

The Inconsistencies of Streaming Services

Matthew Marino, Jakub Kierznowski, Jason Ramjattan,
Hellen Rivera, Alejandro Jaramillo, Allan Lozano Bardales

Abstract. This study aimed to investigate why streaming services provide a bad user experience. The usability problem that was solved was streaming services have inconsistent interfaces when it comes to features across platforms and services. The inconsistencies caused an inefficient and ineffective use of the service as shown in [7], [1], and [8]. New users of a streaming service faced a cognitive overload. Data was gathered from observations with KLM method, surveys, and interviews from various users. The prototype was tested with a heuristic evaluation, cognitive walkthrough, personas, and usability test. The study revealed that streaming services do not offer the same features. People who use streaming services would prefer each service to have the same features and a similar layout. The prototype the researchers developed needed minimal changes. The usability problem was solved because the interface the researchers designed required less keystrokes to complete common tasks that all users perform.

Keywords-streaming service; usability; inconsistencies; KLM

I. INTRODUCTION

The research was conducted to determine the inconsistencies with the interfaces of streaming services and why they provide an unsatisfactory user experience. Five streaming services were evaluated which included Netflix, Hulu, Disney+, Amazon Prime Video, and Max formerly known as HBO Max for examples see [2] [3] [4] [5] [6]. The selected services are the most popular of the streaming services. They all offer a range of movies, shows and original content. The interfaces vary based on platform, so TV applications and PC versions of the interfaces are used for this study.

The usability problem with streaming services is their interfaces are inconsistent with which features are provided to users as talked about and shown in [7], [1], and [8]. These articles go into a deep dive and analysis from a professional's view on how these UI and services could be better in implementation and setup. Some services also provide different features based on the platform someone is using. The inconsistencies between platforms and services causes inefficiency and ineffectiveness when using a service or switching between services. Some services are confusing to use, and all the services do not offer the same features. The research aims to design an interface that provides a great user experience for all streaming services to use. This will eliminate the inconsistencies in streaming services that provide a bad user experience and usability problem. Having a consistent interface between platforms and services creates efficiency and effectiveness for using different services while reducing the cognitive load for new users of a service.

II.METHODOLOGY

A. Materials

- Google Drive
- Google Docs
- Google Sheets

- Google Forms
- Sublime
- HTML

B. Streaming Service Review

In the research five streaming services were evaluated prior to creating a prototype. The five services were Netflix, Hulu, Disney+, Amazon Prime Video, and Max. Common features were listed in a chart and their pros and cons were placed into a different table. The two versions of the services that were evaluated were the TV application and PC version. Those were chosen because they were thought of being the most used interfaces. The final observations made about the services by users, and us can be seen below in (Table 6) under results.

C. Participants

Participant 1 was a retired middle-aged male. The streaming they used was Max. He had high computer self-efficacy and was risk-tolerant when using new technology. He was observed, interviewed, given a survey, and participated in a usability test in his living room.

Participant 2 was a middle-aged female who used Netflix in their living room. She had lower computer self-efficacy and was more risk-averse when using new technology. She was observed, interviewed, and given a survey in her living room.

Participant 3 was a middle-aged male who used Disney + in their living room.

Participant 4 was a middle-aged male who used Disney +, Netflix, and Prime in their living room on a TV, and on a laptop. They possessed an average competency in technology and had high self efficiency and risk tolerance.

Participant 5 was a middle-aged woman who used Disney +, Netflix, and Prime in their living room on a TV, and on a laptop. They possessed low technology skill and experience and are risk averse.

D. Before Prototype Development

Three methods used for data collection were direct observations, surveys, and interviews. The KLM method was also used.

