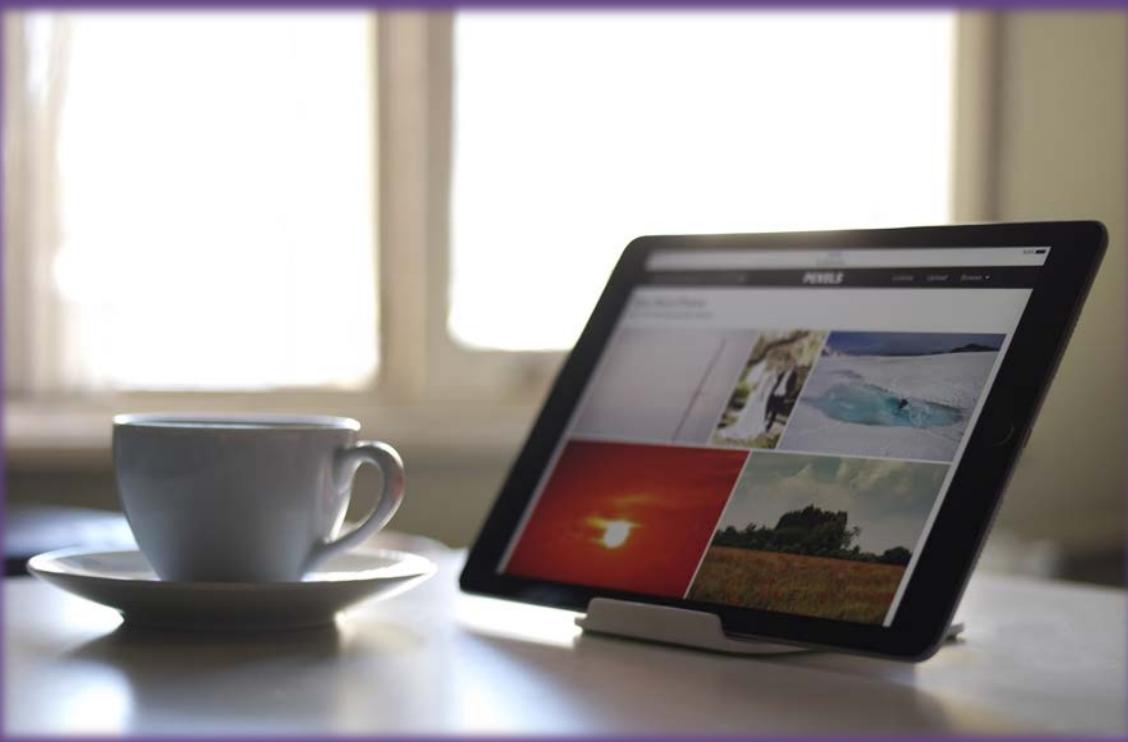
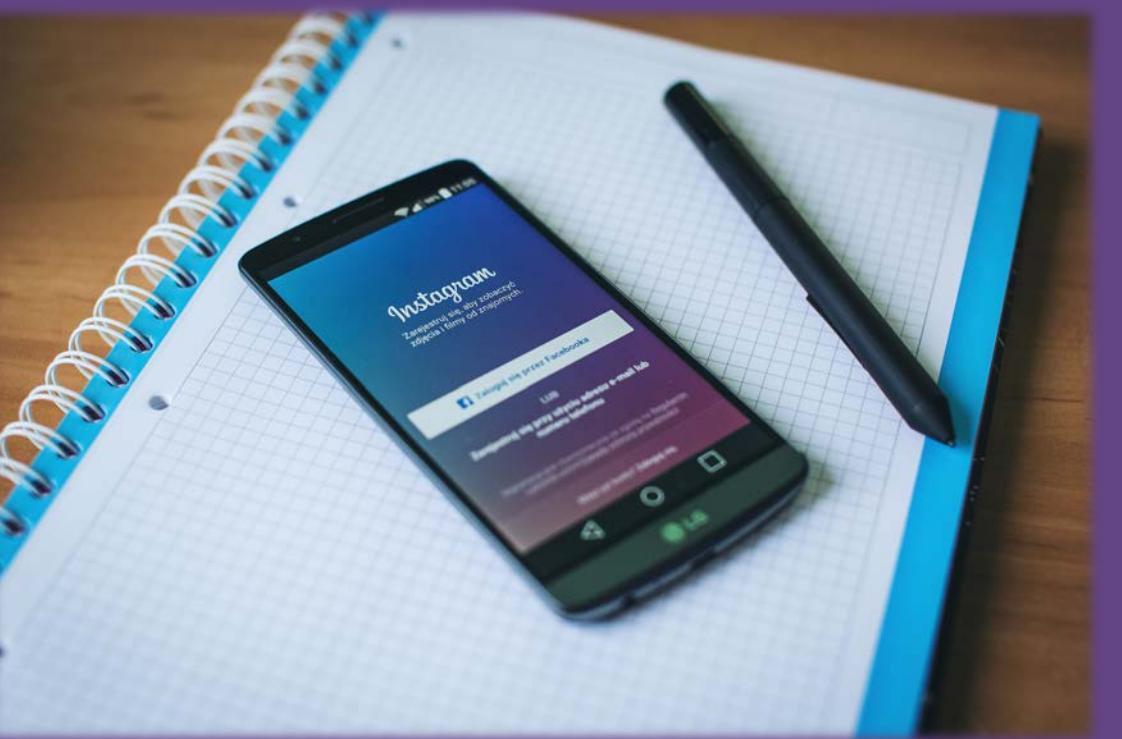


Genie: Input Retargeting on the Web through Command Reverse Engineering

Amanda Swearngin, Andrew J. Ko, James Fogarty



Culture¹ and gender² affect usability, appeal, and trustworthiness of a website.



People with motor disabilities may need to use alternate devices to interact with the web¹.



Blind people frequently use screen readers to navigate and operate web interfaces¹.



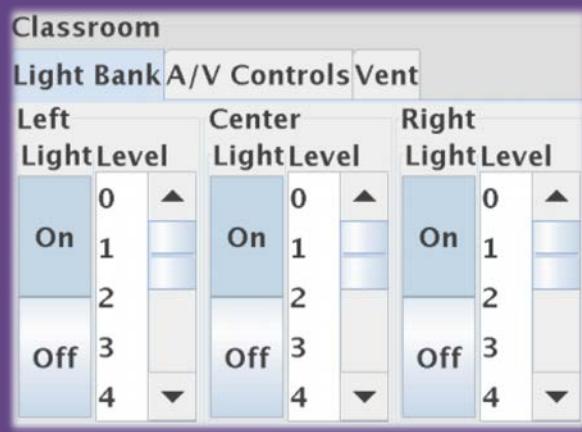
```
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
```

```
<!--Image/gif;base64,R0lGODlhaQABAAAPVVVWV
<div class="container">
  <h1>One more for good measure.</h1>
  <p>Cras justo odio, dapibus ac facilisis in, egester eget quam, donec ut
  <div class="carousel-caption">
    <p><a class="btn btn-lg btn-primary" href="#" role="button" data-slide="prev">
      <span class="glyphicon glyphicon-chevron-left" aria-hidden="true"></span>
      <span class="sr-only">Previous</span>
    </a>
    <a class="right carousel-control" href="#" role="button" data-slide="next">
      <span class="glyphicon glyphicon-chevron-right" aria-hidden="true"></span>
      <span class="sr-only">Next</span>
    </a>
  </div><!-- /.carousel -->
<!-- Featured Content Section-->
<div class="container">
  <div class="row">
    <div class="col-md-4"></div>
    <div class="col-md-4"> <h2> FEATURED CONTENT </h2> or class="col-md-4">
    <div class="col-md-4"></div>
    <div class="col-md-4" style="text-align: right; font-size: small;">
```

Interface Adaptation: 3 prior approaches

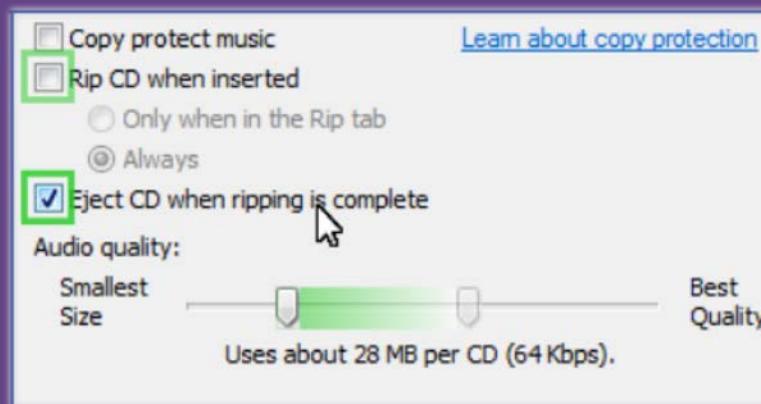
Personalized Interfaces

SUPPLE³



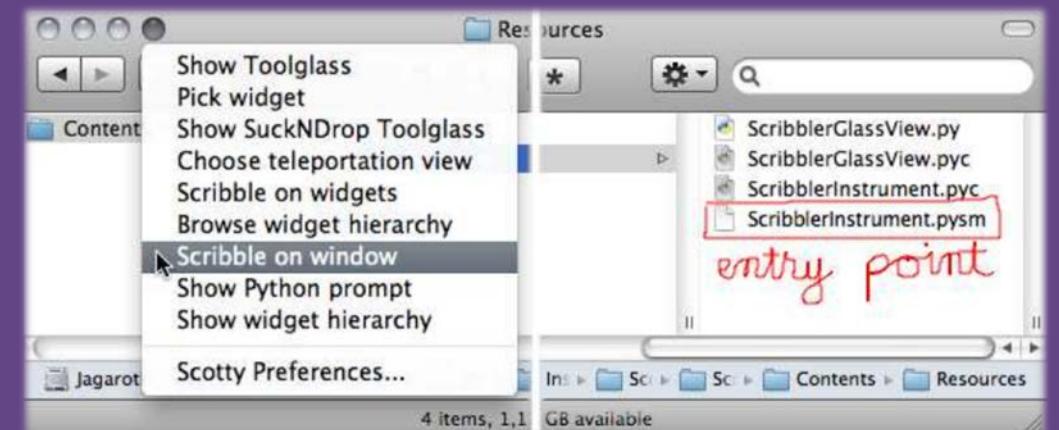
Pixel-Based Analysis

Prefab²

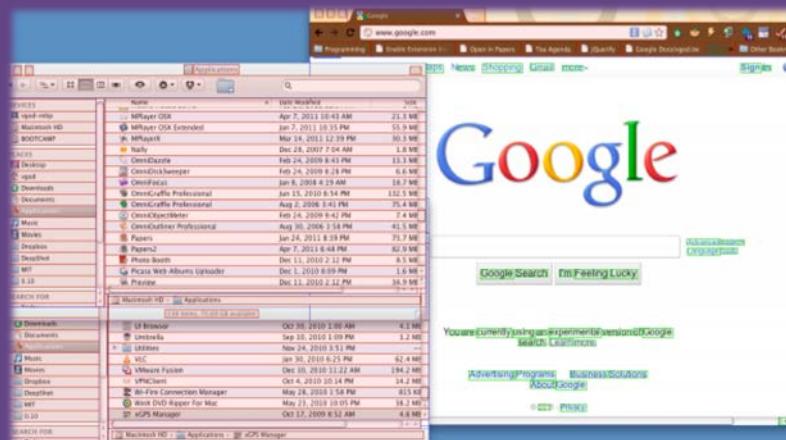


Runtime Toolkit Modification

Scotty⁴



PAX³



```
glink https://...  
 * @package _s  
 */  
if ( ! function_exists( 'incode_starter_setup' ) ) :  
    /**  
     * Sets up theme defaults and registers support for various WordPress  
     * features. Note that this function is hooked into the init hook.  
     * As indicated by the name, this function is also hooked into the  
     * after_setup_theme hook. The init hook is too late for some features,  
     * such as support for post thumbnails.  
     */  
function incode_starter_setup() {  
    /* Make theme available for translation.  
     * Translations can be filed in the /languages  
     * directory. If you're building a theme based on  
     * incode, use a find and replace to change 'incode-starter'  
     * to the name of your theme in all the files.  
     */  
    add_theme_support( 'post-thumbnails' );  
    add_theme_support( 'title-tag' );  
    add_theme_support( 'responsive-fonts' );  
    add_theme_support( 'custom-header' );  
    add_theme_support( 'custom-colors' );  
    add_theme_support( 'custom-selective-refresh-widgets' );  
}  
add_action( 'after_setup_theme', 'incode_starter_setup' );
```

