In the past, the two paradigms were mostly thought of as separate and users had to choose between searching or browsing [20]. Recently however, there has been a shift towards integrating these two ways of finding information, by making search results easier to browse and adding search functionality to browsing interfaces[3].

2.2 Recent Trends

Over the past several years, many important trends in the field of content discovery have emerged, especially as a result of the increasing number of websites that provide users with millions of items to choose from, including user-generated content websites.
and e-commerce platforms. This section provides an overview of the landscape of content discovery tools that are being commonly used by web applications, in order to give context for the design of the Searching and Browsing toolkit.

2.2.1 Search

As outlined by Marchionini, search activities can be broken down into three major categories—lookup, learning and investigating. Lookup, which has been the focus of search systems in the past, can be thought of as fact retrieval or question answering. On the other hand, learning and investigating involve a more continuous and iterative process of browsing and refining results. Recently, there has been a shift from thinking about search as a lookup task to more of an exploratory process that requires active engagement from the user [13].

Search tools on today's websites support exploratory search by helping users iteratively refine their results. For example, many search interfaces present users with many sorting and filtering options. Faceted search has also become popular way of supporting this exploratory process, by allowing users to interactively refine and browse through results. Unlike traditional categories, facets allow documents to exist in multiple overlapping groups and allow users to progressively narrow down choices without having to perform complex queries [11]. One popular example of faceted search is Amazon's interface for browsing products (Figure 2-1) [1].

Search results have also become increasingly interactive through the integration of multimedia elements such as images and videos. Some search engines let users preview pages or documents, allowing them to compare results without having to load the corresponding pages. For example, with Google Instant Preview (Figure 2-2) users can open a preview of the page next to the results so that they can visually compare the pages before choosing which one to load [8].

Finally many search engines have recently started making their search results more personalized by integrating information from users' social network. For example, Google now displays social results, which are mixed in with regular results and are annotated with their relationship to the user [9]. Bing also recently integrated social
results into their search interface, although they are separated from the main results [2].

2.2.2 Explore

Many user-generated content websites are characterized by an "Explore" page, alternatively referred to as "Browse" or "Discover". This page generally provides access to a broad range of content, serving as a starting point for users who want to browse the website without having a specific interest in mind. In many cases, the page will display content from different categories or visualized in different ways so that users are exposed to the diversity present on the website.

The Explore page on Flickr (Figure 2-3) provides different ways for users to explore the diverse collection of shared photos. For example, users can choose to browse images visualized on a map, "interesting" photos from the past week, or those taken with a certain camera model [5]. These methods provide users with different entry points to begin the process of exploring.
2.2.3 Related Content

"Related Content" interfaces are another common feature of websites providing users with millions of options to choose from. These tools allow users to find new and interesting content based on a video they recently watched, a song they recently listened to, or a product they recently bought. For example, YouTube’s related videos interface (Figure 2-4) is one of the most common ways of discovering new content on the popular video sharing website [21, 19].

This type of tool is also present on Amazon product pages, which display similar items based on which products were purchased by other buyers of the current product [1]. Overall, related content interfaces are a valuable way of broadening users’ discovery of the network based on a starting point chosen by them.

2.2.4 Recommender Systems

Finally, another key method for content discovery is recommender systems, which give users suggestions about content or products they might be interested in. Amazon, for example, displays recommendations based on a user’s recent purchases. In Figure 2-5 the user is receiving recommendations for books on user interfaces and algorithms.
due to previous purchases of computer science books [1].

One of the most common techniques used in building recommender systems is collaborative filtering, which uses information about users' previous activity and ratings to create a set of suggestions. The user-based approach to collaborative filtering generates recommendations by finding users with similar rating profiles and recommending items they rated positively. On the other hand, item-based collaborative filtering makes recommendations by computing the similarity between items and then suggesting items similar to those rated positively by the current user. Overall, both approaches are effective and generate high-quality recommendations. However, websites like YouTube and Amazon, with millions of users and items, have taken the user-based approach due to its scalability and prediction speed [4, 12]. Figures 2-6 and 2-7 display how these two collaborative filtering techniques work in the context of Scratch.
Figure 2-4: Related videos interface on YouTube

Figure 2-5: Recommendations on Amazon
Figure 2-6: User-based collaborative filtering

Figure 2-7: Item-based collaborative filtering
Chapter 3

Background: Scratch Website

This chapter outlines some of the main components of the Scratch website, necessary to understand the design of the Searching and Browsing toolkit. The chapter also examines the different ways of finding projects on the current website and introduces some of the new features of Scratch 2.0.

3.1 Current Scratch Website

One of the core design principles guiding the development of Scratch was to make it "more social" than other programming environments [16]. As a result, the design of the website has been tightly coupled with the development of the programming language, and sharing projects was encouraged since the beginning. Today, the website has become "a vibrant online community, with people sharing, discussing, and remixing one another’s projects" [16]. The following sections describe some of the major features of the current Scratch website including: the Homepage, the My Stuff page, Project pages and Gallery pages.

3.1.1 Homepage

The Homepage displays several rows of project thumbnails, providing a snapshot of the Scratch community. When users are logged in, they can view eight different rows
displaying: the most recent projects, featured projects selected by the Scratch Team and a guest curator, the latest projects shared by their friends, and the community’s top loved, viewed and remixed projects (Figure 3-1).

![Screenshot of the Scratch Homepage](image)

Figure 3-1: Screenshot of the Scratch Homepage

### 3.1.2 My Stuff Page

Registered members have a My Stuff page that acts as their profile and portfolio, establishing their identity within the community. This page displays members’ projects
and galleries, some information about them, projects they have marked as favorites and some of their most recent friends.

### 3.1.3 Project Pages

Every project shared on the website has an associated page, where users can play the project and download its code (Figure 3-2). The Project page displays information about the project, including the notes written by the creator, its social statistics, tags and comments. This page also provides a way for logged in users to take actions on the project such as "loving it" or adding a comment.

![Figure 3-2: Screenshot of a Project page](image)

### 3.1.4 Gallery Pages

Galleries are spaces where users can gather collections of projects. Every gallery has a dedicated page that displays its projects and comments. While initially conceived
as a way to group related content, Scratchers have used galleries for many diverse purposes, for example as a place to form sub-communities.