Direct observations were used first to collect data on what users struggled with while they used the service. The data collected from the observations helped generate survey and interview questions. The observations also played a role in determining what should be included in the prototype. The users were observed using one streaming service on the platform they preferred and in the location they typically would use the streaming service. Surveys were used next to gather general information about the users and how they felt about the streaming service they used (Table 1). Some of the questions were expanded on in the interview. The interview was conducted after the survey (Table 2). The interview was used to go into more detail and provided insight into what the users liked, disliked, struggled with, and would like to see included in streaming services. The surveys were given out and taken in the same place the users were observed. The interviews followed immediately after the survey. The location remained the same so consistency was kept

and a different location would not influence the answers. That location provided a relaxing environment for the user because they are familiar with it. The KLM method was used after the interviews to determine which interface provided the fastest and easiest way to complete a common task. Table 3 displays the tasks used in the KLM method. Each task started from the homepage of the streaming service. The gathered data was used to create a paper prototype of an interface that could be adopted.

Before a prototype was developed, six tasks were created that were thought to be important to a streaming services interface. The problem and accomplishment were also identified for each task (Table 4). Four tasks were chosen to be the main focus of a prototype, and three prototypes were developed with each one focusing on a different set of tasks. The first prototype focused on tasks 1, 2, 3, and 5. The second prototype focused on 1, 2, 5, and 6. The third prototype focused on tasks 1, 2, 3, and 4. Table 4 displays the tasks the number in the first column refers to the number of the corresponding task mentioned above.

Table 1. Survey Questions

Survey Questions	
Question Number	Question
1	Which service did you use?
2	How would you rate your overall experience? Scale of 1 to 5
3	What features did you like about the service? (Select those that apply)
4	What features did you dislike about the service?
5	What features would you add to this service?

Table 2. Interview Questions

Interview Questions
<p>What's the first thing you check on your streaming service after logging in?</p> <p>Do you have a favorite show you keep coming back to rewatch?</p> <p>What do you struggle with while using [streaming service]?</p> <p>What would you change about [streaming service]?</p> <p>Which features are irrelevant to streaming services?</p> <p>If a platform offered the option to categorize your continue watching list by genre or release dates would that be helpful?</p> <p>Would having the ability to customize the home page be helpful?</p> <p>Do you think that the service should have the same features on every platform?</p> <p>Do you think the interface is user friendly?</p> <p>Do you think all streaming services should use the same layout?</p>

Table 3. KLM Objectives

KLM Tasks
Find watch list Find continue watching Find leaving soon Find new content Find coming soon Find a-z Find comedies Find all offered companies if it offers it Find watch again Find recommendations

Table 4. The Six Tasks

Task Number	Task
1	Go find the movie/show that you started watching and resume watching it. The problem is people want to be able to easily resume watching content that they previously started and some services do not place the category as the first one on the homepage. The accomplishment is to make the category easily accessible when content is in the section.
2	Add content to watch later and sort by leaving soon. The problem is people want to keep track of and plan what they want to watch on the service. Some of the content might be leaving the service soon. The accomplishment is to be able to sort the watchlist by leaving soon, so users do not miss out on something they want to watch.
3	Review the content that was already watched on the service. The problem is people may not remember what shows or movies they watched on the service. The problem is worse when a movie is part of a bigger series. Some services do not provide this category, and if they do it is placed in an inconvenient location. The accomplishment is to implement this category and place it in a location that is easily accessible for people, so they can view content they have already watched or might want to rewatch.

4	<p>Find a show/movie that is about to leave the service and add it to watch later. The problem is that services may not provide a section that displays everything leaving soon, or they tell someone it is leaving but not when.</p> <p>The accomplishment is to provide a detailed and easily accessible category for users to know what content and when it is leaving.</p>
5	<p>Customize the subtitles to your liking. The problem is people who are hard of hearing or deaf rely on subtitles to watch a show or movie. The person could also be colorblind. Some shows and movies display subtitles when a different language is spoken. Subtitles are necessary to understand what is happening. The feature is not available on every platform. The accomplishment is being able to customize the subtitles to the user's preference on every platform, so they can enjoy the content they are streaming.</p>
6	<p>Customize the homepage to your liking. The problem is that services may not provide the best organization for what users are looking for. The homepage is either fixed or is only customizable on certain platforms. Being able to customize the order the categories are viewed will provide a better user experience and make the service easier for people to use. The accomplishment is to add an icon that when selected allows the user to customize the homepage to their personal preference. This will give more freedom to the user when they use the software.</p>

