EFFECTANCE AND CONTROL IN VIDEO GAMES

Final Project for CSCE 4250
Spring 2017

COLE DAPPRICH

PREVIOUS WORK

- Klimmt, Christoph, Tilo Hartmann, and Andreas Frey. "Effectance and Control as Determinants of Video Game Enjoyment." CyberPsychology & Behavior 10.6 (2007): 845-48. Web.
  - **Result:** Reducing the player's perceived effectance reduced their enjoyment, but reducing the player's perceived control did not. Therefore, effectance and control are important aspects of video game enjoyment, but they are not the sole determinant of how "fun" a game is.
  - **Justification:** The authors produced 3 versions of a breakout clone: a normal (control) version, a version where the controls did not respond 1/3 of the time (reduced effectance condition), and a version where the ball moved much faster (reduced control condition). 500 volunteers then participated in an online between-subjects research study with 3 groups: a group that played the control twice, a group that played the control followed by the reduced effectance condition, and a group that played the control followed by the reduced control condition. The participants then filled out a questionnaire, which justified their results.

PREVIOUS WORK

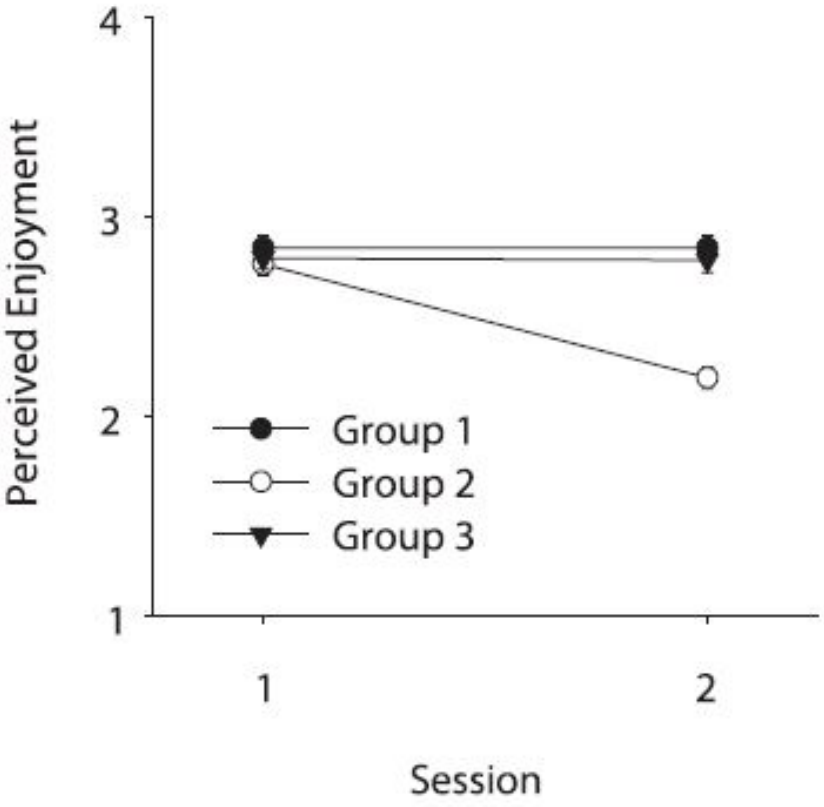


FIG. 1. Mean perceived enjoyment (+*SE*) while playing different versions of a computer game for three experimental groups. At session 1, all groups played the standard condition; at session 2, group 1 ($n = 171$) used the standard condition, group 2 ($n = 170$) played the version with reduced effectance, and group 3 ($n = 159$) played the version with reduced control.

IMPLEMENTATION

- I designed and implemented 5 different versions of a Breakout clone
  - Written in HTML5, CSS, and JavaScript
    - Reasons: portability, simplicity, and ease of distribution
  - Version 1: Experimental control (standard version)
  - Version 2: Mouse controls
    - Increased control and effectance conditions
  - Version 3: Increased ball speed and decreased paddle speed
    - Decreased control condition
  - Version 4: Controls respond only 75% of the time
    - Decreased effectance condition
  - Version 5: Paddle moves automatically, user controls its speed
    - Decreased control and effectance conditions
  - Randomized
    - First game (Game A) is not the control, etc.

IMPLEMENTATION

C:\Users\Cole\Desktop\Comp Sci\2017\Topics in Game Development\Final Project\breakout.html - Notepad++

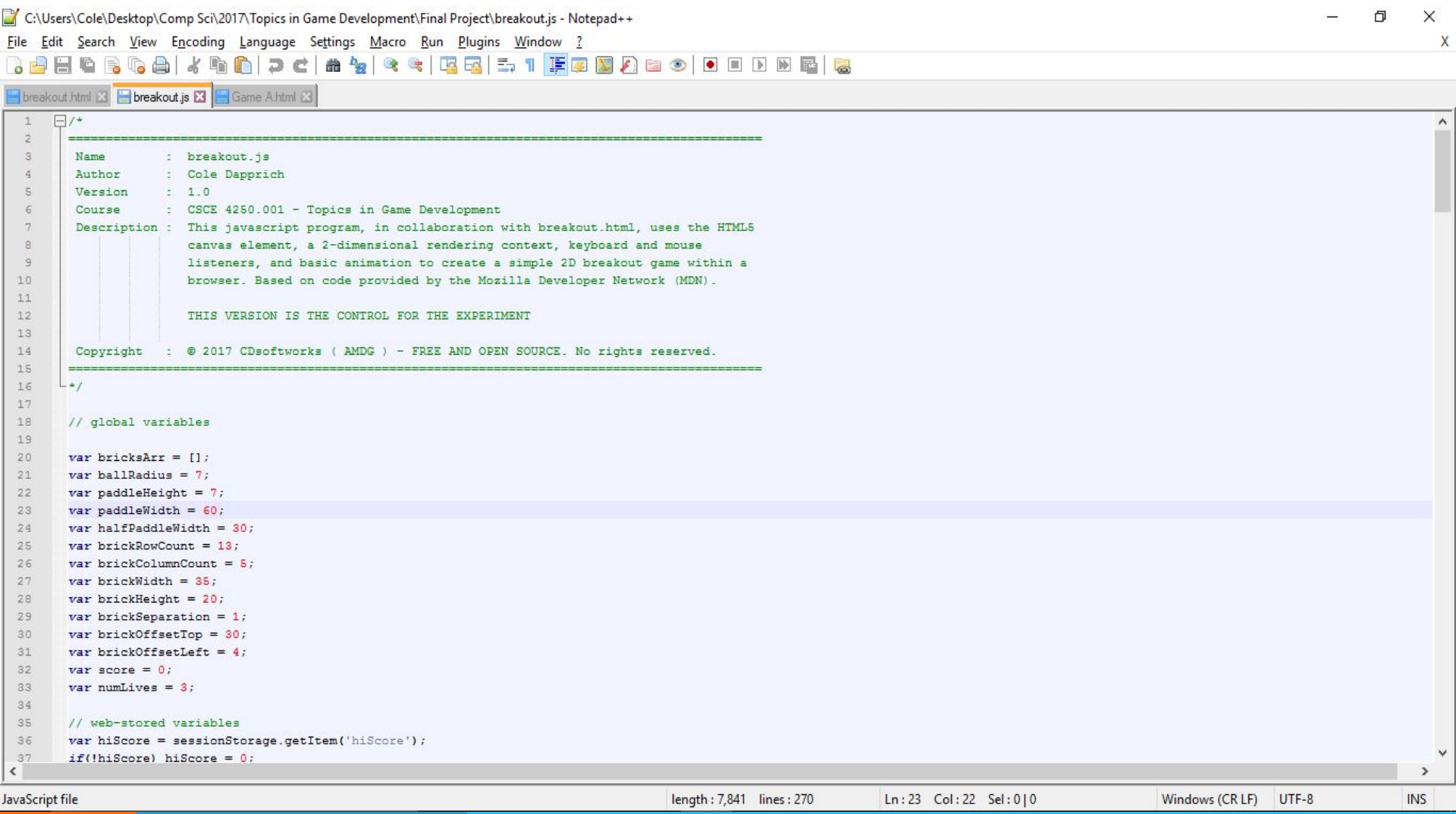
File Edit Search View Encoding Language Settings Macro Run Plugins Window ?