3.2 Finding Projects on the Current Scratch Website

As part of the design process for Scratch 2.0, the Scratch Team released a survey in May 2011 with the goal of better understanding Scratchers’ use of the website. During the three days when the survey was open, over 2100 Scratchers responded. Out of these users, 53% of them reported using the website a few times a day, 35% a few times a week, 8% a few times a month and the remaining 2% said they used the site less than once a month. The questions asked community members about their favorite pages, how they generally found interesting projects, and how often each row on the Homepage helped them find projects they liked [18].

From the responses to the question ”How do you find projects that you like?” several different methods of discovering projects emerged. These different ways include: the search box, the Homepage, tags, friends, forums and galleries. Figure 3-3 displays the number of answers referring to each way of finding projects. Searching was by far the most popular method, followed by the Homepage and friend-related methods. The following sections describe these different ways of finding projects.

3.2.1 Search

The Search page is the most common way of finding new projects on the Scratch website. The current functionality is being powered by the Google Custom Search Engine (CSE), and based on data analytics, the page receives approximately one million queries per month. Among these queries, the fifteen most common ones are related to popular video games such as ”mario” and ”pacman” (Figure 3-4) [6]. Despite being frequently used, the current Search is far from perfect. Results do not feel well integrated with the design of the Scratch website, since they are displayed
How do you find projects that you like?

Figure 3-3: Graph displaying the number of times each method was mentioned in response to the question "How do you find project that you like?"

with the look and feel of Google results. In addition, users cannot sort or filter the results based on Scratch-specific metadata, such as the number of remixes or love-its. As a result, many community members have expressed the need for a better search engine that is more tailored to their needs.

In the survey, many users reported searching for topics related to their interests and passions. For example, one user wrote, "I usually search for things that I like such as soccer and other hobbies of mine," while another Scratcher said, "I just search keywords from my favorite stuff" [18]. Many users mentioned searching for the topic or type of project they were in the mood for at the moment, while only a few reported searching for specific content they intended to look up. Based on these responses, it thus seems like most Scratchers are using the Search page for exploratory rather than targeted search. For example, one user wrote, "I just browse, searching for things I like on the search-bar" [18].

33
Popular web queries all time

<table>
<thead>
<tr>
<th>Query</th>
<th>Instances</th>
</tr>
</thead>
<tbody>
<tr>
<td>mario</td>
<td>213895</td>
</tr>
<tr>
<td>pokemon</td>
<td>123125</td>
</tr>
<tr>
<td>games</td>
<td>113605</td>
</tr>
<tr>
<td>sonic</td>
<td>85762</td>
</tr>
<tr>
<td>pacman</td>
<td>79434</td>
</tr>
<tr>
<td>halo</td>
<td>58176</td>
</tr>
<tr>
<td>minecraft</td>
<td>56147</td>
</tr>
<tr>
<td>maze</td>
<td>52266</td>
</tr>
<tr>
<td>cube world</td>
<td>45240</td>
</tr>
<tr>
<td>game</td>
<td>44788</td>
</tr>
<tr>
<td>pong</td>
<td>42843</td>
</tr>
<tr>
<td>super mario</td>
<td>41138</td>
</tr>
<tr>
<td>call of duty</td>
<td>40867</td>
</tr>
<tr>
<td>star wars</td>
<td>38886</td>
</tr>
<tr>
<td>music</td>
<td>36494</td>
</tr>
</tbody>
</table>

Figure 3-4: Fifteen most popular search queries on the Scratch website

3.2.2 Homepage

The Homepage represents the main entry point into the Scratch community. This page has become an important location where Scratchers look to discover new content, find inspiration and see what is happening in the community. Because each row only displays three projects, however, the diversity of the Scratch community is not always well represented. Depending on the user and what projects are being displayed, the Homepage can attract community members or alienate them if they cannot relate to anything being shown. The space on the Homepage has also been fairly contentious due to the high visibility it provides and small number of available spaces for projects.

The survey provides some insight into which rows of the Homepage are most useful to discover new projects. Based on the responses, users frequently find interesting projects in the rows displaying their friends’ latest projects, as well as the top loved and top viewed projects by the community. On the other hand, users reported rarely finding projects they liked in the newest projects, the Scratch Design Studio, and the top remixed projects by the community [18].
3.2.3 Tags

When uploading projects to the website, users can tag their creations with any of the six default tags—animation, story, game, simulation, art and music—as well as any other tag of their choice. Once it has been shared on the website, other users can add additional free-form tags to the project. While this tagging approach is very flexible, it has proven to be relatively ineffective as shown by the high frequency of irrelevant or misleading tags. For example, the community started a trend of tagging projects as “waffles”, although the projects were completely unrelated to the concept of waffles. In addition to being irrelevant, tags have also been used differently from their intended purpose, by acting as another form of project comment. For example, the game shown in Figure 3-5 has 47 different tags including “total epicness,” “this project rules,” ”awesome” and “way too many tags.”

![Figure 3-5: Example of a project tagged with many irrelevant tags](image)

Despite the noisiness of the current tagging system, Scratchers have been frequently using tags as a way to find new projects. Many users in the survey reported searching for particular tags such as ”3D” or ”platformer”, while other said they
clicked on tag links shown on the Homepage or project pages. Clicking on a tag brings users to a corresponding page that can be sorted by date, love-its, views and remixes. Data analytics from the website show that tag pages are very popular, getting nearly 300,000 page views per month [6]. While tags are often being used as a way to discover new projects, this does not necessarily mean that they are effective for this purpose, but rather could indicate the need for better sorting and filtering options on the Search page.

3.2.4 Friends

Another common method of finding new projects is through friends. Based on the survey, users frequently find interesting project in the row displaying their friends' latest projects on the Homepage. Many Scratchers also mentioned going to their friends' My Stuff pages to see their favorites and explore the projects of their friends' friends. Some users mentioned receiving specific project recommendations from Scratchers they know [18].

3.2.5 Forums

Another place on the website to discover new projects is in the forums, where Scratchers connect, collaborate, and help each other. In particular, many users regularly visit the Show & Tell forum, where Scratchers post advertisements for their new projects. However, it is important to note that the users who participate in the forums tend to be a sub-community of mostly male, highly technical programmers.