E. Prototype Development and Testing

After three prototypes were developed, The team decided to pursue the first prototype. Two personas were developed for testing the prototype later on (Table 5). The selected prototype was tested from a heuristic evaluation that was completed by another team. The team identified any violated Nielsen's heuristics, described any usability problems; and provided a rating between zero and four. A zero rating meant no problem and a rating of four meant usability catastrophe. A cognitive walkthrough was performed using a persona to determine the ease of completing the main tasks. A radial diagram was constructed with the personas in mind as another method for testing the prototype for usability issues. A usability test was performed on participant 1 for feedback. The facilitator and computer was Matthew Marino. The observers were Allan Lozano Bardales, Alejandro Jaramillo, and Jason Ramjattan. The user was shown how testing a paper prototype worked and a sample task was demonstrated. The user was then asked to complete a series of tasks. The two primary tasks were to find the history and continue watching sections. Other tasks included finding how to change the subtitles, go to the movies tab, go to the tv shows tab, expand a section to find more details, add something to the watch list, and change the quality of a movie or show. The

feedback was used to modify the prototype. A digital prototype was then developed using html. The digital prototype was tested using the KLM method.

Table 5. Personas Descriptions used for Heuristic Evaluation

Number	Persona Description
1	<p>Abi is a busy college student who also works part-time. She is a junior who is working towards a bachelor's degree in accounting and is comfortable with learning new technologies. She has limited free time and spends her free time watching shows and movies. She likes to view all the features of the software she uses, and she has high computer self-efficacy. Abi is a little risk averse due to time but usually doesn't mind taking risks. She believes taking risks to learn something new presents an opportunity for growth. Abi leans towards a comprehensive information processing style, and she also likes to tinker when using new software. Abi feels the need to be on top of the latest trends in technology.</p>
2	<p>Nic is middle-aged and retired. He is used to physical media and enjoys watching movies. The technologies used in Nic's life are new to him. He only uses a computer for performing tasks in Excel and browsing the web for information about music or the news. Nic likes being creative and working with things hands-on. Nic likes working things out on paper and is trying out using technology to enhance his music hobby. Nic has recently begun shifting to new technology. He is task-oriented when completing tasks, and he uses methods that are familiar to him. Nic has a low computer self-efficacy which causes him to be risk averse even though he has a lot of free time. Nic tends to process information selectively. Nic only wants to know what he needs to know. He is not interested in understanding the entire system. He uses process-oriented learning. He prefers to follow a guide, tutorial, or set of instructions when learning new technology. He does not like to tinker, and he only tinkers because of his selective information-processing style. He tinkers because the first option did not work, but Nic gets a better understanding of the system.</p>

III.RESULTS

A. Before Participant Data Collection

Before working with participants common features of various streaming services were compiled to see what features were common for a streaming service (Table 6). Table 7 displays the pros and cons of the streaming services the researchers used in the research.

Table 6. Features Observed and Recorded From Each Streaming Service

Platforms	Recently watched/ Continue	Search Function	Customizable Homepage	User Profile	Recommendation Algorithm	Original Content	Watch List	Edit Subtitles	Watch Again
Netflix	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hulu	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Disney+	Yes	Yes	Limited	Yes	Yes	Yes	Yes	Yes	Yes
HBO Max	Yes	Yes	Limited	Yes	Yes	Yes	Yes	Limited	Limited
Amazon Prime	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes

Table 7. Pros and Cons of Different Streaming Services Observed and Pointed out

<p>Netflix Pros: Netflix offers a customizable homepage section that can be tweaked to the users preference in what they see in their feed. It offers good recommendations based on watch history, and while searching for titles or shows in the search function other recommendations will be given to the user related to their search. Along with this it provides different user profiles for the family for personal use to customize and not interfere with other users. To bring in more users they also have their own original content to be viewed from their platform such as shows or movies. A diverse subtitle editing feature is available to users to change up where the subtitles are located and how they look along with color options. And for returning viewers it has a continue watching, watch again, and the ability to create a watch list to check out shows you were interested in and didn't get around to yet.</p>	<p>Netflix Cons: While offering the customizability I listed previously there are some opening problems for its home page until you set it up to your preference. Awkward and weird listing suggestions on the homepage that doesn't really specify or label them in categories or genres confusing people/overloading them with info such as top 10 in the US currently, witty TV drama series to binge. These listings are limited and random to the user and while it does suggest things sometimes it shows repeats and isn't really what the user wants. Navigation can be awkward with netflix since their scroll function will keep looping the user back. Another issue is with the many random sections and listing popping up it could push the things you want to see lower on the listing making it harder for you to find or see such as the watch again or continue watching the section which has been pushed down for some people a couple rows down making them miss it entirely. Netflix also allows one to search up movies and shows not offered on the service along with missing a simple A-Z browsing section for if one wants to look through available options.</p>
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<p>Hulu Pros: Boosts and features many exclusives and originals to bring in clients and viewers displaying them at the start to promote them. Featuring a highly customizable home page to pick and choose what you want to see. Option to stream and view live television with specific subscription. Multiple profiles as others do not interfere with other users' experience in the home. Also contains the usual watchlist option for future viewing along with a continue to watch option on the home screen. A Subtitle editing option is given allowing the change of fonts, size, and color.</p>	<p>Hulu Cons: Hulu was found to have many problems when it came to the user experience starting with its heavy pushing for new content. Most of the convenience features such as continue watching or a genre section are found near the bottom of the page meaning you have to scroll down all the way to access them. And the genre specific options only appeared at the top when you selected either the movie or series sections. Also not all of hulu's content is its own and for your viewing you need to get other subscriptions and pay more for specific options to be available to you hampering your experience.</p>
<p>Amazon Prime Pros: Prime offers up the usual generic options as all other platforms such as a search bar, profiles and watch lists for the user. They provide a continue watching and watch again option to its viewers. They have a vast library of movies and shows open to view, along with original content to draw in users, along with live tv. Plus a basic recommendation features to try and show you or find new movies or shows for you to watch. Also the services come with your Amazon membership.</p>	<p>Amazon Prime Cons: Of all the services we have observed Amazon Prime is without debate the worst designed and implemented. For starters the search bar is connected to all other amazon services so it must be set to videos or movies if you wish to search up any. The vast library is constantly changing with no prior warning or information that you put on your list could be done next week. Not all videos and movies are available to just watch, you have to rent or buy a good portion of them first. The layout of everything is awful since it was just thrown into the existing amazon website layout which was designed for shopping, not viewing and searching for movies and shows. Along with all this just clicking on a show you want to watch does not take you to directly watching the movie or show, it takes you to an in between page to say if the show is included with prime or if it's something you have to rent or buy. Other subscriptions are needed to view other content on the site as well.</p>
<p>Disney+ Pros: Disney+ provides one of the cleaner and more simple layouts but makes it easier to see everything and navigate without overloading the user. It offers multiple profiles or individual user experiences without troubling others in the family (7 profiles per Sub I believe). It provides the user with the continue watching section along with the different major studios and stations they provide on the service, its exclusive content that draws in users just like the previous services did, along with recommendations and suggestions of shows similar to previously watched ones. Disney+ knows its big draw factor is its exclusives so it puts it right in the users face since it's what mainly draws users to the service. Contains a watchlist you can add shows you're interested in for later use. Does not create weird general labels or sorting of movies/series that go purely off genres or recommendations based on what you watched before or previously. There is a clear divide between</p>	<p>Disney+ Cons: While Disney+ has shown to have one of the better, more streamline services there are some minor details and flaws with its service. One it does not provide a watched already section or listing to show you have already seen this show or movie. Along with that it does a poor job of communicating or listing if content will be removed or taken away from the service such as a section or heading informing the viewer that they have limited time to get around to it. Customization of service, and home screen isn't as extensive as say netflix but there's some. Does not have the best indicator of where you are currently in your selection and when typing or inputting things the cursor goes away.</p>
<p>HBO Max Pros: Max provides an ease of finding and showing off their newest additions and shows to stimulate or interest users in them. It does not have a loopback function on its scrolling navigation so no worries of just endlessly repeating things and shows an end to a listing. A good amount of customization available to the user to fit their needs and</p>	<p>HBO Max Cons: The first thing is difficult is discovering and looking into specific networks and channels they offer you. The A-Z section is done only by genre. When looking into what to watch or searching for something suggestions are not offered and the site itself is not built around learning your likes and dislikes to give suggestions to you over what</p>