breakout.html | breakout.js | Game A.html

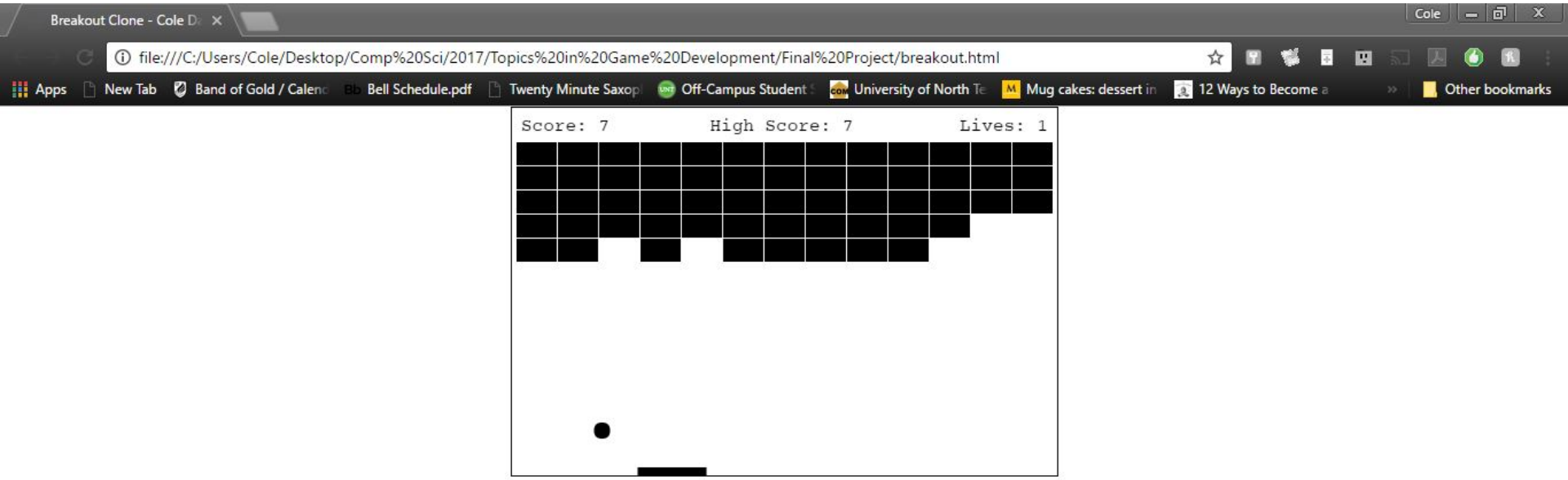
```
<!--
=================================================================================================
 Name        :  breakout.html
 Author      :  Cole Dapprich
 Version     :  1.0
 Course      :  CSCE 4250.001 - Topics in Game Development
 Description :  This html driver, in collaboration with breakout.js, uses the HTML5 canvas
                element and basic CSS to create a simple 2D breakout game within a browser.
                Based on code provided by the Mozilla Developer Network (MDN).
 Copyright   :  © 2017 CDsoftworks ( AMDG )  - FREE AND OPEN SOURCE. No rights reserved.
=================================================================================================
-->

<!DOCTYPE html>
<html lang = "en">
    <head>
        <meta charset = "utf-8" />
        <title>Breakout Clone - Cole Dapprich</title>

        <!-- basic CSS code for centering the game in the browser window and drawing a white background with black borders -->
        <style>* { padding: 0; margin: 0; } canvas { background: #FFF; display: block; border: 1px solid black; margin: 0 auto; }</style>
    </head>
    <body onload = "main()">
        <canvas id = "canvas" width = "475" height = "320"></canvas>
        <script src = "breakout.js"></script> <!-- THE NUMBERS 2 - 6 CAN BE ADDED TO THE FILENAME TO RUN DIFFERENT VERSIONS OF THE GAME -->
    </body>
</html>
```

Hyper Text Markup Language file | length : 1,393 lines : 27 | Ln : 27 Col : 8 Sel : 0 | 0 | Windows (CR LF) | UTF-8 | INS