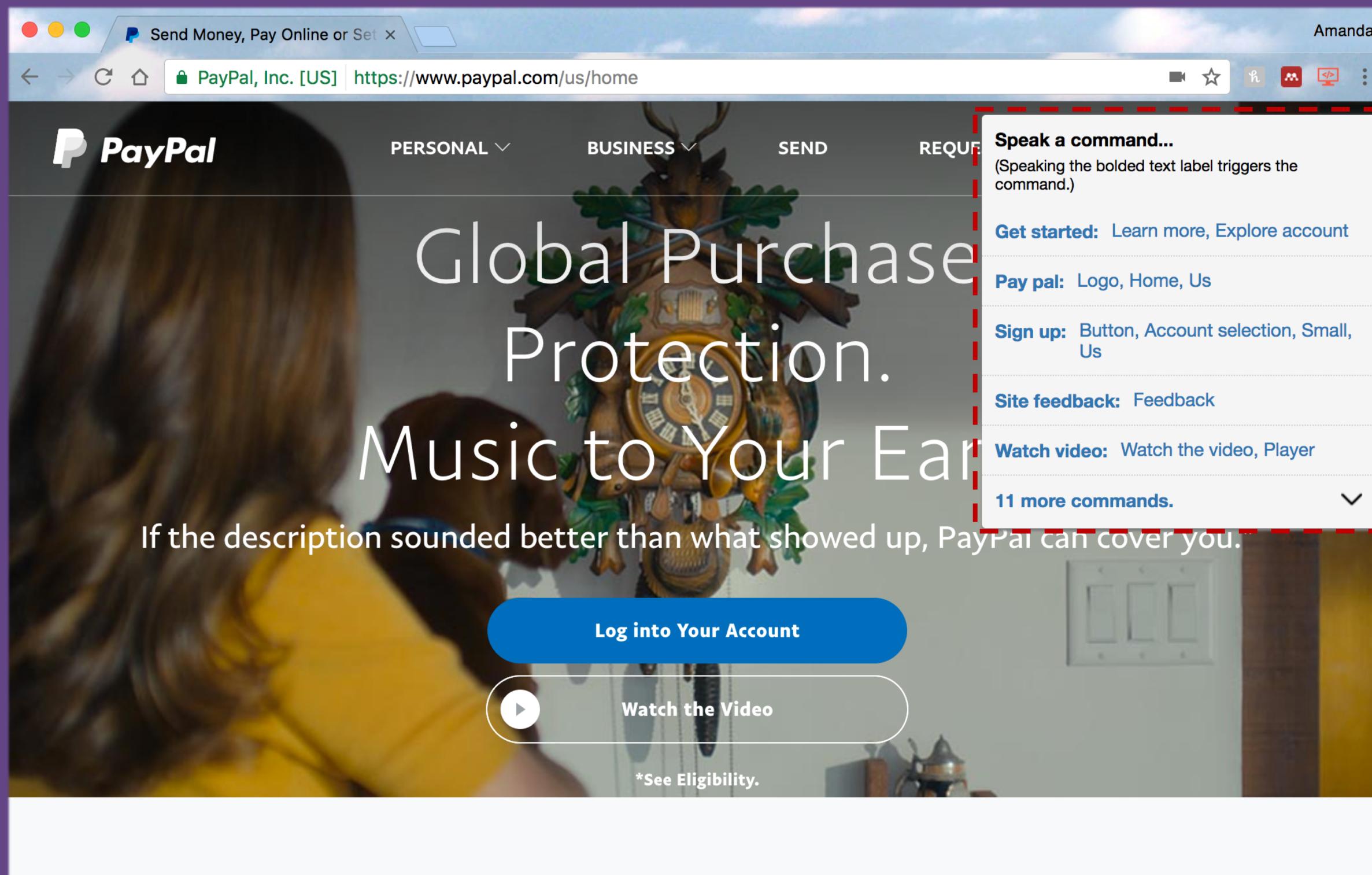
Program Analysis

Genie

Enables new interactions on the web through program analysis and *input retargeting*.

Automatic Speech Input

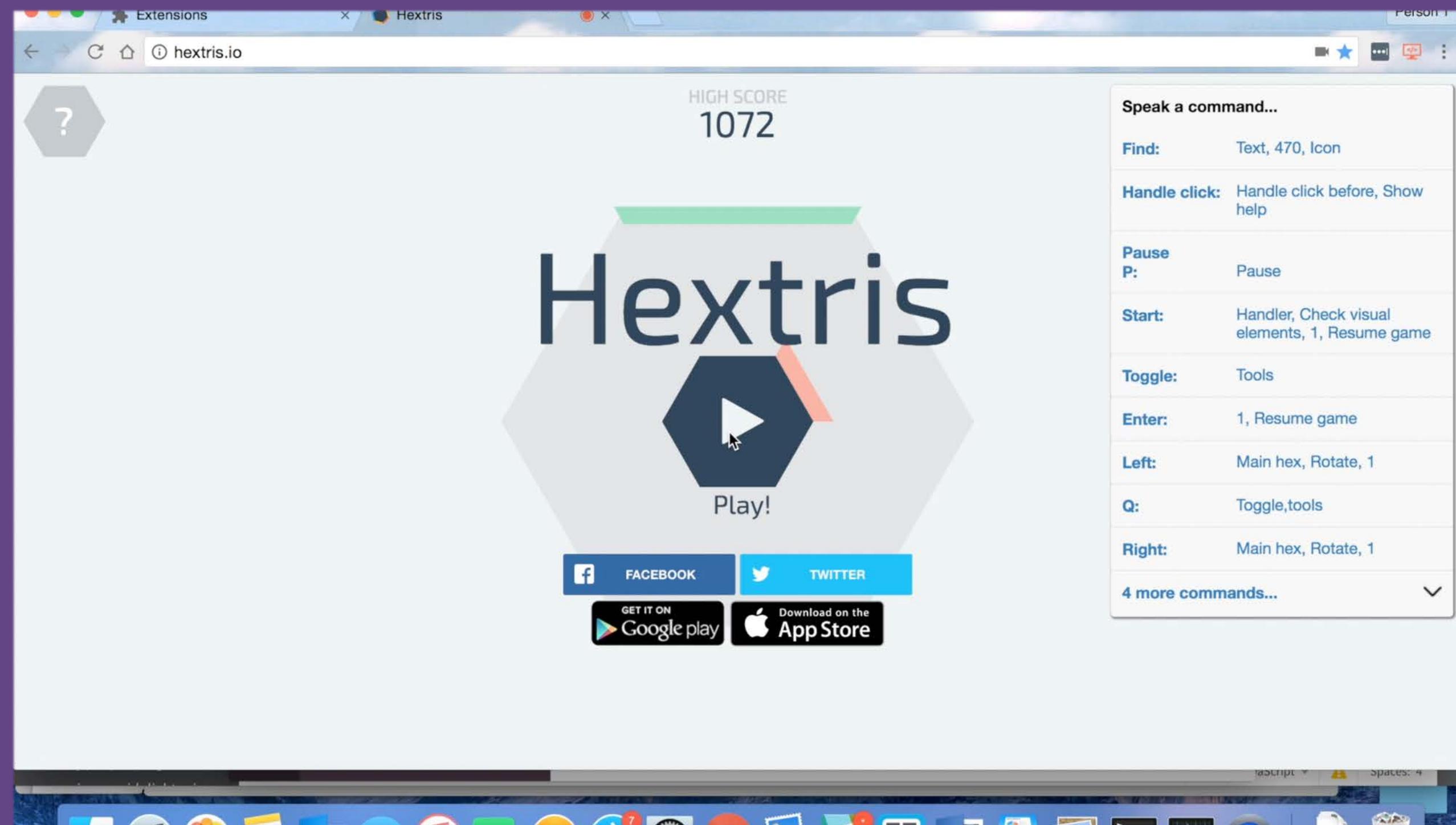
Navigate a website.



Genie
Interface

Automatic Speech Input

Use your voice to play a game.