wants in what they see. Exclusive content available like all others to draw in users, along with multi profiles for personal customization in households. Has a good indicator and section to let one know when shows or movies are leaving the service to get you to check them out while you can. Possesses a continue watching section to continue from where you left off on your shows, along with a watchlist to put in shows you want to watch in the future. Has an A-Z listing for exploration and discovery of shows.	you may like. Limits the display of informing you what is coming and newly available for watching. The subtitle editing options do not work on the Tv version, but on pc you have full control and many options. This is a consistency issue and gets rid of a popular and handy ease to use and experience option on TV viewers.
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B. Observations and KLM

Table 8 features general observation data gathered from one Max and one Netflix user .

Table 8. Observation Results

Observation Results		
Participants	Service	Results
1	HBO Max	<ul style="list-style-type: none"> • Could not find the section watch again/already watched section • Easily found the continue watching section • Knew where to go to find movies and shows • Did not skip past the section that has the hub for everything it offers (HBO, food network, TCM, etc). They used this section instead of the top menus on the home page • Took them less time to find the new and leaving soon areas • Found a-z faster • Took longer to find how to sort by genre
2	Netflix	<ul style="list-style-type: none"> • Did not use search function • Scrolled through the entire home page from top to bottom • When scrolling left to right it took a little time to realize the movies repeat themselves since it loops

		<ul style="list-style-type: none"> • Watch again was further down on the page • Hard to filter what they were looking for • Watch later was towards the bottom of the page which made it take longer to find
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Table 9. Max KLM results

Max KLM		
Task	Keystrokes	Time
Find watch list	4	4s
Find continue watching	4	4s
Find leaving soon	28	10s
Find new content	9	6s
Find coming soon	33	13s
Find a-z	9	6s
Find comedies	39	15s
Find all offered companies if it offers it	10	7s
Find watch again	N/A	N/A
Find recommendations	3	2s

Table 10. Netflix KLM results

Netflix KLM		
Task	Keystrokes	Time
Find watch list	38	19s
Find continue watching	7	5s

Find leaving soon	N/A	N/A
Find new content	4	4s
Find coming soon	46	22s
Find a-z	N/A	N/A
Find comedies	3	3.5s
Find all offered companies if it offers it	N/A	N/A
Find watch again	30	12s
Find recommendations	12	7s

Table 11. Disney + KLM results

Disney + KLM		
Task	Keystrokes	Time
Find watch list	4	2.6s
Find continue watching	6	3.9s
Find leaving soon	N/A	N/A
Find new content	4	2.2s
Find coming soon	9	7.2s
Find a-z	N/A	N/A
Find comedies	7	5.4s
Find all offered companies if it offers it	2	1.1s
Find watch again	N/A	N/A
Find recommendations	3	2s

Table 12. Amazon Prime Video KLM results

Amazon Prime KLM

Task	Keystrokes	Time
Find watch list	2	18.7s
Find continue watching	1	3.4s
Find leaving soon	N/A	N/A
Find new content	10	11.7s
Find coming soon	23	33.3s
Find a-z	6	14.1s
Find comedies	3	9.1s
Find all offered companies if it offers it	2	6s
Find watch again	24	47s
Find recommendations	1	5s