IMPLEMENTATION



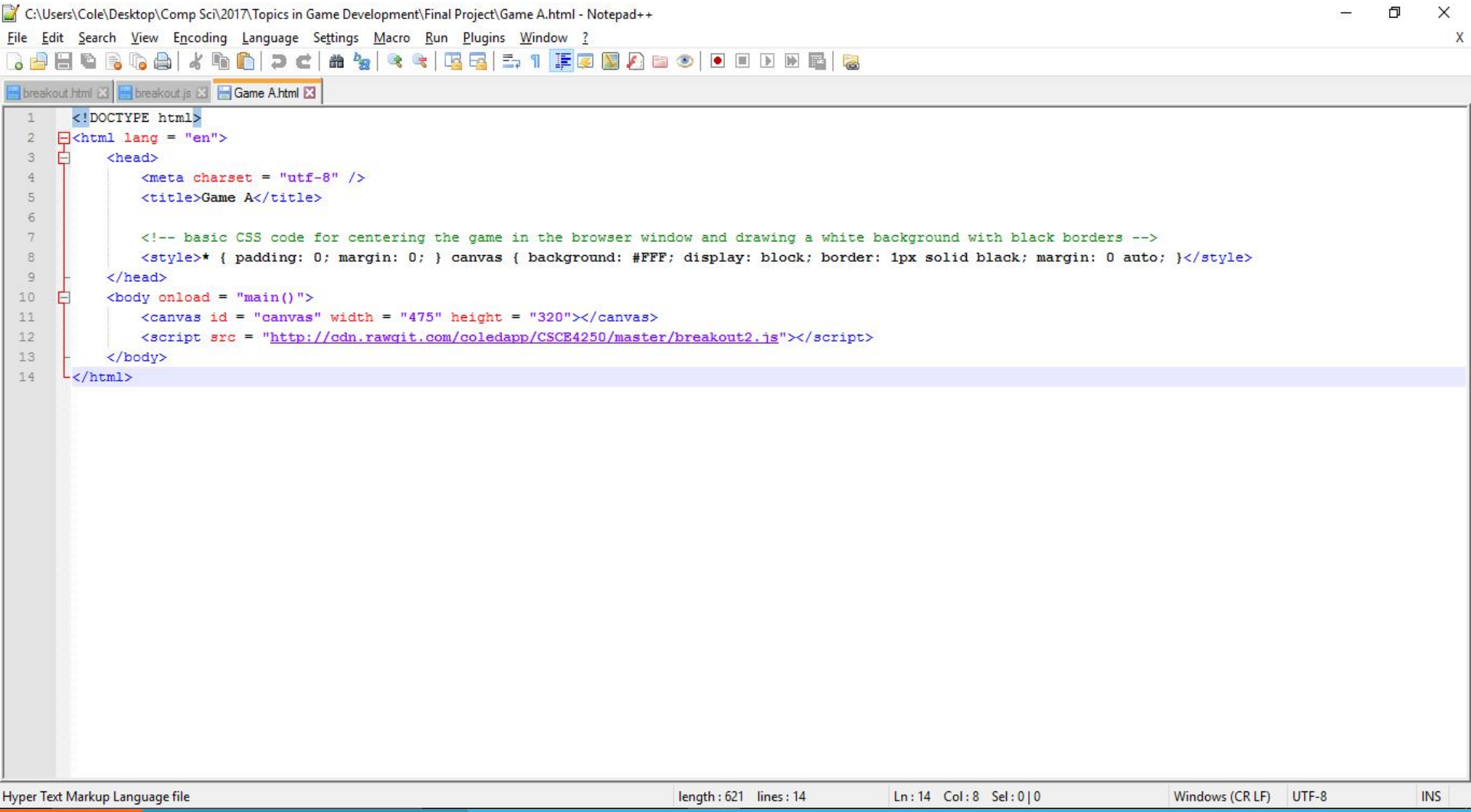
IMPLEMENTATION



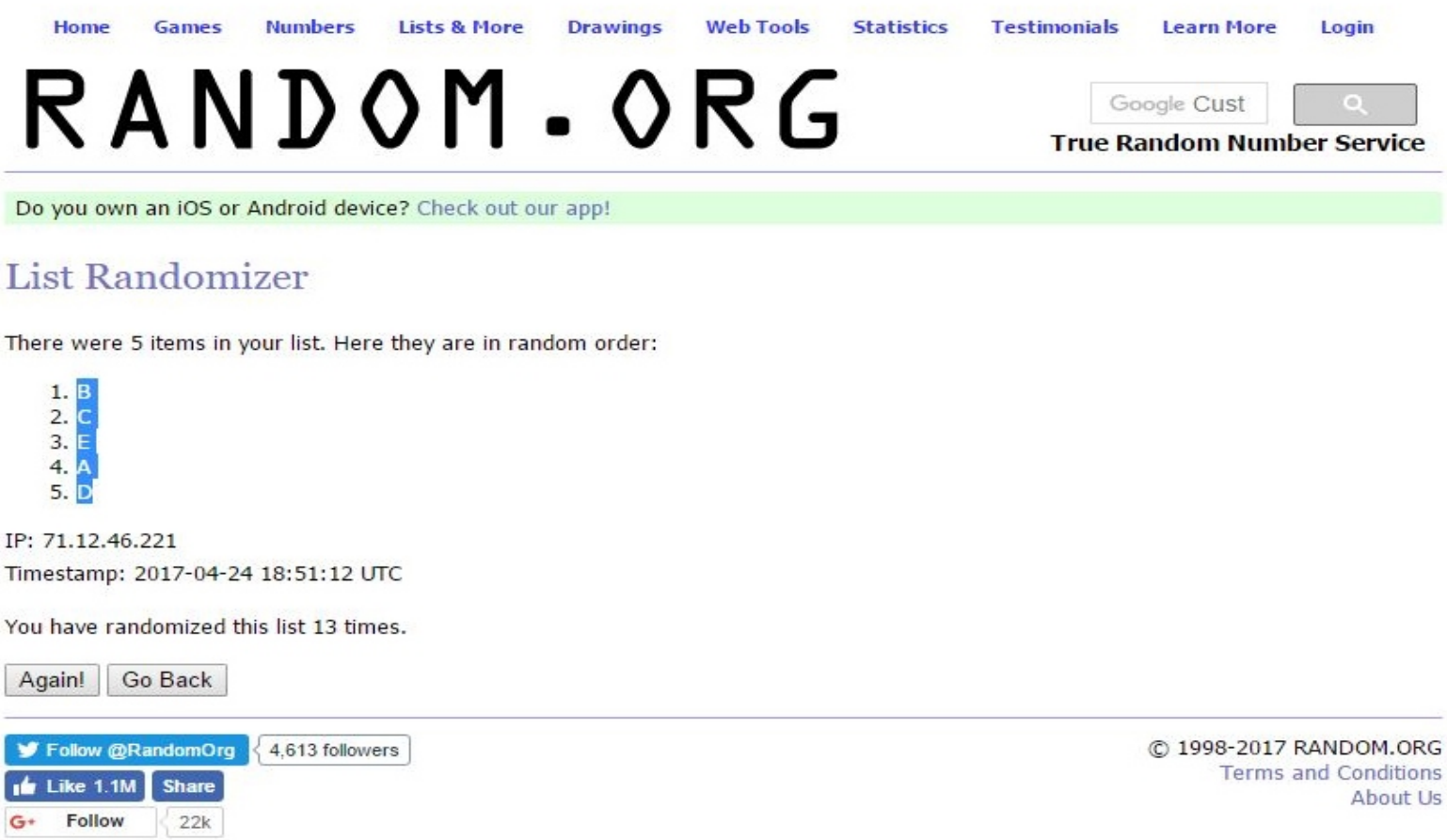
EXPERIMENTATION

- I designed a within-subjects research study that had each participant play the 5 versions of Breakout in random order, in an attempt to reduce the effects of ordering and fatigue
  - Reasons: time and numbers limitations
  - Using random.org, a “true” RNG that uses atmospheric noise
  - 29 participants in total
  - Were told to play each version as many times as they liked
- The participants were then asked to complete a survey about their experience
  - Using SurveyMonkey