3.2.6 Galleries

Finally, the last major way of finding projects is through galleries. Scratchers can discover new content by looking through galleries dedicated to the genres of projects they are interested in. However, although there are nearly 150,000 galleries, there is no effective way to browse through their projects.
3.3 New Features of Scratch 2.0

Over the past few years, the Scratch Team has been working to design and implement a new version of Scratch, Scratch 2.0. The most important feature of Scratch 2.0 is that it will be "in the cloud", meaning that users will be able to create projects directly on the website instead of having to download the application. Since the programming environment will be integrated with the website, users will no longer need to download project files to see their code. Instead, clicking on the "See Inside" button on any Project page will open the programming editor where users can immediately start tinkering with the code or remixing the project.

In addition to changes to the design of the website, Scratch 2.0 will be characterized by several new features in the programming language. First, there will be some new camera programming blocks that will allow kids to create projects that react to movements in the physical world through the use of a webcam. Users will also be able to create their own procedure blocks, store persistent data in "cloud variables," and clone objects programmatically. In addition to facilitating the process of sharing projects, Scratch 2.0 will enable users to share scripts, images, and sounds through the use of the "backpack".

The design and implementation of Scratch 2.0 has given the Scratch Team an opportunity to rethink and redesign some of the major features of the website based on the development of the community over the past five years. As described in this chapter, there are several ways to find projects on the current website, however, none of these methods are entirely effective. The Searching and Browsing toolkit has the opportunity to fill the need of providing better ways to discover projects on the Scratch 2.0 website.
Chapter 4

Design

This chapter discusses the underlying goals and design principles that influenced the creation of the Searching and Browsing toolkit. These aspects are aligned with some of the major goals and core design principles that guided the development of Scratch.

4.1 Goals

Several major goals influenced the interface design and choice of features for the Searching and Browsing toolkit. These goals emerged from the motivations described in Chapter 1, and the current ways of finding projects discussed in Chapter 3. In particular, the goals of the toolkit are to enable the discovery of projects that are more meaningful, serendipitous, and inspirational, while also making projects more discoverable overall.

4.1.1 More Meaningful

Scratch was designed to support the creation of more meaningful projects, by allowing users of diverse backgrounds to create many different types of projects based on their own personal interests [16]. Similarly, the Searching and Browsing toolkit was designed to support the discovery of more meaningful projects, by enabling users to find content that connects to their interests and passions. If users cannot find any
projects that are interesting or relevant, they may feel alienated and distanced from the community. Instead, by helping them find projects that are more meaningful to them, the Searching and Browsing toolkit allows Scratchers to feel more connected to other community members so that they are more likely to continue participating and sharing their projects on the website. Finding projects that are more meaningful may also help Scratchers form sub-communities of interest or establish collaborations with other users sharing their same passions.

For example, suppose Lauren is a fourteen-year-old girl, who has recently joined the Scratch online community. Lauren enjoys role-playing games (RPGs), but as she looks through the Homepage she only sees examples of animations, interactive art projects, and videogames. She continues to browse through the website but does not find any projects or users that connect to her passion for RPGs. If Lauren had an effective way to search and browse projects, she could have discovered the hundreds of galleries dedicated to RPGs, allowing her to find other users sharing her interests as well as projects to inspire new ideas for her own creations.

4.1.2 More Serendipitous

Another goal of the Searching and Browsing toolkit is to allow Scratchers to discover more serendipitous projects—ones they never would have thought to look for. Certain Scratchers only create and search for a certain genre of project. Exposing them to diverse content that is unexpected, while still interesting, can be an effective way to broaden the range of projects users interact with and give them ideas for new creations to work on. While the toolkit aims to enable users to find projects based on their interests, it also aims to surprise them with more serendipitous content so that they do not miss opportunities to discover projects outside of their immediate network. In addition, users may be interested in browsing projects without knowing exactly what they are looking for. Integrating serendipity into the Searching and Browsing toolkit can be an effective way to address this scenario.

For example, consider Brian, a thirteen-year-old boy who has only been interested in side-scrolling games so far. His friends in the Scratch community are also focused on
this type of game. As a result, Brian's experience on the website has been restricted to one narrow genre, because of his personal interests and friend network. If the Searching and Browsing toolkit suggested content that was more serendipitous and unexpected, Brian might discover different types of projects he did not know existed, exposing him to new ideas and forms of creative expression.

4.1.3 More Inspirational

The Searching and Browsing toolkit aims to help users find projects that are more inspirational. In fact, the website displays a large collection of diverse projects, which represents a valuable literature of examples for the Scratch programming language. Shared projects are useful resources to learn about new programming techniques or how to use a specific block of code. Projects are a source of new ideas for creations users might want to work on, while others may inspire users to create remixes. An important goal of the Searching and Browsing toolkit is thus to support the discovery of more inspirational projects that might encourage users to learn something new or inspire them with ideas for their next creation.

For example, suppose Katelyn is a middle-school girl who loves creating digital art and particularly enjoys working on fantasy characters. Recently she discovered Scratch and started sharing some of her artwork by making interactive slideshows. Katelyn would love to animate her characters and use them to create an interactive story; however, she does not have any programming experience. The Searching and Browsing toolkit could enable her to easily browse other animated stories so that she could look at the code as an example and learn how to bring her artwork to life.

4.1.4 More Discoverable

Projects that are displayed on the Homepage or are made by famous Scratchers often get hundreds or thousands of views. Some of the most popular projects that were shared over the past five years have even been viewed by tens of thousands of users. However, the cases mentioned above represent a very small percentage of all Scratch
projects. The average project receives only a few views in total. One of the major goals of the Searching and Browsing toolkit is thus to give greater visibility to the average Scratch user. In fact, putting up projects in front of an audience is a strong motivation for many Scratchers. Greater visibility also means a greater number of opportunities for receiving feedback from others users. Helping project creators get their projects discovered may be an effective way encourage them to share additional projects and participate more actively in the community. In addition, many examples of collaboration have begun with users discovering each others projects and then starting to work together. Making projects more discoverable could thus increase the opportunities for users to begin collaborating with each other.