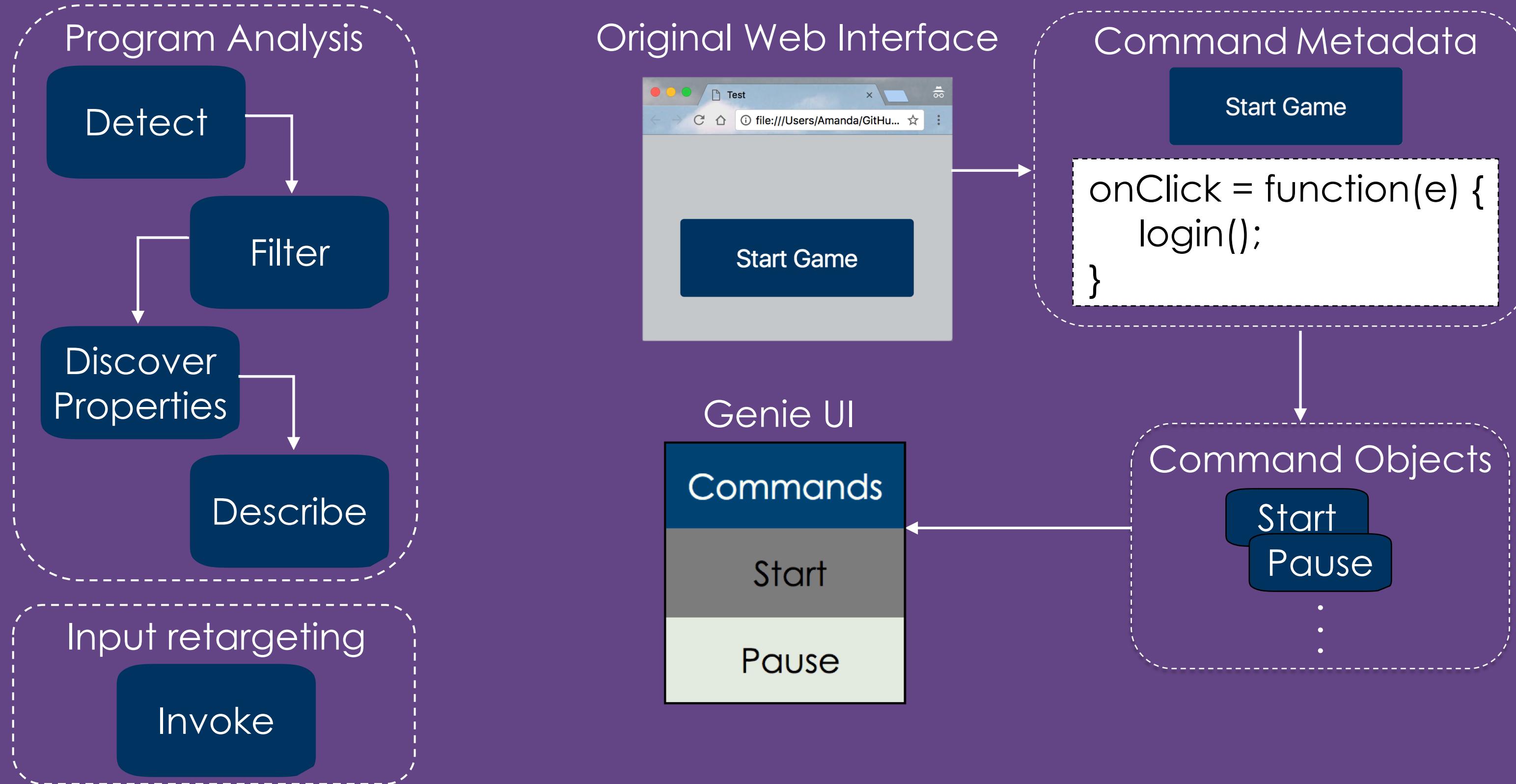
Overview

Program Analysis & Input Retargeting

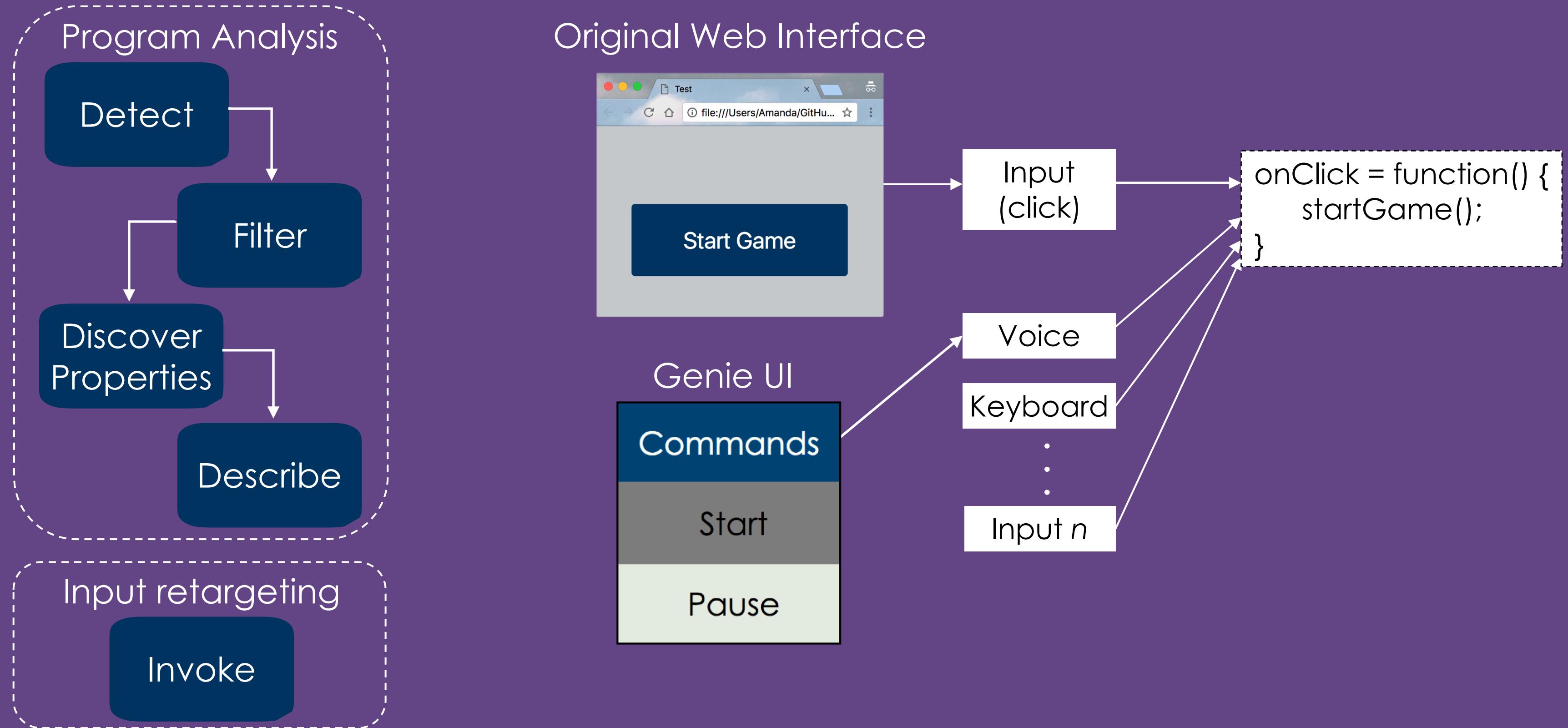
System Details

Demonstration

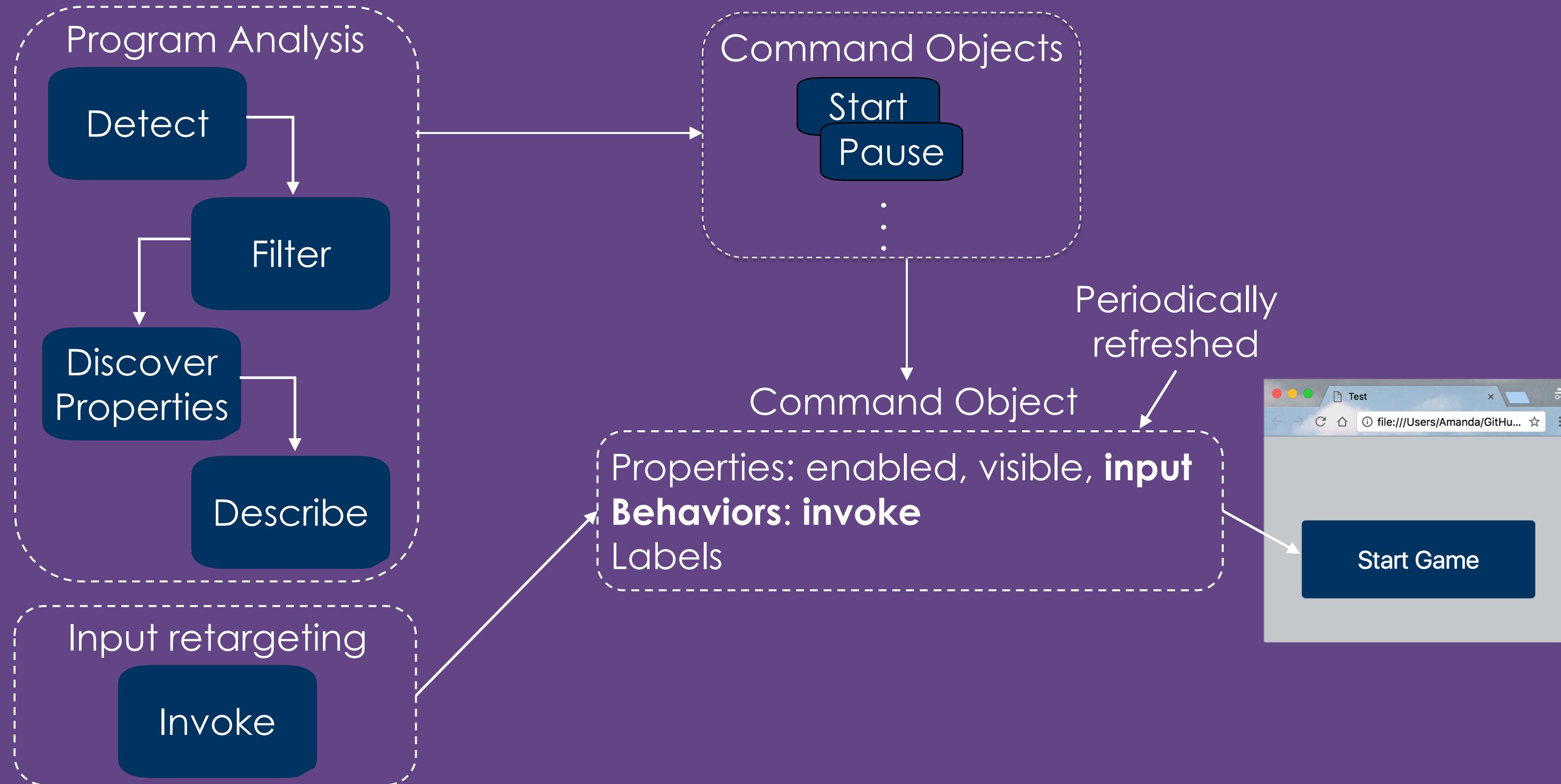
Program Analysis



Input Retargeting



Dynamic Command Objects



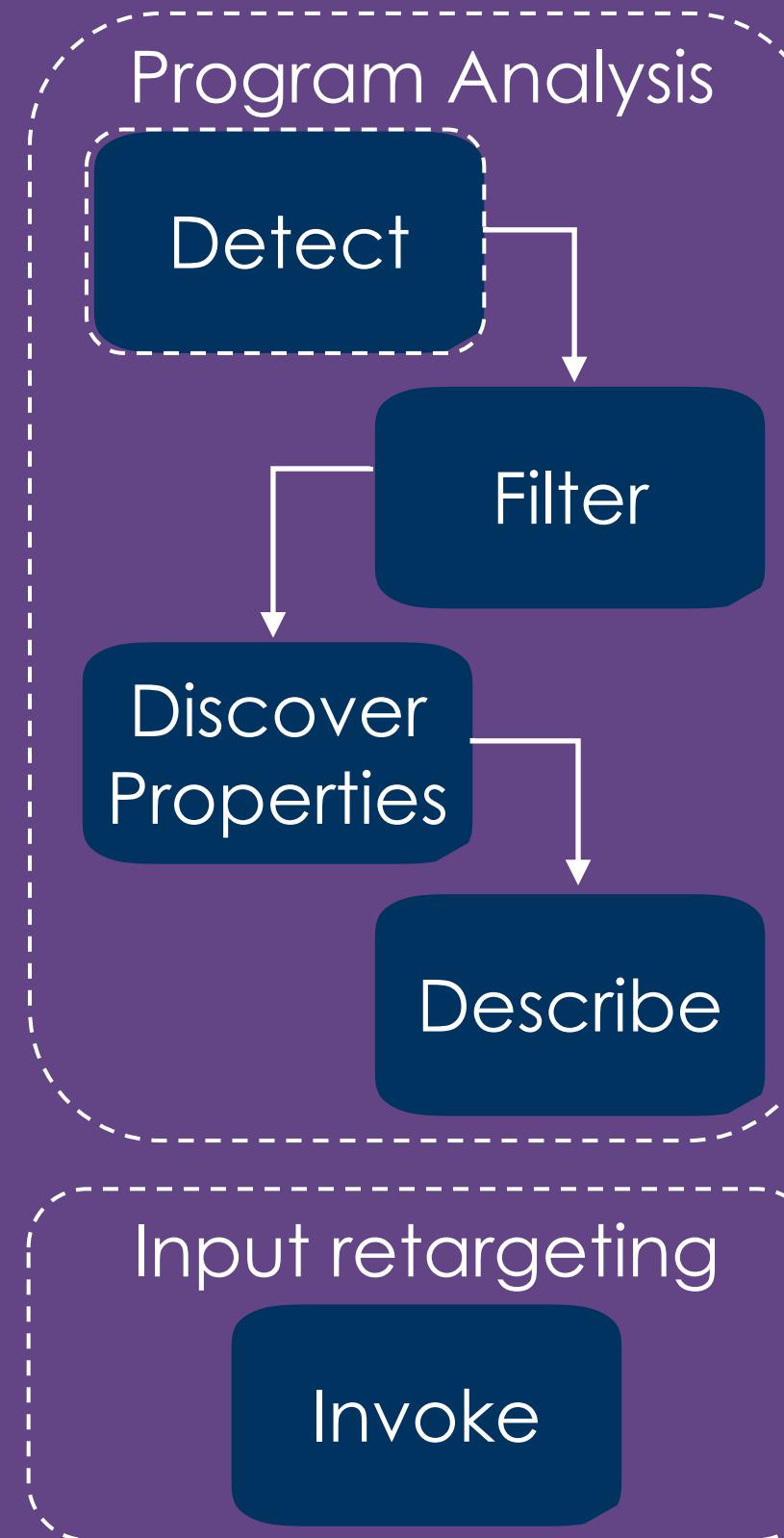
Overview

Program Analysis & Input Retargeting

System Details

Demonstration

Detecting Commands



What is a command?