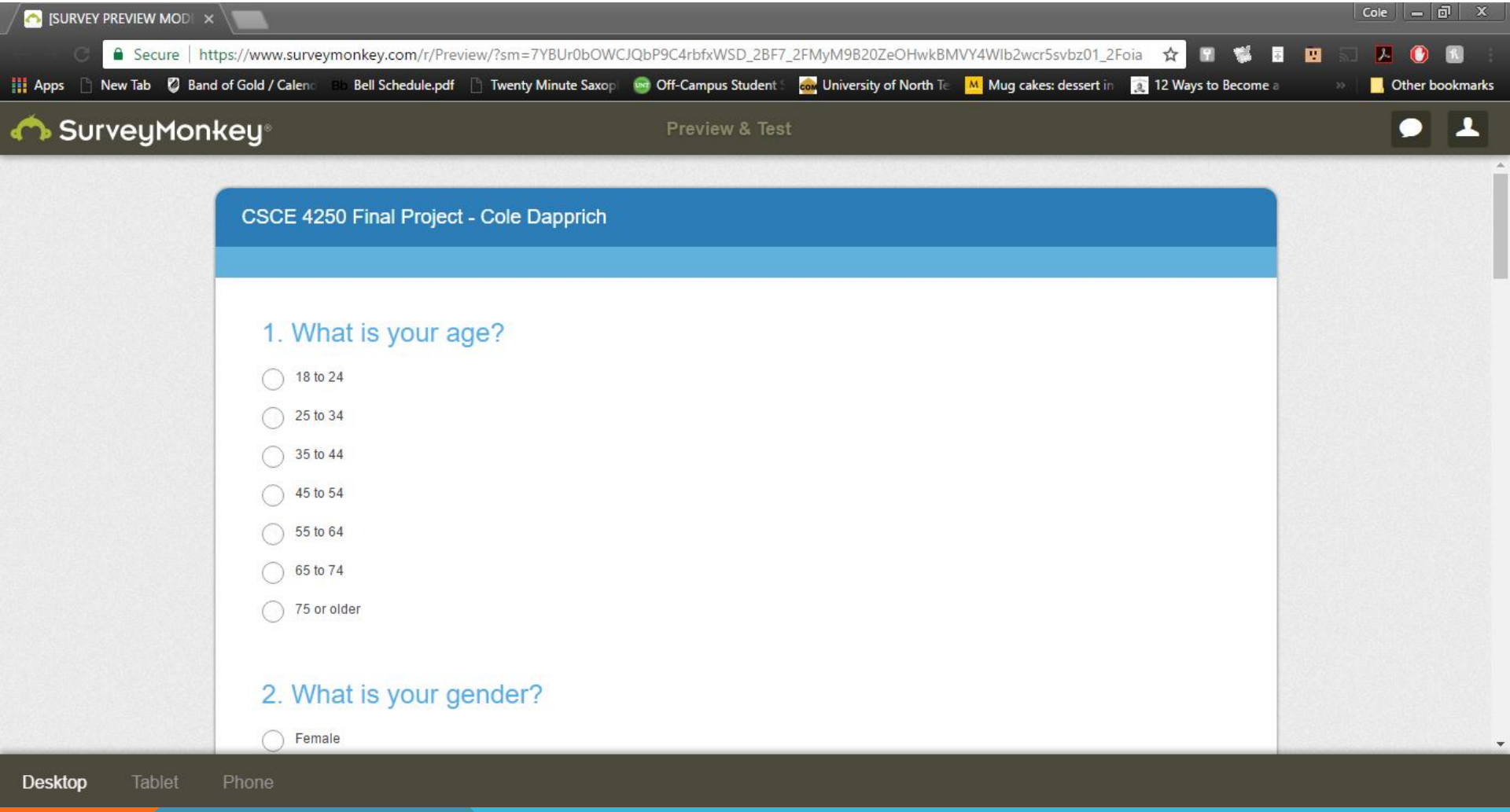
EXPERIMENTATION



EXPERIMENTATION



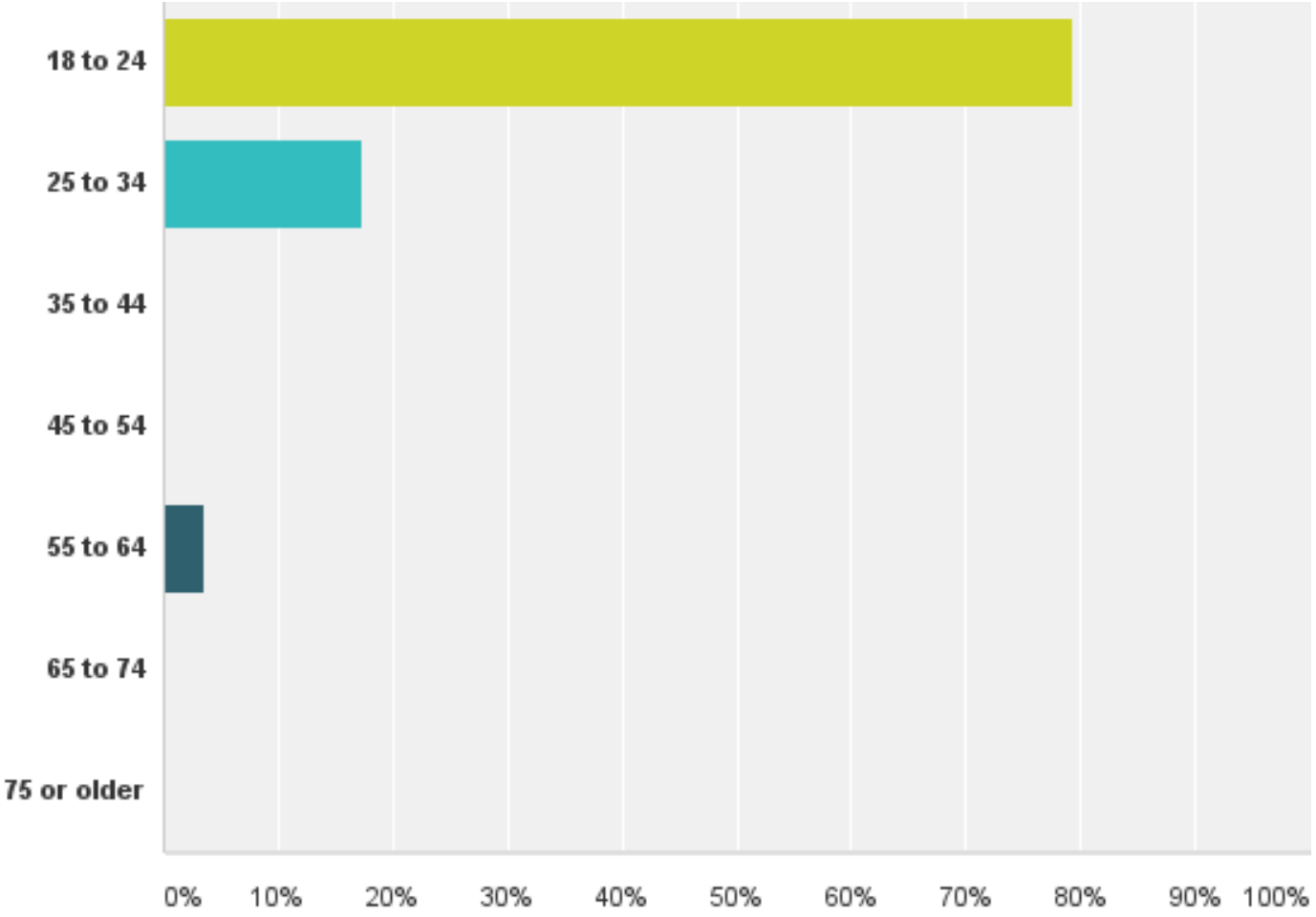
EXPERIMENTATION



RESULTS

Q1: What is your age?

Answered: 29 Skipped: 0



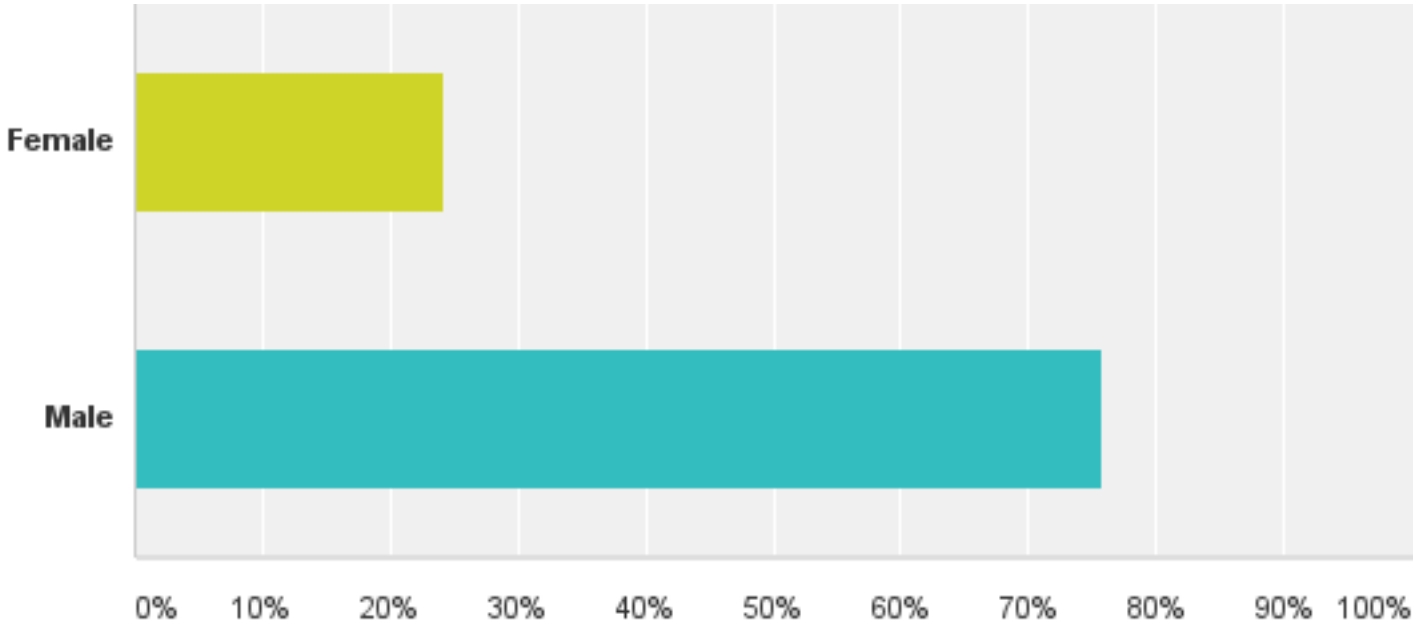
Q1: What is your age?