For example, suppose John is a 10th grader at an urban school in Los Angeles. He has just finished working on a school project, for which he was asked to create a representation of a social issue present in his community. John chose to use Scratch to create a game to portray some of the income inequality issues seen in his neighborhood. After spending many hours perfecting the game, he shared it on the website, hoping to get a conversation started with other Scratchers about the topic. A month later, his project had only 5 views and did not have any comments. If there was a way to make projects more discoverable, a greater number of Scratchers might have seen his creation and could have given him feedback or reflected on the broader issue. This might have given John the opportunity to meet other teenagers who are experiencing similar issues both in Los Angeles and other cities around the world.

4.2 Design Principles

The design of the Searching and Browsing toolkit was guided by three major design principles. First, the new tools were designed to have a low floor and a high ceiling. Second, the interfaces were designed to be interactive and playful, in order to promote exploration. Finally, they were designed to fit naturally with Scratch 2.0.
4.2.1 Low Floor and High Ceiling

The Scratch programming language was designed to have a low floor so that novices can easily get started, and a high ceiling so that expert users can develop complex programs. Similarly, the new Searching and Browsing toolkit was designed to incorporate both of these ideas.

On one hand, the new Searching and Browsing tools have a high ceiling, as they give the user a high degree of control and flexibility. In fact, the interfaces enable users to iteratively refine the content being shown, through different methods of sorting and filtering. The tools are also very powerful in that they allow users to explore the network of projects in multiple different ways. On the other hand, the tools have a low floor, as shown by their clean and simple interfaces that are intuitive to use for novice users. The language used in the toolkit also contributes to lowering the floor, seeing as the terms used are simple enough for young users to understand.

4.2.2 Interactive and Playful

Another important design principle was to make the tools interactive and playful in order to encourage exploration. In the spirit of tinkering, which is key to the Scratch programming language, the Searching and Browsing toolkit was designed to provide a playful and compelling interface for finding projects. Playing projects without have to leave the page and being able to easily jump between related projects is a fun and engaging way to browse through creations on the website.

4.2.3 Fit Naturally into Scratch 2.0

Finally, the Searching and Browsing toolkit was designed to fit naturally within the new Scratch 2.0 website. This design principle influenced the layout of different pages, as well as the overall aesthetics of project thumbnails and the project player. While the Searching and Browsing tools are well integrated with the overall design of Scratch 2.0, their interfaces are fairly distinct seeing as they serve very different purposes compared to the other pages on the website.
Chapter 5

Search

This chapter discusses the design and implementation of the new Scratch 2.0 Search page, which allows for greater customization, sorting, and previewing of results. The design of the page was guided by the principles discussed in Chapter 4, with the aim of helping Scratchers find projects they are interested in.

5.1 Google Custom Search

Search on the current website is powered by Google’s Custom Search Engine (CSE), which allows developers to add search functionality to their web applications using Google’s core search technology [7]. CSE has several advantages, for example, being able to rely on Google’s servers to index all the documents and getting access to the data analytics about queries made to the search engine. While these are significant benefits, the CSE approach also has many disadvantages from the point of view of both the user interface and the functionality.

First, relying on CSE causes search results to be displayed with the look and feel of Google results (Figure 5-1), such that they do not feel well integrated with the Scratch website. In addition, Google does not have access to project metadata such as statistics about how many users have viewed, loved, or remixed a project. Users thus cannot sort or filter results based on these Scratch-specific metrics, and until recently, no thumbnails were shown next to project results. Finally, when the “All
Due to these various limitations, many members of the community have expressed the need for a better search engine, in the forums and on the Scratch Suggestions page. Many users asked for the ability to sort and filter results based on the date, views, and love-its. For example, one user wrote, "I would love to have more powerful search capabilities! I would like to be able to say, find all the projects that have the word Easter in either the description or the title or in tags and present them in reverse chronological order." [17]. Many users also requested adding thumbnails next
to projects results, in order to "get a better idea of what [the project] is about" [17]. Some Scratchers suggested adding common features of popular search engines, such as autosuggesting queries while the user is typing. One user even created a Scratch project (Figure 5-2), displaying a mockup of his idea for a new search bar.

![Figure 5-2: Project displaying a Scratcher’s idea for a new search bar](image)

Based on the feedback and suggestions from Scratchers, it was thus clear that there was a significant opportunity to improve the Search page so that it was better integrated with the website and more tailored to Scratchers' needs. In order to fully accomplish these goals, we realized that it was necessary to design and implement our own search engine. The next section of this chapter discusses how the Search page design evolved based on feedback received from the Scratch Team and members of the online community. Finally, the last section of this chapter describes some of the key aspects of the search engine implementation.

### 5.2 New Search Page

Designing the new Search page was an iterative process of implementing prototypes and receiving feedback on them. The following sections describe some of the major phases of this process.
5.2.1 Initial Designs

The Search page is characterized by two major components: the sorting and filtering tools, and the actual search results. The first step was to design the filtering and sorting tools, which had to be sufficiently powerful to allow users to refine their results, while being simple enough for young users to understand. In the context of Scratch, the tools had to allow users to sort results based on social statistics, such as love-its, views, and remixes. In addition, it was important for users to be able to filter and sort results by date in order to give them access to fresh content and help them discover recently shared projects. Finally, due to the wide-ranging variety of creations, it seemed valuable to give users the option of restricting results to a certain project type, such as games or animations.

Figure 5-3 displays an early mockup of the project search interface. We considered several different layouts for the filtering and sorting tools based on examples from popular search engines. Ultimately, we decided to have the tools in a sidebar on the left side, as this design seemed to best satisfy the tension between achieving a low floor and a high ceiling. In fact, the design's similarity to Google's new interface meant that the Search page would seem familiar to users of different ages, while still providing a high degree of flexibility and control over the results. Also, because each filter allowed users to select only one option at a time, it seemed more intuitive than using a more advanced faceted search approach.