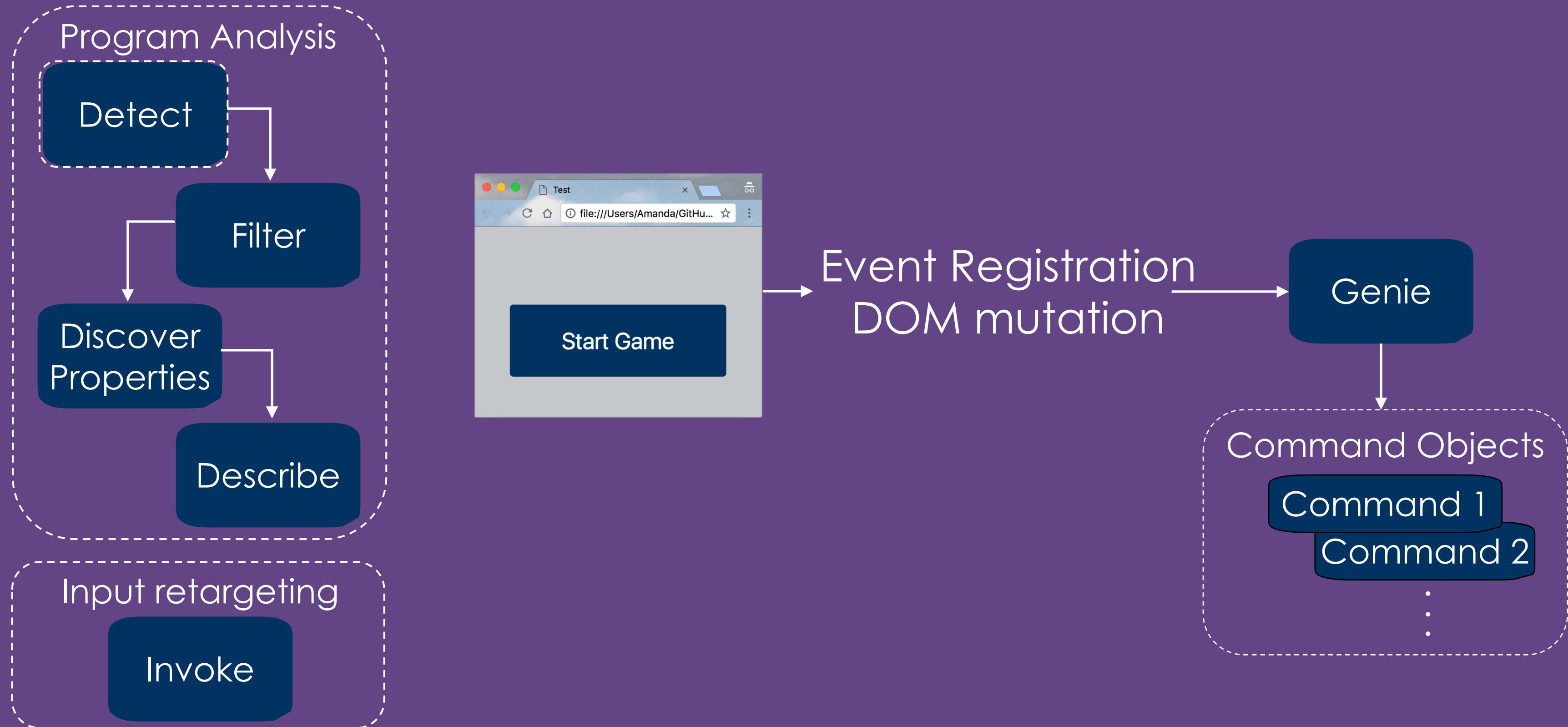
Event

OR

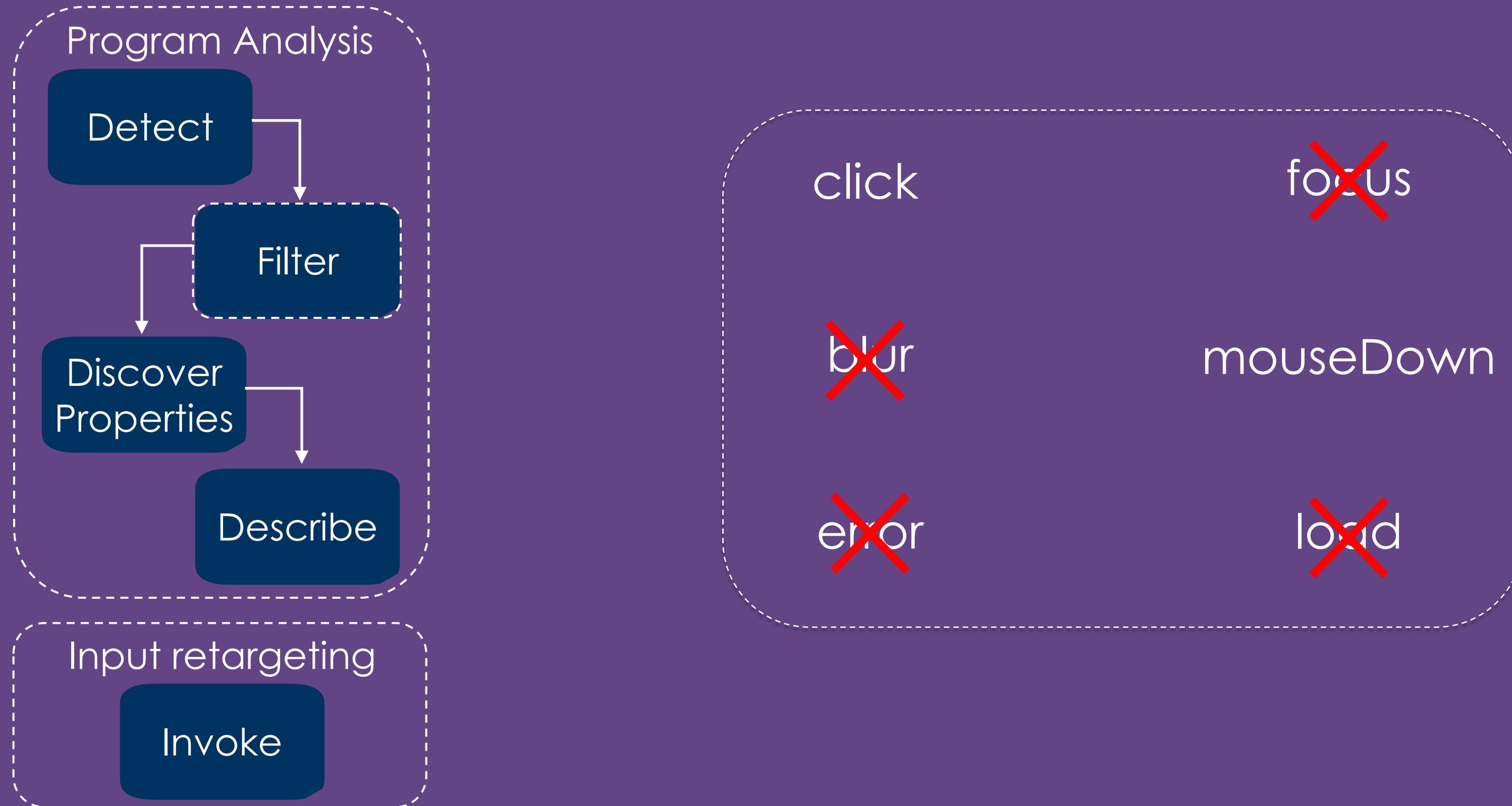
Interactive Element



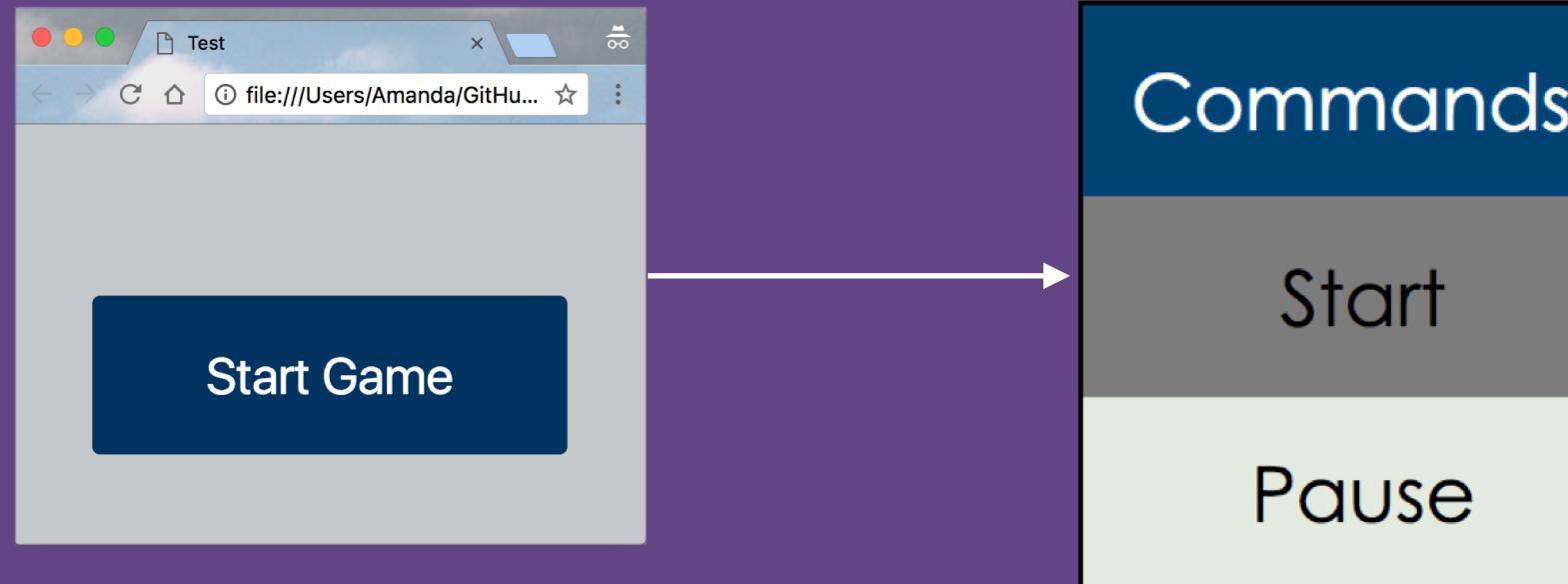
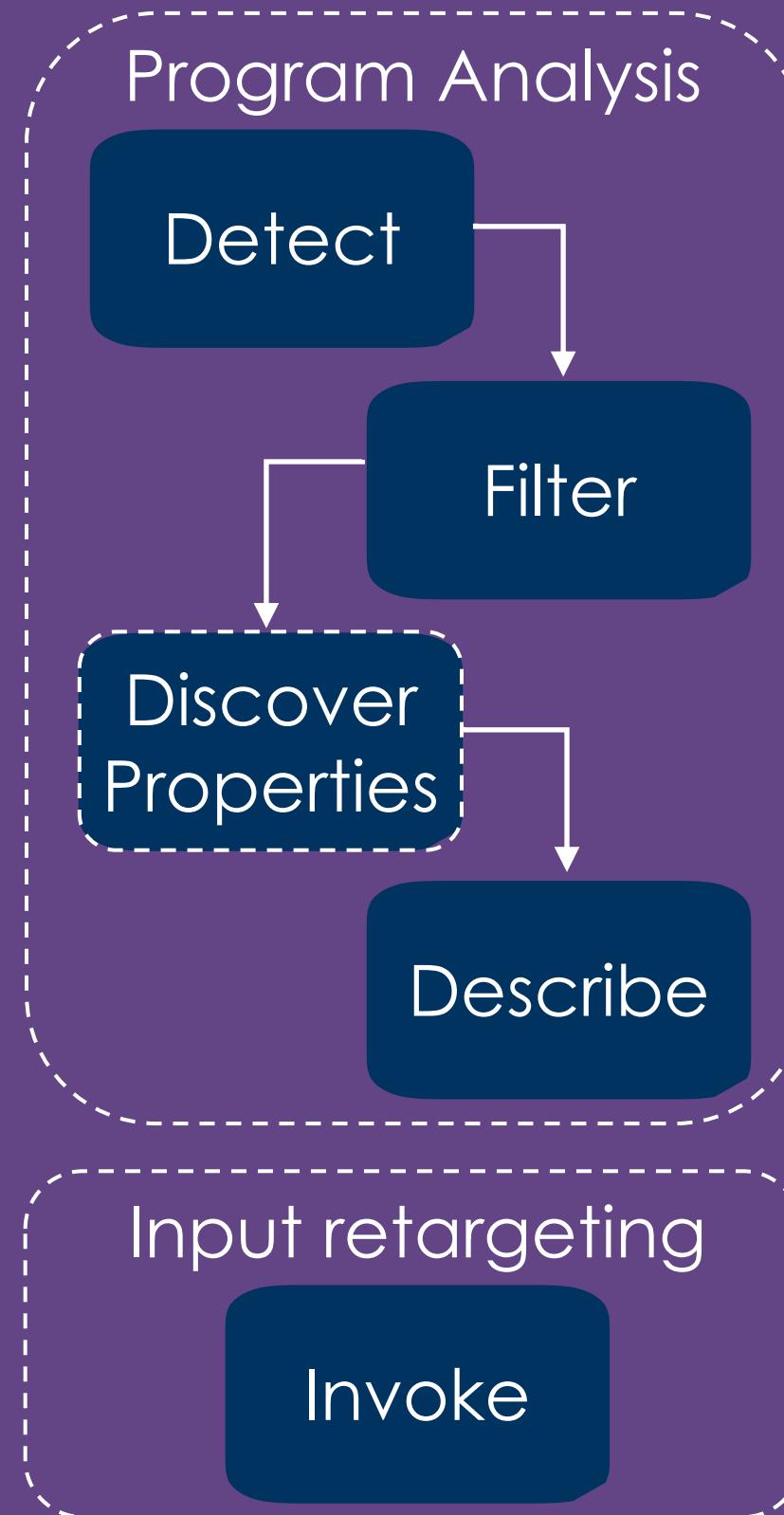
Detecting Commands



Filtering Commands



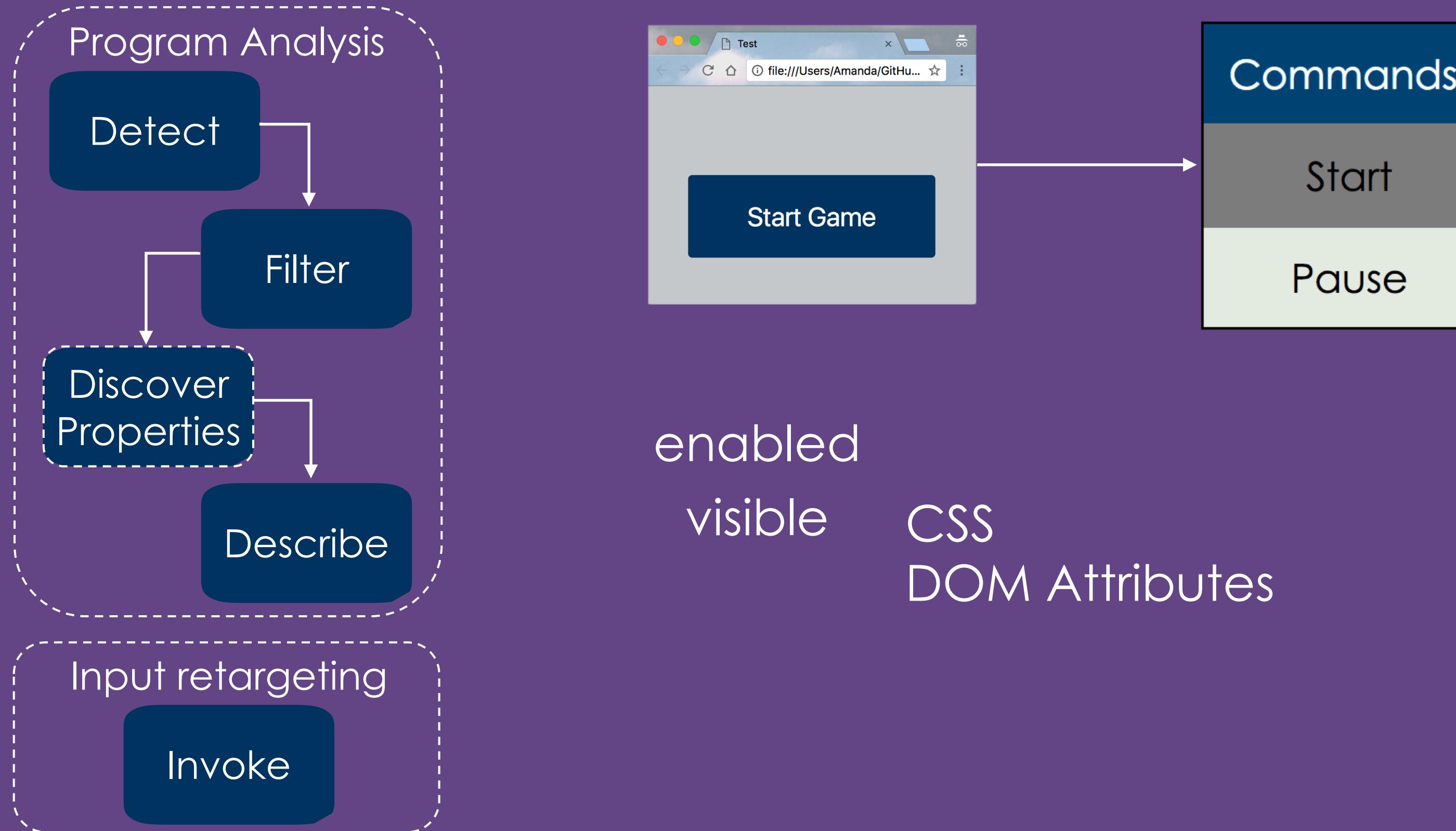
Discovering Properties