Answered: 29 Skipped: 0

Answer Choices	Responses	
18 to 24	**79.31%**	23
25 to 34	**17.24%**	5
35 to 44	**0.00%**	0
45 to 54	**0.00%**	0
55 to 64	**3.45%**	1
65 to 74	**0.00%**	0
75 or older	**0.00%**	0
Total		**29**

Q2: What is your gender?

Answered: 29 Skipped: 0



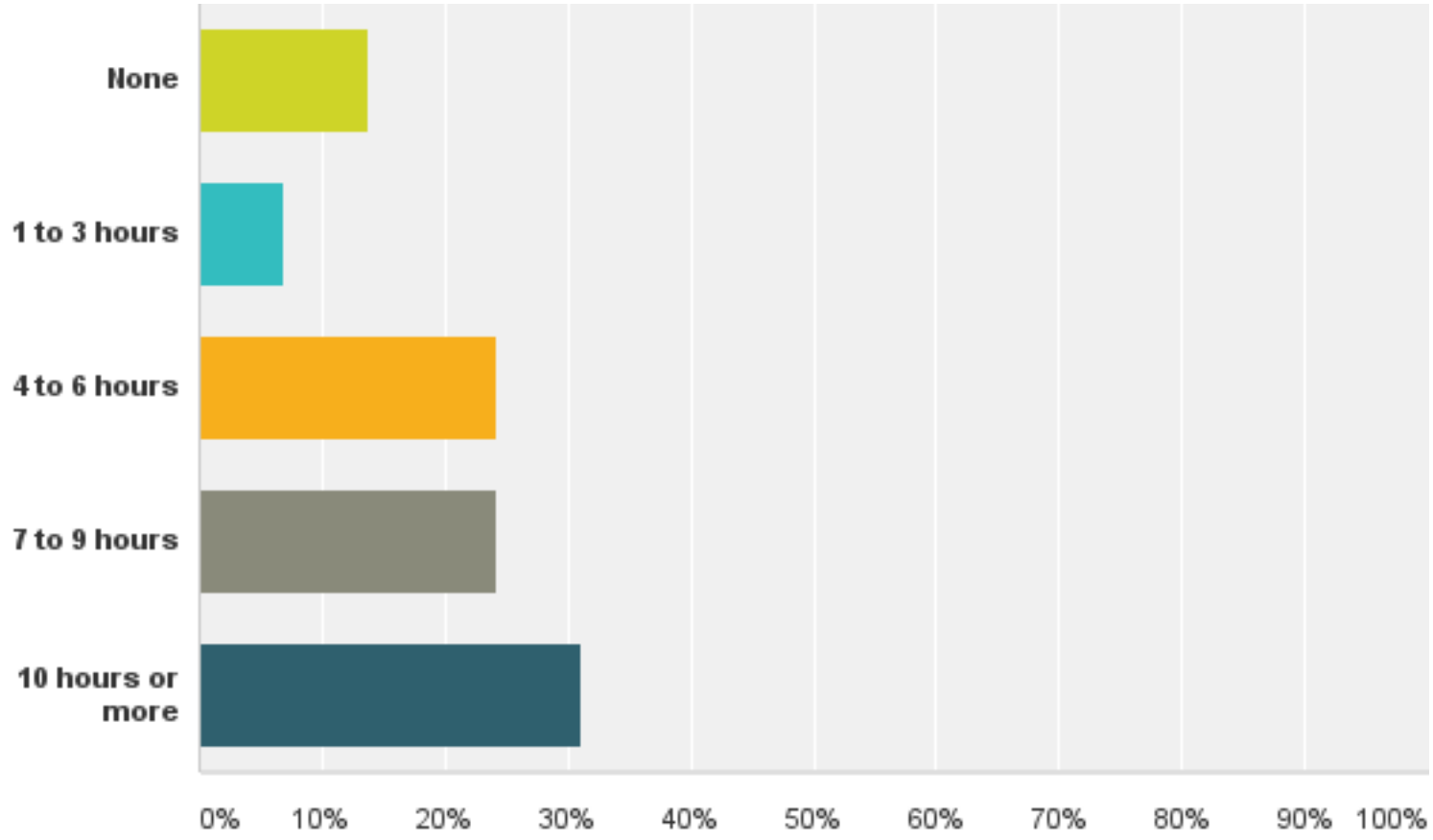
Q2: What is your gender?

Answered: 29 Skipped: 0

Answer Choices	Responses	
Female	24.14%	7
Male	75.86%	22
Total		29

Q3: In the past 7 days, roughly how many hours have you spent playing video games (e.g. gaming consoles, mobile phones, computers, etc.)?

Answered: 29 Skipped: 0



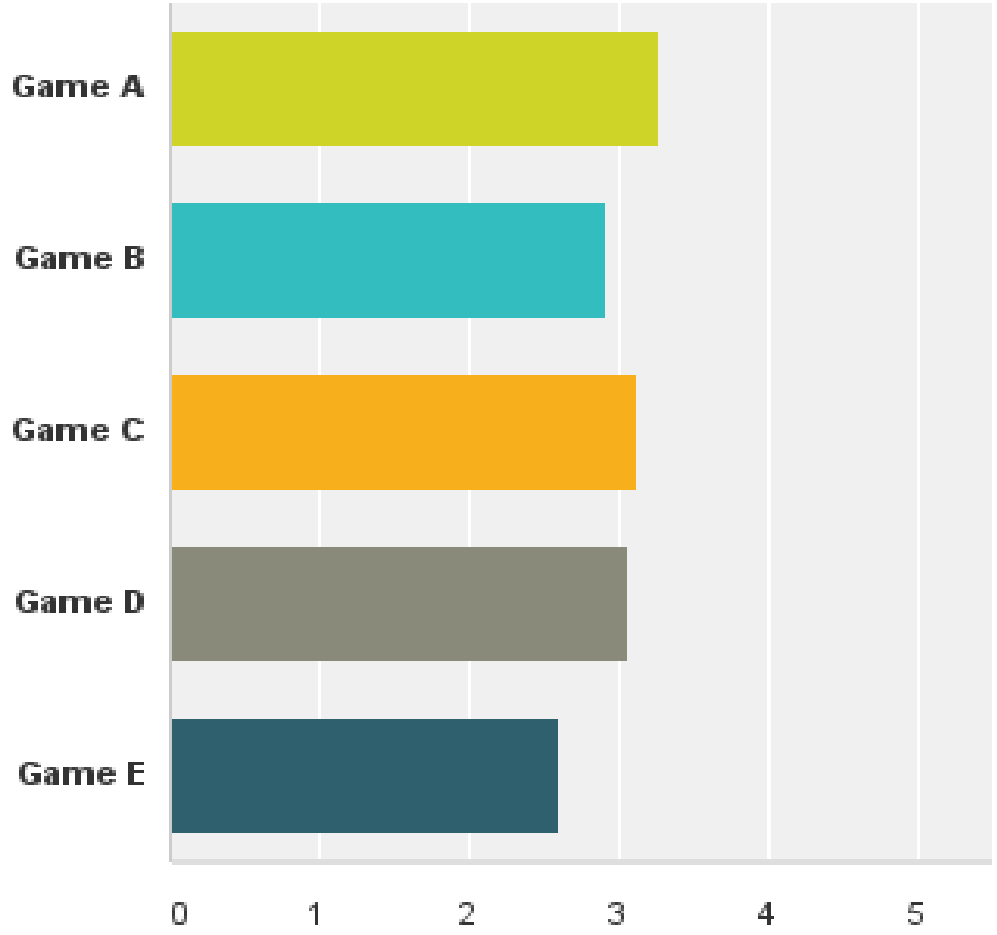
Q3: In the past 7 days, roughly how many hours have you spent playing video games (e.g. gaming consoles, mobile phones, computers, etc.)?