Another major component of the design was the appearance of the search results. In order to achieve a balance between showing many results and making them more interactive, the initial design provided two ways of viewing results—a thumbnail view and a player view. In the thumbnail view (Figure 5-3), results were shown as a grid of thumbnails with their corresponding titles and creators. In contrast, the player view (Figure 5-4) was composed of a project player, an area displaying detailed information about the project, and a carousel of thumbnails to choose from. Clicking on a thumbnail loaded that project into the player, thus providing a simple and playful way to preview projects directly from the search results.
5.2.2 Feedback from the Scratch Team

Discussions with the Scratch Team provided helpful feedback on the initial design. First, we realized that while the thumbnail view was effective for the Gallery page where users were interested in looking at many projects simultaneously, the layout was not well suited for search results where users were interested in specific information about each project. We thus decided to shift to a list view, with thumbnails shown on the left and information about them shown on the right. Also, having two different views for project results seemed unnecessarily complex, so we decided to combine the thumbnails and player within a single view.

Figure 5-5 displays an initial attempt to integrate the list view of results with the ability to preview projects. In this prototype, users could click on the magnifying glass icon causing the thumbnail to be replaced by a project player. The area displaying information also expanded to reveal the project's social statistics and its full description. This prototype was a very preliminary version of the Search page, yet it
captures some of the major features of the current design.

5.2.3 Pre-Alpha Prototype

After further feedback from members of the Scratch Team, the Search page prototype was refined in several ways (Figure 5-6). First, the magnifying glass was changed to a green flag icon, based on the feedback that the magnifying glass gave the impression that users would see the project's code rather than a preview. Also, the social statistics and project notes were moved to the right side of the project player, in order to emphasize that they were associated with the project being previewed. Finally, graphical elements such as the icons and interface colors were changed to match the new Scratch 2.0 website design.

Discussions about the prototype also raised questions about whether users should be able to "preview" gallery and user results in a similar way to how they could preview project results. For example, a gallery preview might have consisted of
a player and a carousel of thumbnails displaying the projects within that gallery. Although this feature would have made the page more interactive, it seemed excessive for the search results. Instead, this issue of providing a simple way to browse through projects in a gallery or by a certain user, was addressed by the Related Projects strip described in Chapter 6.

5.2.4 Feedback from an Experienced Scratcher

At this stage of the design process, the prototype was shown to Jack, an experienced Scratcher who has been an active member of the community since 2007. His experience as a community member and moderator was a great source of insight into how the new Search page would be received by other Scratchers. Overall, Jack thought
the page was a great improvement over the one on the current website. He liked the appearance of search results and the ability of previewing projects directly on the page. However, Jack was concerned that using a full-sized project player in the results would discourage users from visiting Project pages, meaning that they would miss the opportunity to provide feedback and tinker with the code. To address this issue, Jack suggested significantly reducing the size of the player in order to make it feel more like a "preview" rather than the full project experience. Finally, he mentioned that the green flag icon was unclear so users might not realize their ability to preview projects.

5.2.5 Alpha Prototype

Based on feedback from Jack and members of the Scratch Team, the Alpha version of the Search page (Figure 5-6) has a significantly smaller project player, giving users more of the sense that they are previewing projects. Additional projects statistics,
such as the number of comments and remixes, were also added to the results. Displaying the remix count was particularly important in order to provide feedback when users sorted results based on the number of remixes. The green flag icon to open the project preview was also changed, in order to match the rest of the website and better indicate its functionality.

5.2.6 Feedback from the Scratch Community

In April 2012, the Scratch 2.0 prototype was released to a small set of Alpha testers, composed of community moderators, educators and researchers. The testers were asked to experiment with the prototype and provide their feedback and suggestions in the forums. Additionally, the Alpha prototype was opened to the entire online
community for five days, on the occasion of Scratch Day 2012. Users were given the
ability to test the prototype and were asked to provide feedback in the forums and
in an online survey. During these five days, over 1000 comments were posted in the
Scratch 2.0 feedback forum threads and approximately 630 users responded to the
survey. Although most comments focused on the new features of the programming
language, several users mentioned the new Search. In addition, the Alpha testers were
explicitly asked to provide feedback on the functionality and design of the Search page.

Overall, users enjoyed being able to preview projects because it was "helpful
for quickly going through search results without having to load a bunch of project
tables" [17]. One tester also mentioned that she liked the preview feature because
it was "useful to be able to look at projects without losing [her] spot on the list or
having to make a new tab" [17]. The testers thought the sorting options were helpful,
although one of them mentioned that it might be useful to sort in both ascending and
descending order. For example, in some situations it would be useful to see the oldest
projects, rather than just the newest ones [17]. While the current prototype uses
infinite scroll to load additional results, the Alpha testers mentioned that it would be
better to have paginated search results, as this would allow Scratchers to say "just
search card games' and you'll find [the project] on the second page" [17].

While testers generally liked the new design of the Search page, several responses
emphasized the need to improve the relevance of results and add advanced search
functionality. Currently, the "most relevant" sorting option searches for projects that
contain the searched keywords in the title, the description or the creator's username.
Since social data is not being used in the ranking, the top results often display projects
that match the query but are not particularly high quality. Giving some weight to
social data, such as views and love-its, as well as further experimenting with the
weighting function, might be effective ways to improve the relevance of project re-
sults. Several users also mentioned the need for more advanced search query func-
tionality such as the use of wildcards and excluding words or phrases from the results.
Integrating these advanced features will increase the power and flexibility of the new
Search page without adding to the complexity of the interface.
5.3 Implementation

The first major step in implementing the search engine was to index all the documents being searched. To accomplish this task, we evaluated several potential open-source indexing platforms including Sphinx, ElasticSearch, Xapian and Apache Solr. Ultimately, we decided to use Solr due to its advanced functionality, extensive documentation, and widespread use on other websites. Solr also had the advantage of being supported by Haystack, a Django search framework that was easily integrated with the backend of the Scratch 2.0 website.

Currently, the search index contains four different types of documents: projects, galleries, users, and forum posts. Table 5.1 displays the fields indexed for each type of document. The social statistics were particularly computationally expensive to index, seeing as the counts are not being stored in the database; however, indexing these fields was necessary in order to allow users to sort results based on them.