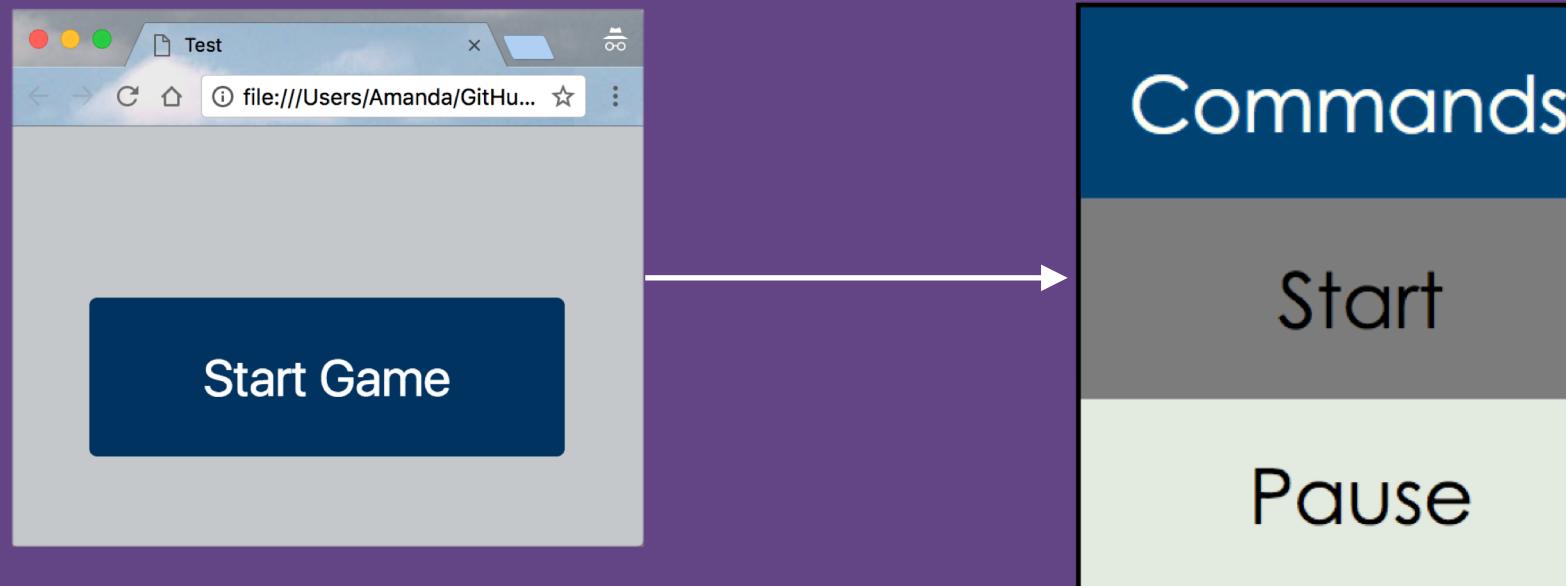
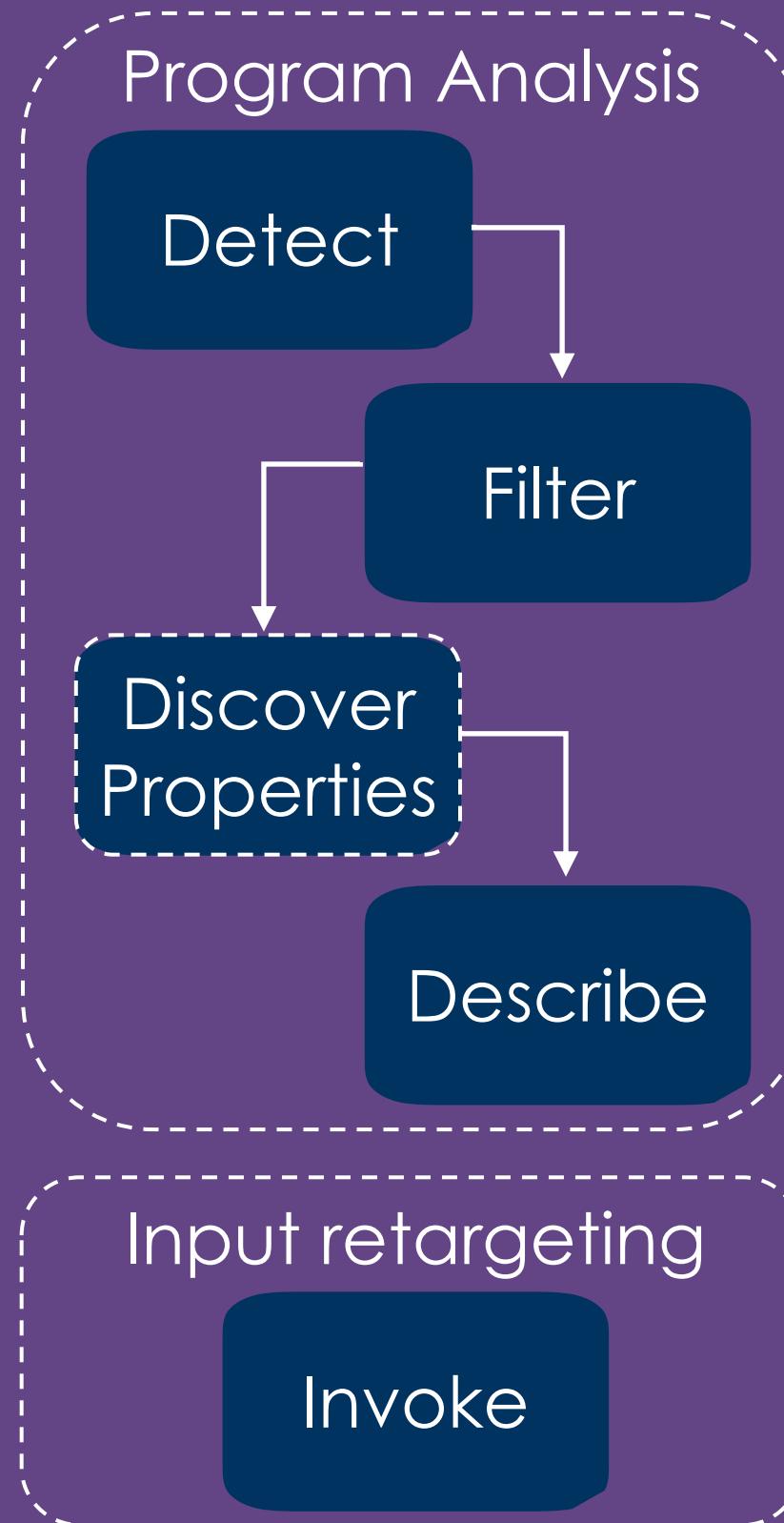
enabled

```
onClick = function handleStartGame(e) {  
    var startBtn = $("#startBtn");  
    if(!startBtn.attr("disabled")) {  
        startBtn.attr("disabled", true);  
        startGame();  
    }  
}
```