Answered: 29 Skipped: 0

Answer Choices	Responses	
None	13.79%	4
1 to 3 hours	6.90%	2
4 to 6 hours	24.14%	7
7 to 9 hours	24.14%	7
10 hours or more	31.03%	9
Total		**29**

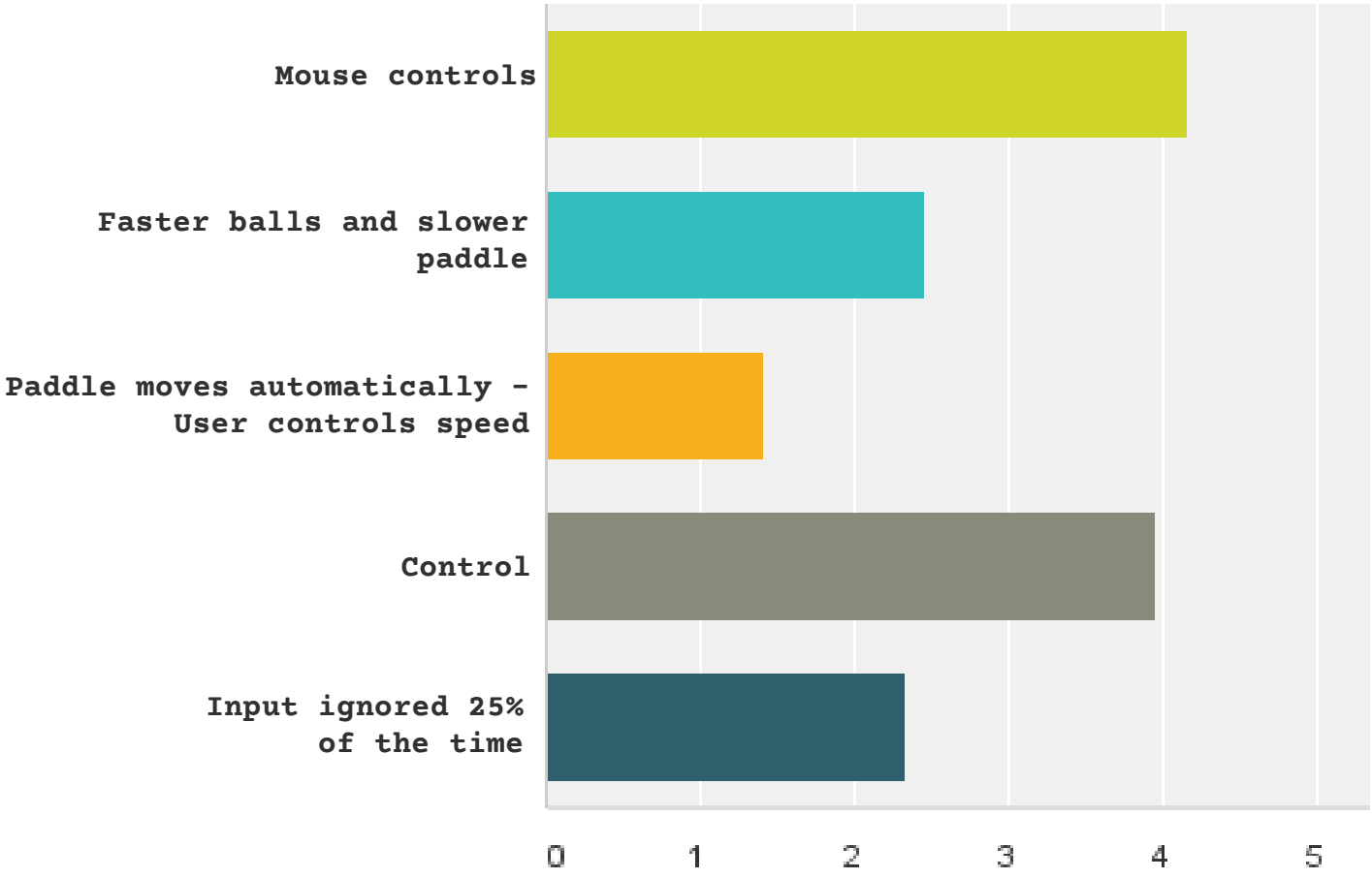
Q4: Please indicate the order in which you played the games.

Answered: 29 Skipped: 0



Q5: Please indicate the level of effectance (your ability to affect the game environment) you felt during each game.

Answered: 29 Skipped: 0



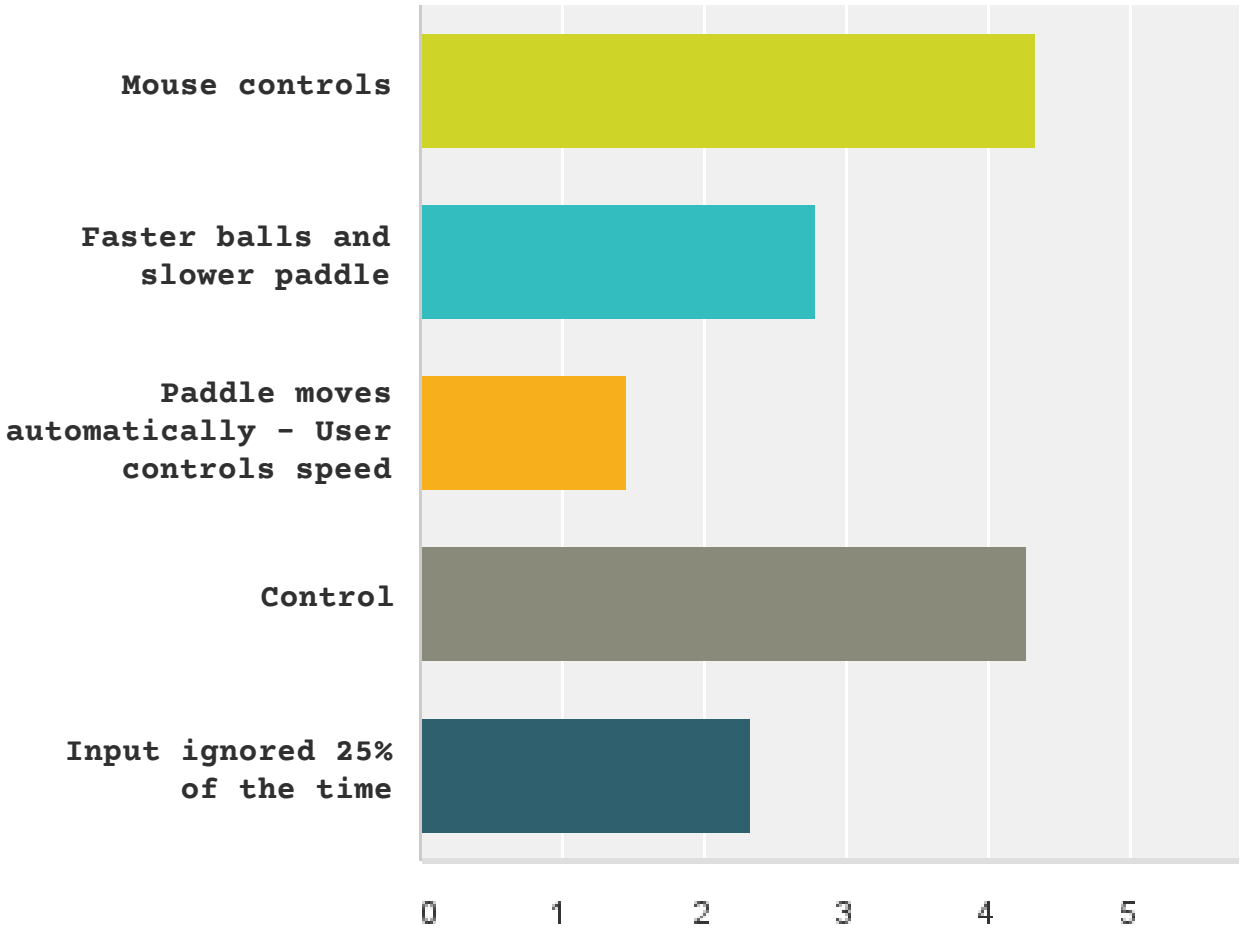
Q5: Please indicate the level of effectance (your ability to affect the game environment) you felt during each game.