Table 5.1: Data indexed for each type of document

<table>
<thead>
<tr>
<th>Project</th>
<th>Gallery</th>
<th>User Profile</th>
<th>Forum Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>title</td>
<td>title</td>
<td>username</td>
<td>author</td>
</tr>
<tr>
<td>description</td>
<td>description</td>
<td>user id</td>
<td>topic</td>
</tr>
<tr>
<td>creator</td>
<td>owner</td>
<td>country</td>
<td>category</td>
</tr>
<tr>
<td>moderation status</td>
<td>date created</td>
<td>bio</td>
<td>forum</td>
</tr>
<tr>
<td>loves count</td>
<td>permissions</td>
<td>follower count</td>
<td>date created</td>
</tr>
<tr>
<td>views count</td>
<td>projects count</td>
<td>following count</td>
<td></td>
</tr>
<tr>
<td>remixes count</td>
<td>comments count</td>
<td>favorites count</td>
<td></td>
</tr>
<tr>
<td>favorites count</td>
<td></td>
<td>projects count</td>
<td></td>
</tr>
<tr>
<td>comments count</td>
<td></td>
<td>comments count</td>
<td></td>
</tr>
</tbody>
</table>

Once the documents were indexed, the next step was to implement the search functionality. Search requests are sent to the server in the form of GET requests so that the query options are displayed in the URL. This was done explicitly in order give users the ability to copy or bookmark links to particular sets of search results. In addition, in order to improve the relevance of results, different weights were assigned to specific fields. For example, in the current prototype, a project’s title has the
most weight, followed by the description and the creator’s username. Continuing to experiment with the weighting function and integrating some social data into the ranking will allow us to improve the quality of results.
Chapter 6

Browse

This chapter discusses the design and implementation of the new Scratch 2.0 browsing tools—the Explore page and the Related Projects strip. These tools aim to provide easier ways to browse projects on the website and accomplish the goals of the Searching and Browsing toolkit.

6.1 Explore Page

Early in the design discussions for the Scratch 2.0 website, we realized it would be valuable to provide users with a better way to browse through projects. Specifically, there seemed to be a need for a page where users could browse through interesting and unexpected content when they did not necessarily know what they were looking for. Although the page had an overall goal, what the content of the page should be and how it should be displayed were very unclear. Accordingly, the Explore page has been the part of the Searching and Browsing toolkit that has evolved the most throughout the design process and many questions still remain open.

6.1.1 Initial Prototype

The inspiration for the Explore page derived from an early prototype of the Scratch 2.0 Profile page (Figure 6-1), which facilitated browsing through a user’s projects
and friends. Clicking on a project thumbnail caused the corresponding project to be loaded in the player, while clicking on a user’s thumbnail loaded that person’s profile. The result was a very interactive and playful way to browse through projects and users in the network. In later versions of the Scratch 2.0 website, we decided to abandon this idea as it led to confusion about the distinction between Profile and Project pages. Nevertheless, the team remained intrigued by the possibility of having a place where Scratchers could browse through a collection of projects by loading them into the player, without having to leave the page.

![Figure 6-1: Early prototype of the Profile page](image)

The first version of the Explore page (Figure 6-2), aimed to capture a similar experience as the one provided by the Profile page prototype shown in Figure 6-1. Another source of inspiration was YouTube’s related videos interface, given that many Scratchers had been requesting a related projects section similar to the one present on the popular video sharing website. While the layout was similar to the one on YouTube, we decided to give the user more control over the type of relationship connecting the main project to its related content. For instance, instead of simply
seeing a collection of related projects chosen by the system, the user could specifically choose to view other projects by the same creator. The decision to give users control over the type of related content was guided by the desire to make the interface more flexible and at the same time clearly indicate how the projects were related to each other.

The initial prototype of the Explore page consisted of a player and information about the "seed" project on the left side, and a list of related projects on the right. A dropdown menu gave users the ability to select between five different relationships to explore by:

- **Creator**: projects by the same creator
- **Remixes**: remixes of the project
- **Galleries**: projects in the same galleries as the seed project
- **Loves**: projects loved by the users who loved the seed project
- **Location**: projects created by users in the same country as the seed project

Clicking on the thumbnail of a related project loaded that project into the player and updated the list of related content to reflect the new seed project. If none of the related projects seemed interesting, users could click on the "Random Project" button to change to a completely new project in the network.

A contextual approach was used to determine which project was initially loaded in the player; that is, the seed project depended on the page users were coming from. For instance, if a user was previously on a Project page, then that project would be chosen as the seed. If instead the user came from a Profile page, then one of the corresponding user’s projects would be loaded in the player. Likewise, if the user was coming from a Gallery page, a project from that gallery would be displayed. Otherwise, if the user was coming from any other location on the website, the seed project would be chosen from the Homepage. Although this behavior was not explicitly clear from the interface, it seemed like a potential way of allowing users to influence where they wanted to start exploring from.
6.1.2 Feedback from the Scratch Team

Once the initial prototype of the Explore page had been implemented, members of the Scratch Team were given the opportunity to experiment with the interface and provide feedback on the design. Overall, everyone enjoyed being able to continuously load projects into the player without having to navigate away from the page. They also liked being able to choose the type of related content being displayed, as it gave them control over their browsing experience, although some of the terms used to describe the relationships were relatively unclear.

An important issue discussed during this phase of the design process was the overall look and layout of the page. First, the vertical arrangement of thumbnails in the related projects area seemed inconsistent with the rest of the Scratch 2.0 website, where thumbnails were generally displayed in horizontal carousels. Second, we realized that the Explore page significantly overlapped in appearance and functionality with the Project page. This overlap was problematic because it had the potential of
creating confusion between the two pages and had the risk of reducing the need users felt to visit the Project page. Although the Searching and Browsing toolkit aims to provide better ways of browsing projects, Scratch’s main goal remains to engage users with designing and creating. It was thus important that the design of the Explore page did not reduce Scratchers’ likelihood of visiting Project pages, where they could tinker with the code and provide feedback to creators. It thus became clear that the Explore page had to be more distinct, in order to avoid repeating the same functionality and more importantly to encourage Scratchers to visit Project pages.

Another key issue was the question of how the Explore page should behave when users clicked on a project thumbnail. Based on the discussions, there seemed to be two different ways of thinking about browsing through projects—exploring a collection versus exploring the network. In the collection approach, users are interested in looking at many projects related to the same seed; therefore, it makes sense to maintain the list of related content until the user explicitly chooses to load another project’s related content. Conversely, in the network approach, users are interested in moving through the network of projects. As a result, when considering the second approach it makes sense to think of every selected project as a new seed, changing the set of related content being displayed every time. Both ways of exploring are powerful and different people seemed to prefer one approach to the other. Ultimately, we decided to enable both styles of exploring, as described later in this chapter.