Discovering Properties



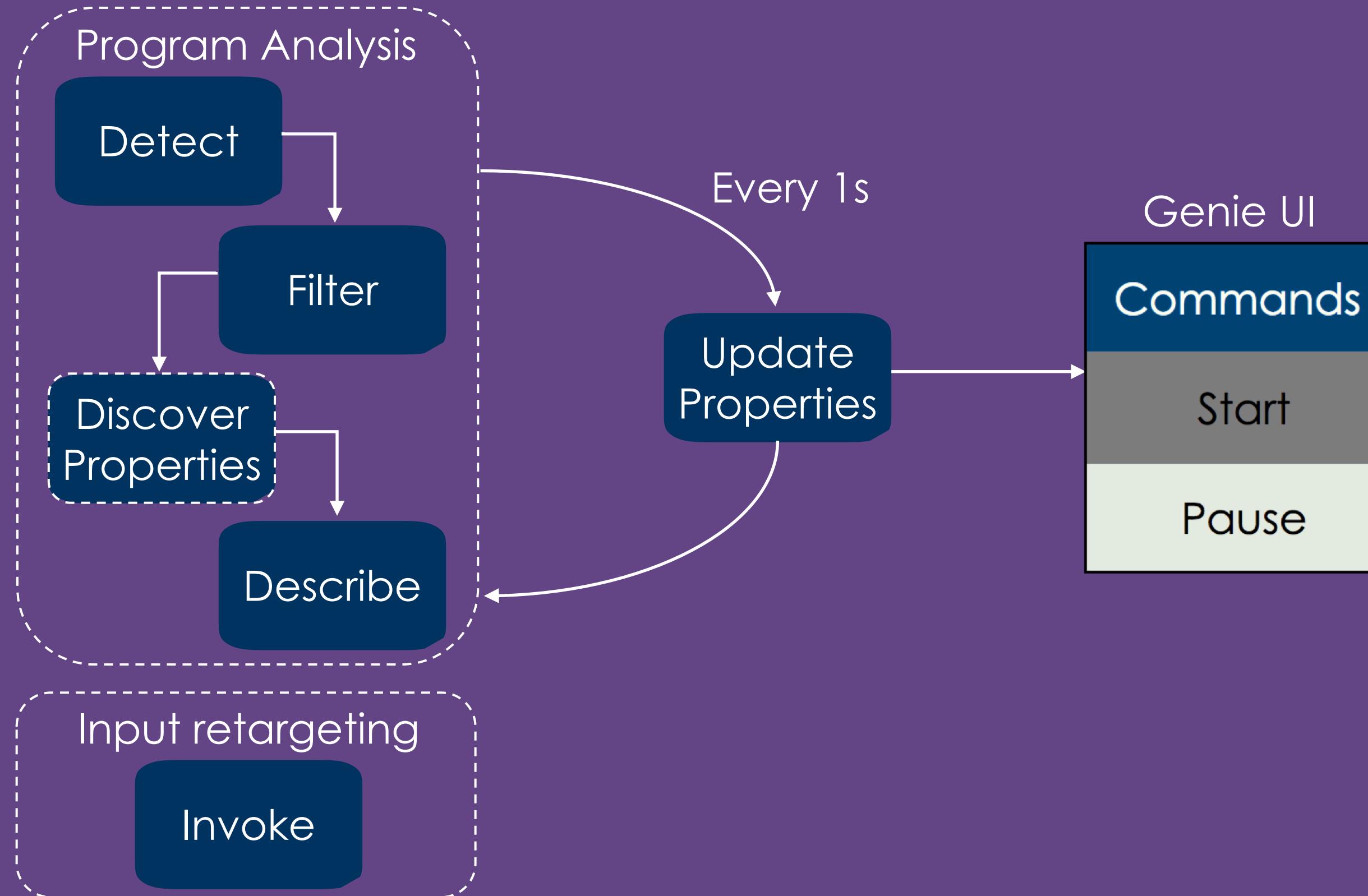
Discovering Properties



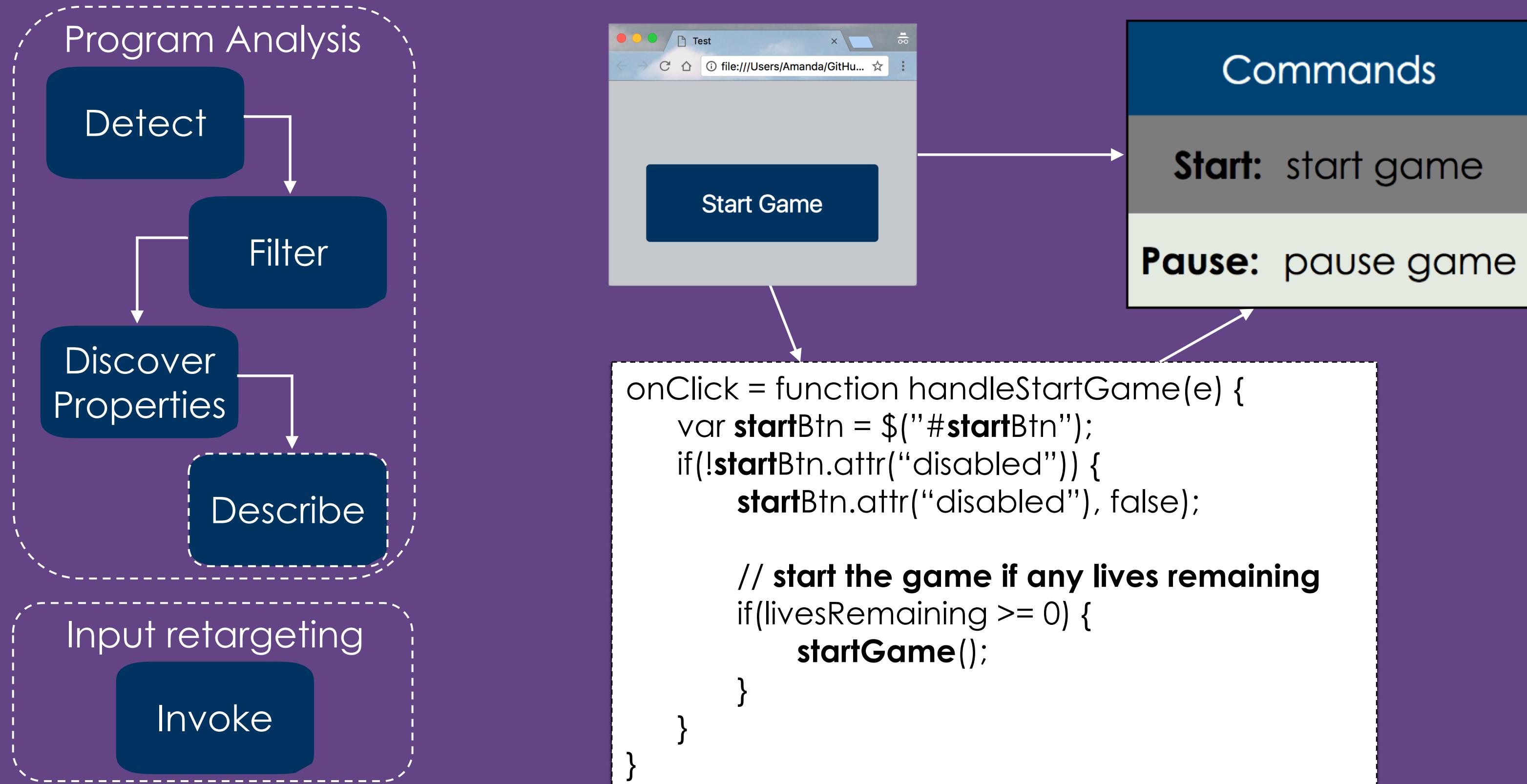
enabled
visible
input

```
onKeyDown = function keyDownHandler(e) {  
    if (e.keyCode == 13) {  
        submitOnEnter();  
    }  
}
```