Answered: 29 Skipped: 0

	No effectance felt	Slight amount of effectance felt	Moderate amount of effectance felt	Fair amount of effectance felt	Extreme amount of effectance felt	Total	Weighted Average
Mouse controls	6.90% 2	10.34% 3	3.45% 1	17.24% 5	62.07% 18	29	4.17
Faster balls and slower paddle	10.71% 3	50.00% 14	25.00% 7	10.71% 3	3.57% 1	28	2.46
Paddle moves automatically - User controls speed	71.43% 20	17.86% 5	7.14% 2	3.57% 1	0.00% 0	28	1.43
Control	0.00% 0	10.71% 3	14.29% 4	42.86% 12	32.14% 9	28	3.96
Input ignored 25% of the time	20.69% 6	44.83% 13	20.69% 6	6.90% 2	6.90% 2	29	2.34

Q6: Please indicate the level of control (your ability to anticipate and influence the game in order to achieve your goal) that you felt during each game.

Answered: 29 Skipped: 0



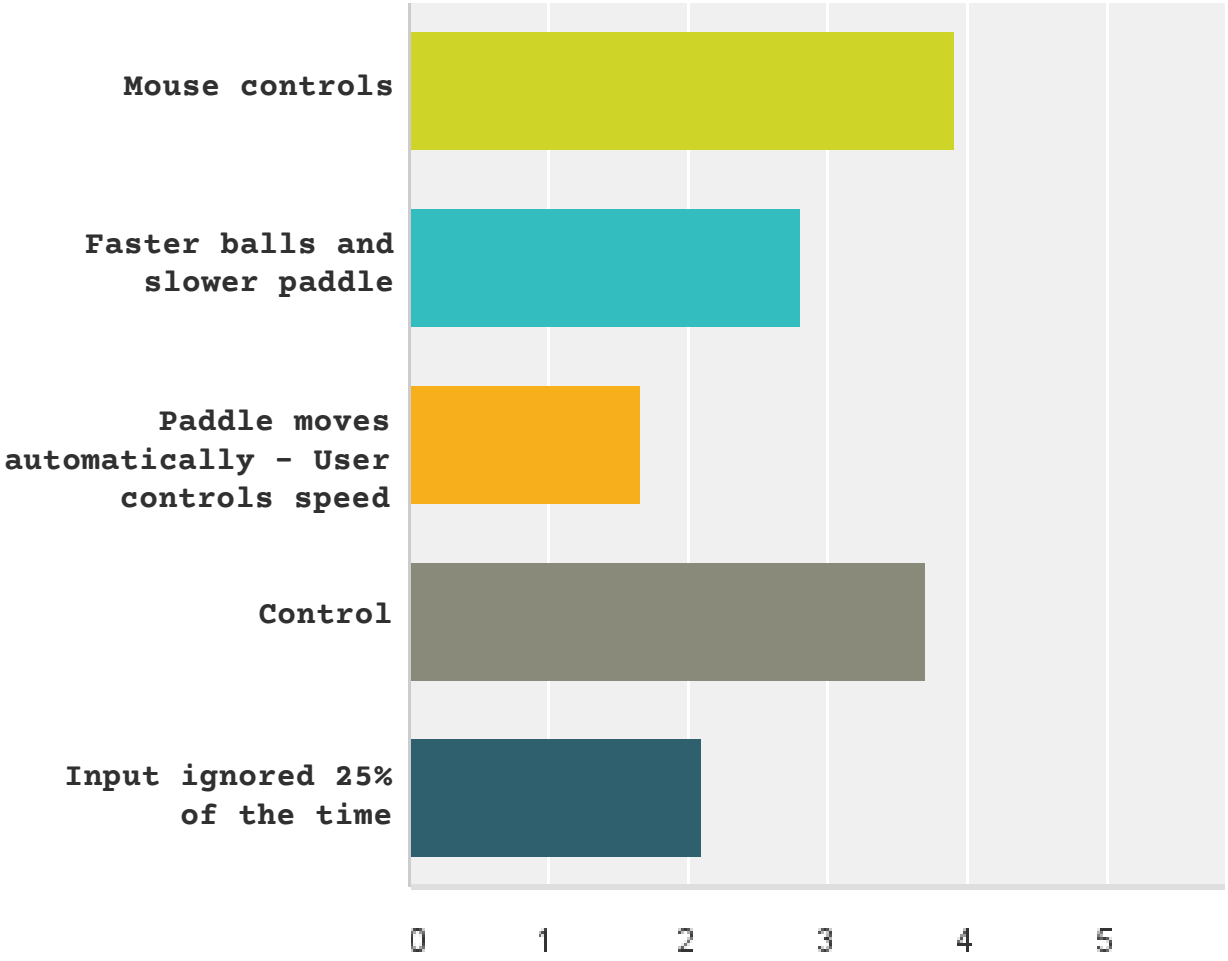
Q6: Please indicate the level of control (your ability to anticipate and influence the game in order to achieve your goal) that you felt during each game.

Answered: 29 Skipped: 0

	No control felt	Slight control felt	Moderate control felt	Fair control felt	Extreme control felt	Total	Weighted Average
Mouse controls	**6.90%** 2	**3.45%** 1	**3.45%** 1	**20.69%** 6	**65.52%** 19	29	4.34
Faster balls and slower paddle	**10.71%** 3	**32.14%** 9	**35.71%** 10	**10.71%** 3	**10.71%** 3	28	2.79
Paddle moves automatically - User controls speed	**67.86%** 19	**25.00%** 7	**3.57%** 1	**0.00%** 0	**3.57%** 1	28	1.46
Control	**0.00%** 0	**0.00%** 0	**14.29%** 4	**42.86%** 12	**42.86%** 12	28	4.29
Input ignored 25% of the time	**24.14%** 7	**37.93%** 11	**24.14%** 7	**6.90%** 2	**6.90%** 2	29	2.34

Q7: Please indicate the level of enjoyment (the amount of fun and desire to keep playing) that you felt during each game.