6.1.3 New Directions

The following stage of the design process was marked by a significant shift in direction for the Explore page. Based on the feedback discussed above, we understood that giving users the ability to choose the type of related projects being displayed was valuable. However, we realized that this content would be most useful on the Project page, in order to avoid the confusion between the two pages and avoid the risk of users staying only on the Explore page. This realization led to the decision to create the Related Projects strip, described in Section 6.2.

Given that the previous functionality was moved to the Related Projects strip,
the question of what to display on the Explore page remained open. As described in Chapter 2, on many popular websites, the equivalent of the Explore page displays a diverse collection of content that users can use as a starting point when they are looking for something interesting. In the context of Scratch however, the Homepage already serves this purpose by displaying many rows of project thumbnails. As a result, one option we considered was to completely remove the Explore page, since its purpose was potentially being satisfied by a combination of the Homepage and the Related Project strip. Although this option was considered, we preferred to keep the Explore link in the main navigation bar, and the team was still intrigued by the idea of having a page where users could continuously browse through projects.

6.1.4 Alpha Prototype

The final design of the Explore page for the Alpha prototype is shown in Figure 6-3. In this design, a project player is surrounded by eight thumbnails related to the seed project. Clicking on a thumbnail loads the corresponding project into the player without changing the eight thumbnails. Once a project has been loaded into the player, users have the option of loading the selected project’s related content by clicking the "Shuffle" button. The interface thus supports both the collection and network approaches to exploring. Additionally, users can change to a completely new seed project in the network by clicking the "Jump" button.

The Alpha version of the Explore page reveals how it is possible to satisfy the principles of both low floor and high ceiling. On one hand, the interface has a high ceiling as it allows users to move through the network of related projects in several different ways. On the other hand, the interface has a low floor, because it is simple enough for a novice user to start experimenting with. The choice of the words "Shuffle" and "Jump" was an attempt to further lower the floor by referring to the different movements in the network with playful and concrete terms, in order to make them more understandable to young users.

Finally, another key aspect of the new design was the removal of unnecessary features from the interface. The first element that was removed was the dropdown
that allowed users to select between different types of related content. Since this functionality was moved to the Related Projects strip it seemed redundant to have it on the Explore page as well. The social data about projects was also removed in order to keep the interface simple and clean. Finally, the project player was significantly reduced in size, in order to make it feel more like a preview and encourage users to visit the Project page.

![Explore page example](image)

Figure 6-3: Alpha prototype of the Explore page

### 6.1.5 Feedback from the Scratch Community

The Explore page received positive feedback from the Alpha testers and members of the online community during the Scratch day trial period. In particular, the Alpha testers liked the new layout of the page, which was "rather slick and pretty intuitive to use" [17]. They also enjoyed being able to play projects without leaving the page. One tester wrote, "I'm enjoying seeing and exploring projects that I might not see otherwise. Great idea in order to help people move beyond the front page" [17]. Based
on their feedback, the testers seemed to agree that the Explore page "will really make Scratchers interested in each other's projects" [17].

One significant point of confusion among the testers was the difference between "Shuffle" and "Jump". As mentioned previously, we chose these words in an effort to make the interface more simple and playful, although we realized that they might be "hard to decipher" [17], as one tester mentioned. One reason the Shuffle feature may have confused testers is due to the algorithm used to generate the list of related content—a mixture of projects by the same creator, in the same galleries, and loved by the same users. For projects with little social data or not part of any galleries, however, the related content was mainly by the same creator. In this scenario, clicking on Shuffle meant that many of the same thumbnails were loaded, simply in different positions. Improving the algorithm to select related projects could thus be an effective way to increase the distinction between Shuffle and Jump. Despite the confusion about the two functions, many Scratchers mentioned that they were fun to play with, and in particular the Jump button got them "to see things [they] wouldn't necessarily have picked out [themselves]" [17].

Some other issues mentioned by the testers revolved around the seed project. In the design of the Alpha prototype, we explicitly decided not to allow users to take any actions on the project, in order to encourage them to visit the Project page. However, several testers mentioned that they were "disappointed that [they] couldn't immediately click favorite' or love' on the projects [they] viewed from Explore" [17]. One Scratcher wrote that it would be nice to allow users to "respond immediately to the projects in ways that leave traces. Otherwise there's all that feedback that might not be left because one has to [...] go to the project page to do those things" [17]. Several other Alpha testers shared this concern, and thought it was important to be able to favorite or love the project directly from the Explore page. Regarding the issue of which project was chosen as the seed, the testers agreed that it would be valuable to have this be personalized based on their recent activity on the website, for example, the projects they recently love or added to their favorites. For anonymous users and new Scratchers, the testers agreed that the contextual approach would work
well.

6.2 Related Projects Strip

6.2.1 Initial Prototype

The Related Projects strip is an expandable bar at the bottom of the Project page that allows users to explore projects related to the one currently being viewed. Users can select from different types of related content, and clicking on a thumbnail in the strip causes the corresponding Project page to load. As discussed in Section 6.1, the strip originated from an effort to move the functionality of the initial Explore prototype to the Project page, where it seemed to belong.

We decided to implement the Related Projects strip as an expandable bar that overlays the Project page, inspired by YouTube's new playlist interface. In fact, having the bar as an overlay meant that the related thumbnails would always be visible when the strip was opened, such that users could move between projects without having to scroll further down on the page. Instead of allowing users to select the type of related content through a dropdown menu, the Related Projects strip contains buttons that allow users to change between different relationships more efficiently.