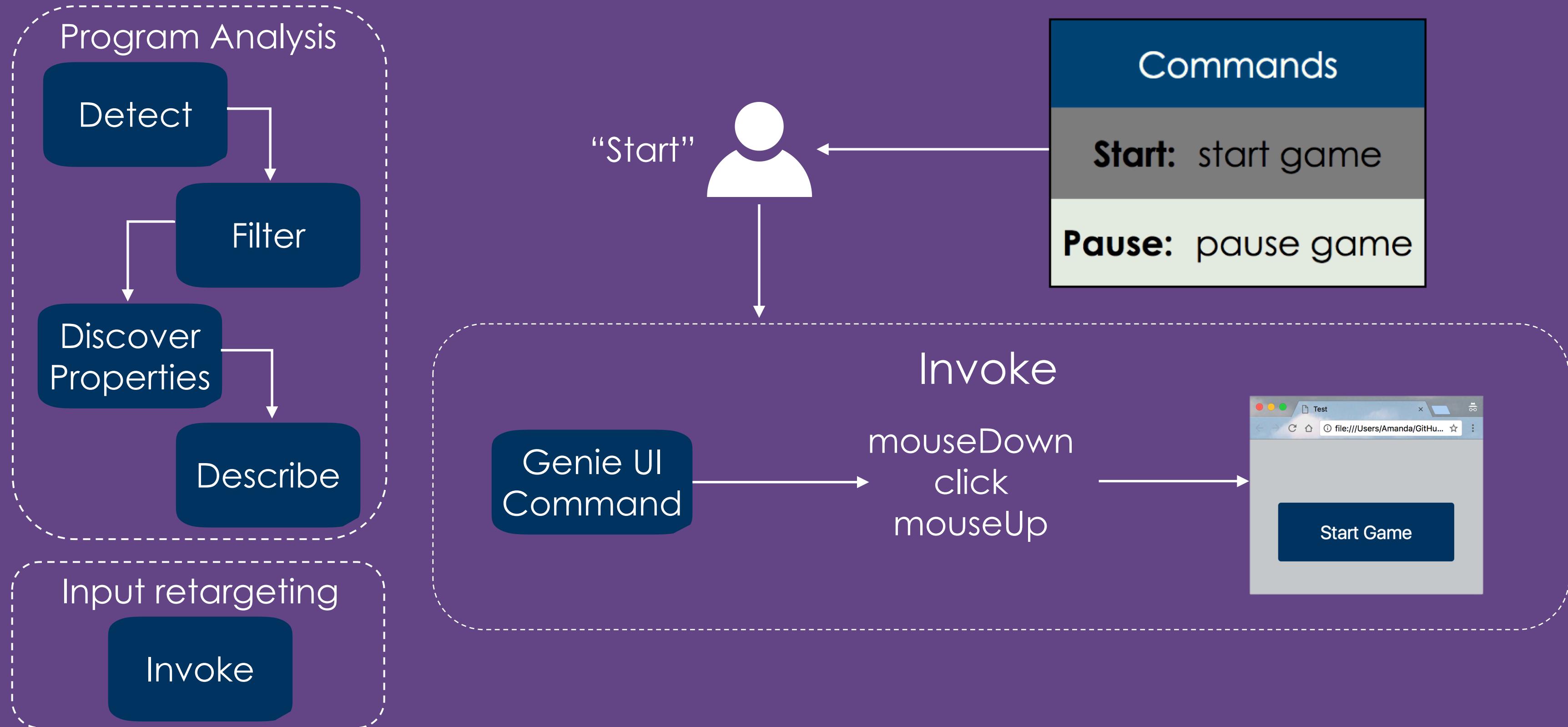
Discovering Properties



Describing Commands



Invoking Commands



Demonstration

4 example applications
3 types of input

Built with Genie API

- HTML/CSS
- Translation layer
- Small amount of code

Audio

Command
Line

Keyboard

⋮
⋮

Gaze

Gesture

Touch

Possible Input Types



Keyboard Shortcuts

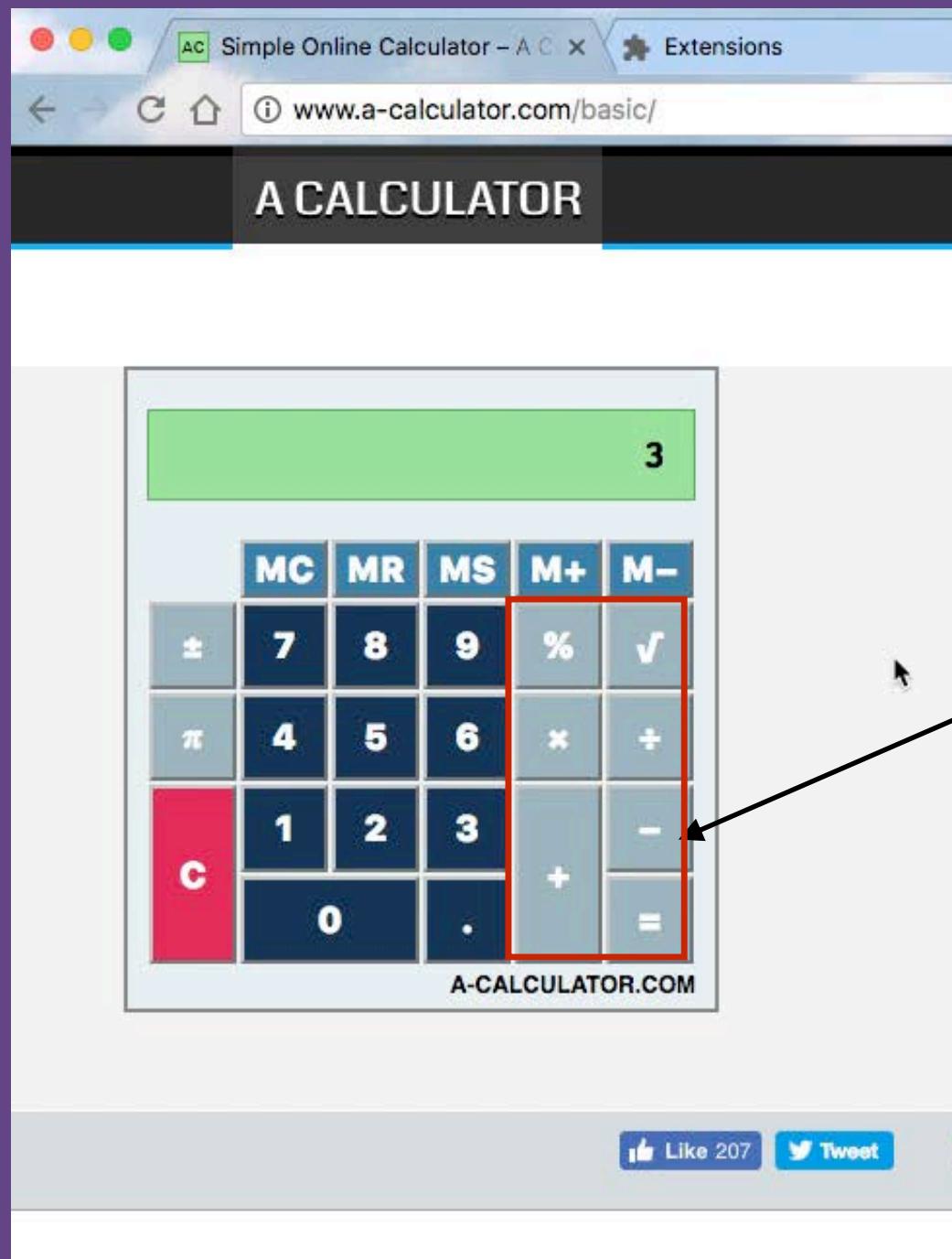
A screenshot of a 2048 game window in a web browser. The title bar shows '2048' and 'Extensions'. The address bar shows 'https://gabrielecirulli.github.io/2048/'. The game interface includes a large '2048' logo, a 'New Game' button, and a 'Keyboard shortcuts' modal window.

The 'Keyboard shortcuts' window lists the following:

- shift + k --- **Keep going**: Try again, Keep playi...
- shift + s --- **Set notice closed**: Storage, True, Notice...
- shift + t --- **Start**: Keep going, Try agai...
- shift + r --- **Try again**: Retry button

Text overlay: Type No shortcut for "Try Again" "New Game"

Keyboard Shortcuts

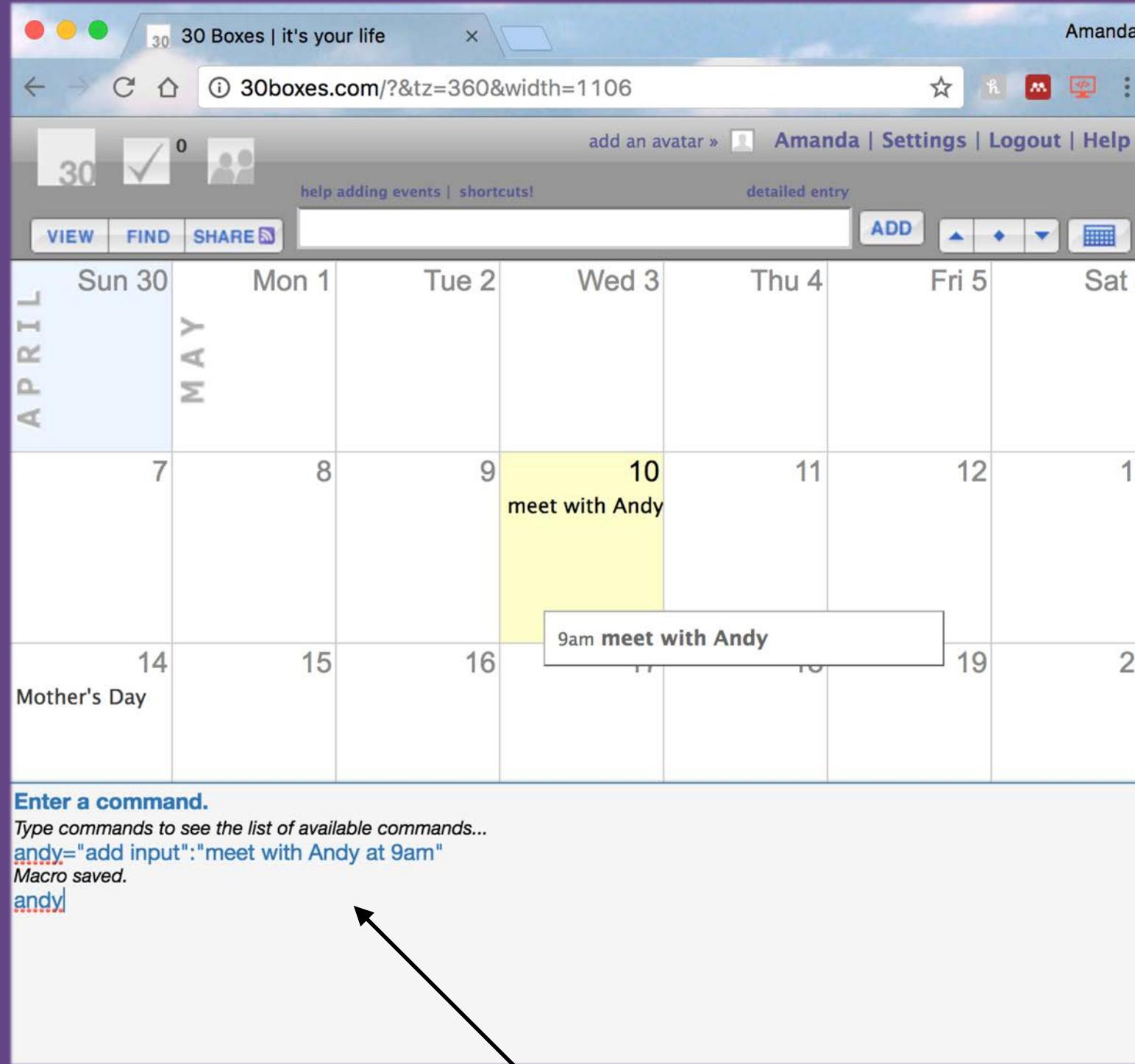


- Type "33"
- Type "Ctrl+d"
- Type "11"
- Type "Enter"