Answered: 29 Skipped: 0



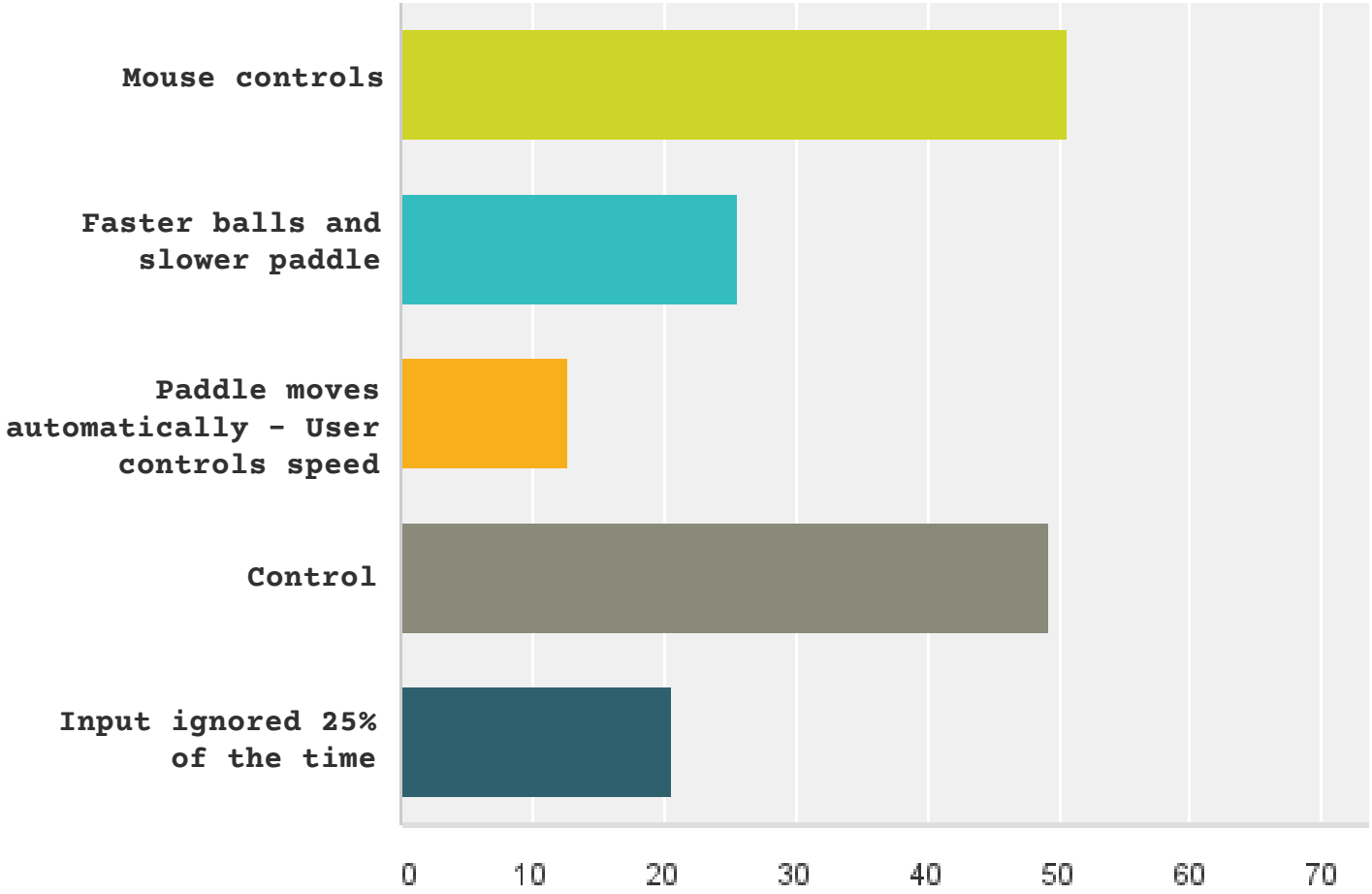
Q7: Please indicate the level of enjoyment (the amount of fun and desire to keep playing) that you felt during each game.

Answered: 29 Skipped: 0

	No enjoyment felt	Slight enjoyment felt	Moderate enjoyment felt	Fair enjoyment felt	Extreme enjoyment felt	Total	Weighted Average
Mouse controls	7.14% 2	7.14% 2	7.14% 2	42.86% 12	35.71% 10	28	3.93
Faster balls and slower paddle	14.29% 4	32.14% 9	21.43% 6	21.43% 6	10.71% 3	28	2.82
Paddle moves automatically - User controls speed	71.43% 20	7.14% 2	10.71% 3	3.57% 1	7.14% 2	28	1.68
Control	0.00% 0	10.71% 3	17.86% 5	60.71% 17	10.71% 3	28	3.71
Input ignored 25% of the time	34.48% 10	37.93% 11	10.34% 3	17.24% 5	0.00% 0	29	2.10

Q8: Please enter the highest score you were able to achieve in each game.

Answered: 29 Skipped: 0



Q8: Please enter the highest score you were able to achieve in each game.

Answered: 29 Skipped: 0

Answer Choices	Average Number	Total Number	Responses
Mouse controls	51	1,469	29
Faster balls and slower paddle	26	744	29
Paddle moves automatically - User controls speed	13	371	29
Control	49	1,429	29
Input ignored 25% of the time	21	600	29
Total Respondents: 29			

VALIDATION

- I was able to validate Klimmt Et Al.'s result that reduced effectance directly leads to decreased enjoyment for the player (Game E / Ignoring random inputs).
  - Additionally, I was able to expand on this result by showing that *increased* effectance and control led to increased enjoyment (Game A / Mouse controls) **and** even less effectance and control led to even less enjoyment (Game C / Automatic paddle movement, user-controlled paddle speed).
  - Not only did the participants find the higher effectance and control conditions more enjoyable, but they also were able to achieve a significantly higher score in those conditions.
- However, while the original paper found that decreased control did not lead to decreased enjoyment, my study did. The difference was smaller than decreased effectance, but it was still significant (Game B / Faster ball and slower paddle).
  - Possible reasons: different sample sizes, different numbers of "hardcore" gamers, relative extremity of my reduced control condition, order effects

LINKS

- Original paper:
  - https://drive.google.com/file/d/0BzbGO6AAs4pPanBMQ21MR1VhbjQ/view?usp=sharing
- Full source code:
  - **Version 1**
    - https://www.dropbox.com/s/dfmuc5ofrm3552y/breakout.js?dl=0
  - **Version 2**
    - https://www.dropbox.com/s/nuua6orf207iy78/breakout2.js?dl=0
  - **Version 3**
    - https://www.dropbox.com/s/0nvzmdzljsftsfa/breakout3.js?dl=0
  - **Version 4**
    - https://www.dropbox.com/s/e755czohmzo7h7n/breakout4.js?dl=0
  - **Version 5**
    - https://www.dropbox.com/s/ozf0dmzfapukf5l/breakout5.js?dl=0
  - **HTML**
    - https://drive.google.com/file/d/0BzbGO6AAs4pPdmp6dDZQWmlYOGc/view?usp=sharing
- Raw data:
  - https://docs.google.com/spreadsheets/d/1HcRCxwVvSJWk_19fNiU3QGtzKPUFBtB68c0xgZ1S7EA/edit?usp=sharing