6.2.2 Feedback from the Scratch Team

When the prototype was shown to members of the Scratch Team, they agreed that the Related Projects strip was much better suited for browsing through related content compared to the initial Explore page. It also seemed well integrated with the overall Scratch 2.0 design because it matched the other horizontal carousels of thumbnails present on site. One issue that came up was the ambiguity of some relationships. For example, the "Gallery" option did not display any information about which galleries the project was in and it was unclear whether mixing projects from different galleries would actually be useful.
6.2.3 Alpha Prototype

The next step in the design process was to implement the Alpha version of the Related Projects strip. Based on feedback from the Scratch Team, one of the major changes was the ability to choose which gallery was being displayed through a dropdown menu (Figure 6-5). For example, in Figure 6-5, the Gallery dropdown displays a list of the galleries the current project is part of, while the strip contains thumbnails of other projects in the "Best of Interactive Art" gallery. In addition to giving more flexibility, being able to select which gallery is being shown, provides a fun and simple way to browse through galleries.

Also, the "Loves" relationship was removed, as it did not seem to display any relevant content and was difficult to accurately express with a single word. Finally, we changed the top bar of the Related Projects strip be a darker color and to have a gradient, based on feedback that it was not visible and did not give the impression that it could be opened.
6.2.4 Feedback from the Scratch Community

During the Scratch Day trial, several Community members mentioned that the Related Projects strip was among their favorite features of the new website. The Alpha testers echoed the positive feedback. For example, one tester wrote, "I think the Related Projects section is *great*," while another user said she "love[d] the Related Projects [because] it [was] fun and easy to use" [17]. Many of the Alpha testers recognized that the strip would be widely used by community members because it would be "useful when there's something [they] can't figure out how to do on [their] own" [17]. One user mentioned that the strip will allow users to discover new projects, just as on YouTube the related videos section is one of the main ways of finding new content. Another Alpha tester wrote that he liked being able to easily browse through projects in the same gallery because it "could be a way to find projects in similar
genres or about similar topics” [17]. This user also suggested adding the ability to browse projects with matching tags or similar titles. Finally, several of the testers mentioned that the Location relationship would be useful to Scratchers outside the United States, who wanted to find more projects from their own country.
Chapter 7

Conclusion

7.1 Introduction to Scratch

The new Searching and Browsing tools—the Search page, the Explore page, and the Related Projects strip—have been integrated with the Alpha Prototype of the Scratch 2.0 website. Over the past few months, a group of testers, composed of experienced Scratchers, educators, and researchers, has been experimenting with the website and providing feedback on the new features. As described in Chapters 5 and 6, the new components of the Searching and Browsing toolkit have been well received by the testers and other members of the community.

In particular, the testers feel that the tools will be valuable to Scratchers who are searching for projects based on their interests, browsing to discover new content, or looking for help and inspiration. Furthermore, the testers mentioned that the tools will make Scratchers more interested in discovering each other's projects. Overall, these reactions are well aligned with the goals we set out to accomplish with the toolkit, described in Chapter 4. However, although the Searching and Browsing toolkit represents a step in the right direction, there are still many ways in which the tools can be further developed and refined. The following section describes some of the major potential changes and improvements.
7.2 Future Work

Based on feedback from the Alpha testers and the online community, there are several potential ways of improving the design and functionality of the toolkit.

7.2.1 Search Page

The design of the new Search page was well received by testers; however, their feedback demonstrated the need to improve the quality of the search results. In particular, one way to increase the relevancy of results would be to experiment with the weighting function and integrate social statistics so that high quality projects are ranked higher. Another way would be to add advanced query functionality and additional filtering tools, to enable users to further refine their searches.

An additional area that could be explored in future versions of the Search page is the integration of social network data in order to personalize results. For example, when users are searching for projects, creations shared or loved by their friends might receive a higher ranking in the results. Search could be further personalized by taking into account users’ past queries and recent activity on the website.

Finally, another potential improvement would be the addition of an Advanced Search tool, which would most likely not be part of the main interface but would allow advanced users to perform sophisticated queries. An important feature of this tool might be the integration of a "code search" that allows users to search for projects containing specific programming blocks. For instance, a user might search for "game projects that use arrow key blocks" or "interactive art projects that use procedures". This type of functionality would be useful to users looking for help as well as to educators searching for project examples containing certain types of programming blocks.

7.2.2 Explore Page

The Explore page also received positive feedback from the testers as it provided an interactive and playful way of browsing through new projects. A major way of im-
proving the functionality of the page would be to make it more personalized to the user, by implementing a recommender system that suggests projects to users based on their recent activity on the website. An effective way to generate recommendations might be to use an item-based collaborative filtering approach, as described in Chapter 2. This approach would be particularly effective on the Scratch website due to its scalability to millions of users and items. Greater personalization might encourage Scratchers to frequently visit the Explore page, in addition to the Homepage, when looking for new interesting projects.

The Explore page could also be personalized with more of a focus on presenting users with projects that encourage them to learn something new. For example, if there was an algorithm to measure project complexity, then the Explore page could display projects that encourage Scratchers to improve their skills as creators and designers. By taking into consideration their block usage and the complexity of their creations, the Explore page might display projects that are slightly above users’ current programming level or that use a block they have not tried before.

### 7.2.3 Related Projects Strip

Based on feedback from the Alpha testers, the Related Projects strip is very promising in terms of helping Scratchers find new and interesting content. As testers mentioned, this feature has the potential of becoming a central way for users to discover projects besides the Homepage. In order to further increase the value of the Related Projects strip, several new types of relationships could be integrated. As the Alpha testers suggested, adding an option to view related projects based on overlapping tags might be useful, especially with the transition to a less noisy tagging system in Scratch 2.0. In addition, to facilitate the discovery of low visibility projects, it is important to integrate relationships that are independent of social data. An example of this might be to display projects that are similar based on their title or description.
7.3 Final Words

This thesis presents the design and development of the Searching and Browsing toolkit, which aims to help Scratchers find projects that are more meaningful, serendipitous, and inspirational, while also making projects more discoverable overall. The design of the toolkit satisfies the principles of low floor and high ceiling, as demonstrated by the simplicity of the interfaces and the advanced iterative refinement functionality. In addition, the tools were designed to provide an interactive and playful user experience, as shown by the integration of the project player in the search results and the Explore page. Finally, the toolkit was designed to be well integrated with the new Scratch 2.0 website. Overall, the components of the toolkit—the Search page, the Explore page and the Related Projects strip—represent a promising step forward in helping Scratchers find interesting projects that connect to their personal interests.
Bibliography