Missing keyboard shortcuts

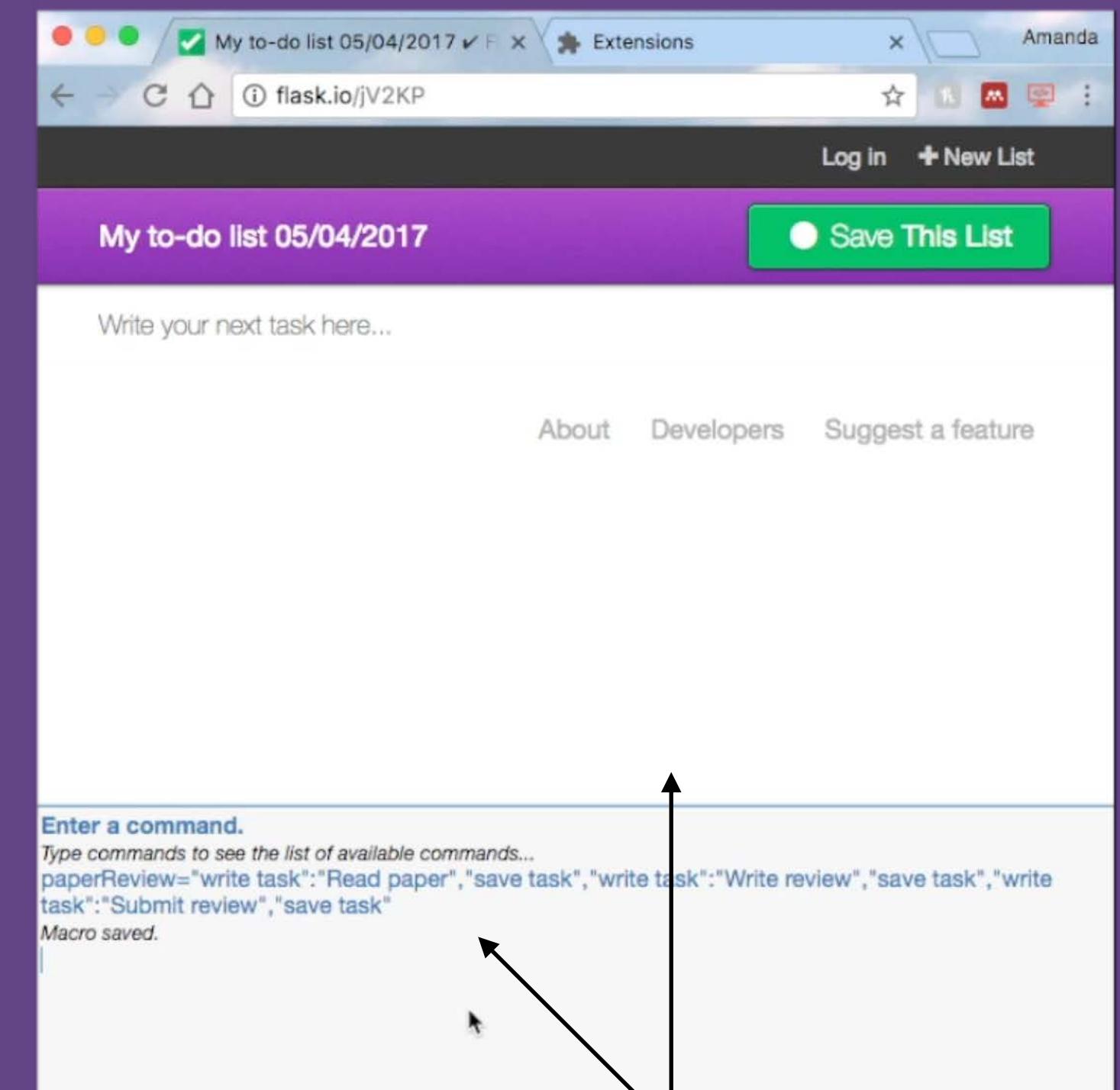
Command-Line Input

Creating a meeting



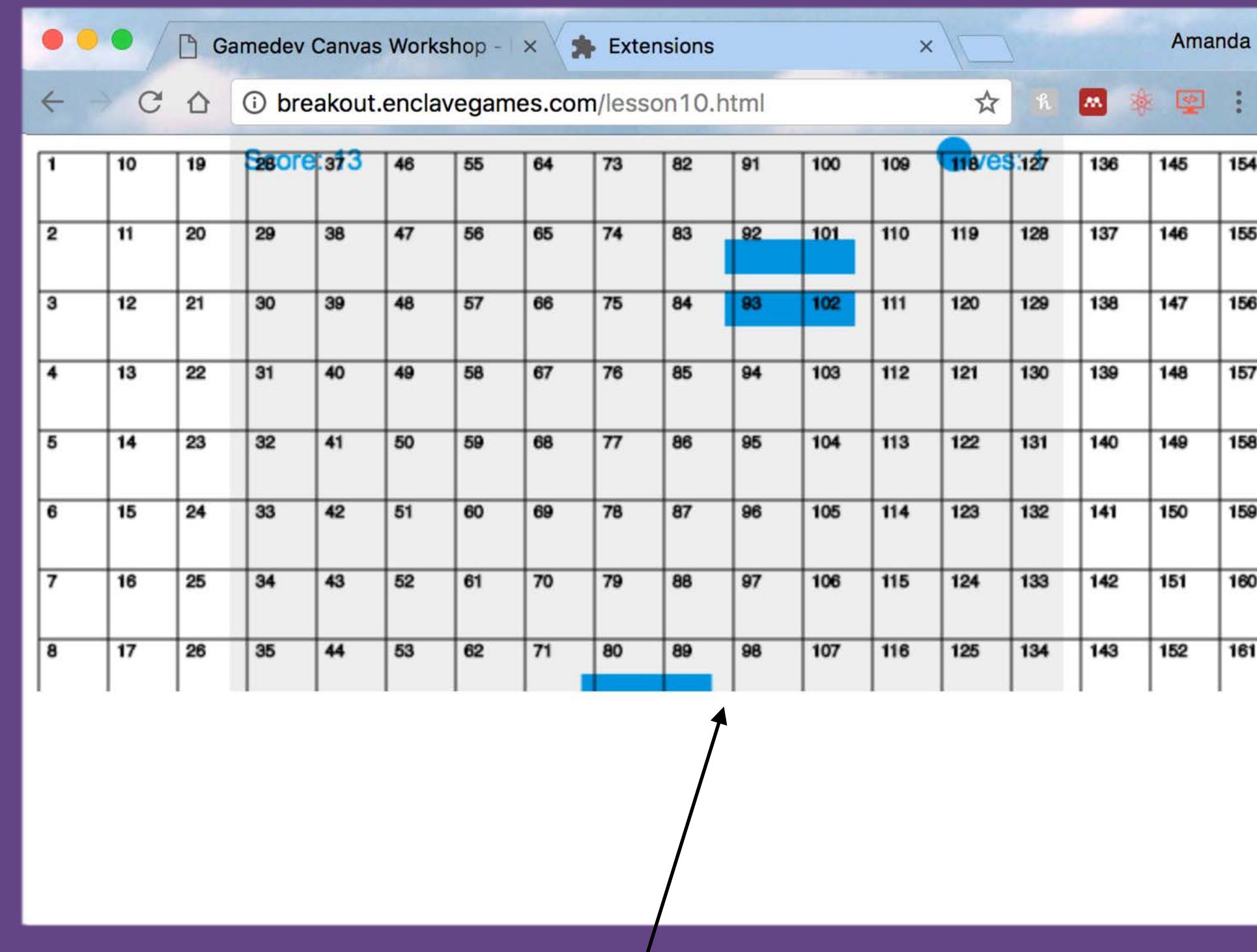
Type commands here.

Creating a To-Do list



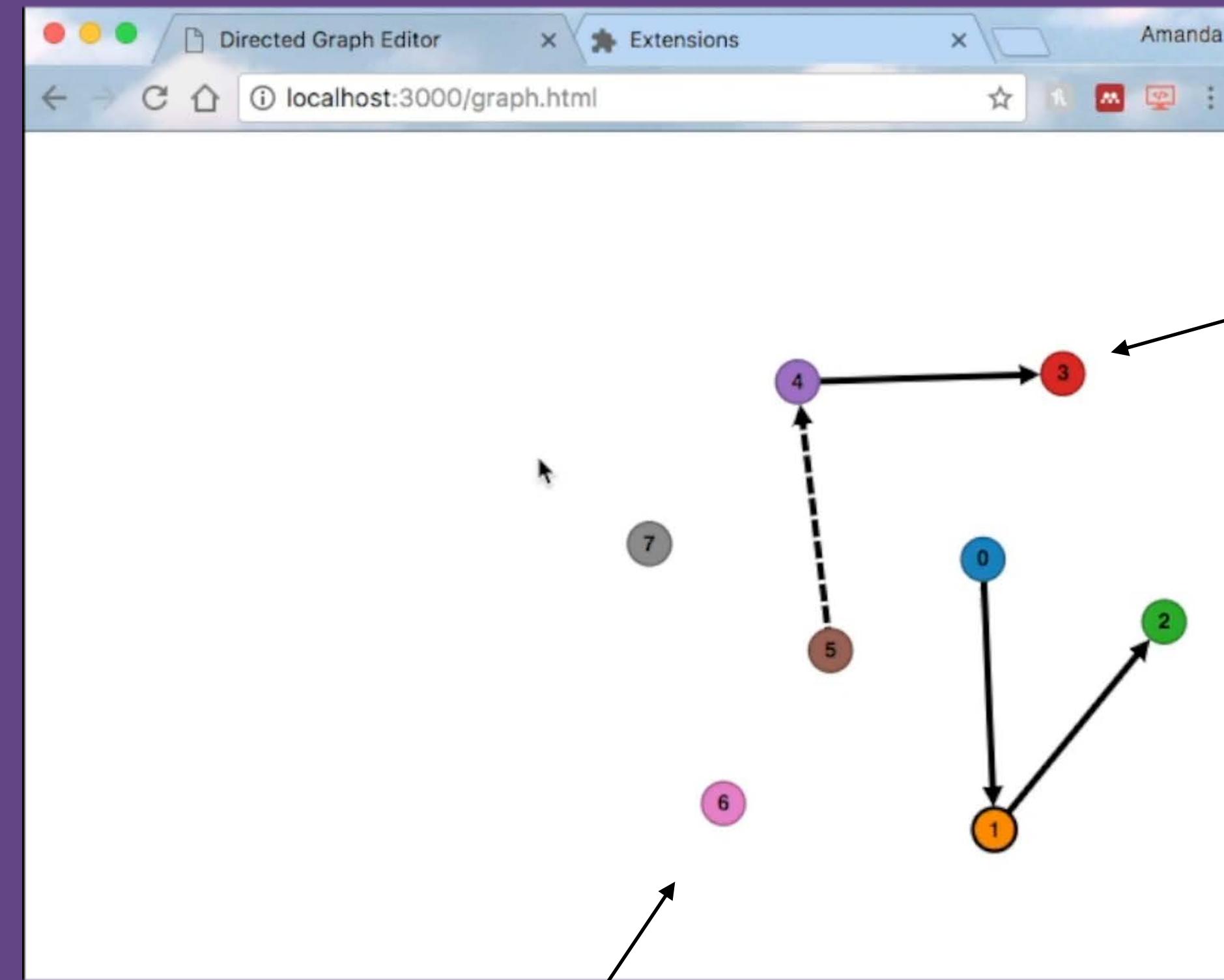
User typed "paperReview="

Keyboard Mouse Input



Type cell number to move mouse

Keyboard Mouse Input



Type cell number to place a node.

Add node – click
Add edge – drag

Genie

Enables new interactions on the web through program analysis and *input retargeting*.

Genie

Key Takeaways

Genie enables interacting with the web
in new ways through *input retargeting*

Genie enables discovering and monitoring
interactive commands through *program analysis*

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DESIGN
USE
BUILD



Information School
UNIVERSITY of WASHINGTON



PAUL G. ALLEN SCHOOL
OF COMPUTER SCIENCE & ENGINEERING