Table 13. Hulu KLM results

Hulu KLM		
Task	Keystrokes	Time
Find watch list	40	1.25s
Find continue watching	2	8s
Find leaving soon	N/A	N/A
Find new content	4	10s
Find coming soon	N/A	N/A
Find a-z	N/A	N/A
Find comedies	9	16s
Find all offered companies if it offers it	6	17s
Find watch again	13	29s
Find recommendations	1	1s

Table 14. StreamLine KLM results

KLM StreamLine(Our Prototype)		
Task	Keystrokes	Time
Find watch list	4	1s
Find continue watching	6	5s
Find leaving soon	8	4.75s
Find new content	10	6s
Find coming soon	N/A	N/A
Find a-z	6	7s
Find comedies	3	2.5s
Find all offered companies if it offers it	5	3s
Find watch again	10	5.6s
Find recommendations	12	7s

C. Surveys and Interviews

Figures 1, 2, and 3 and table 15 display the results from the survey.

Which service did you used?
6 responses

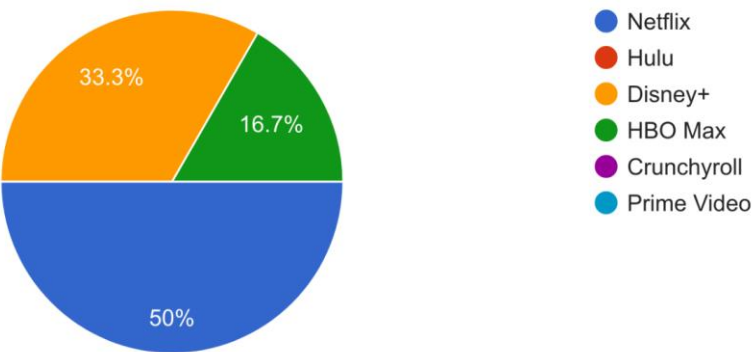


Figure 1. Results of survey question 1

How would you rate your overall experience?
6 responses

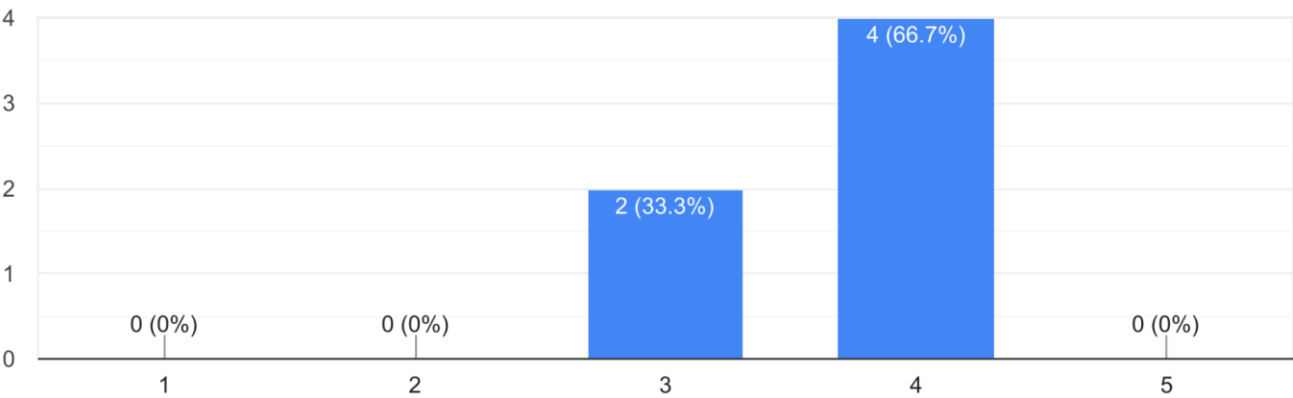


Figure 2. Results of survey question 2

What features did you like about the service? (Select those that apply)
6 responses

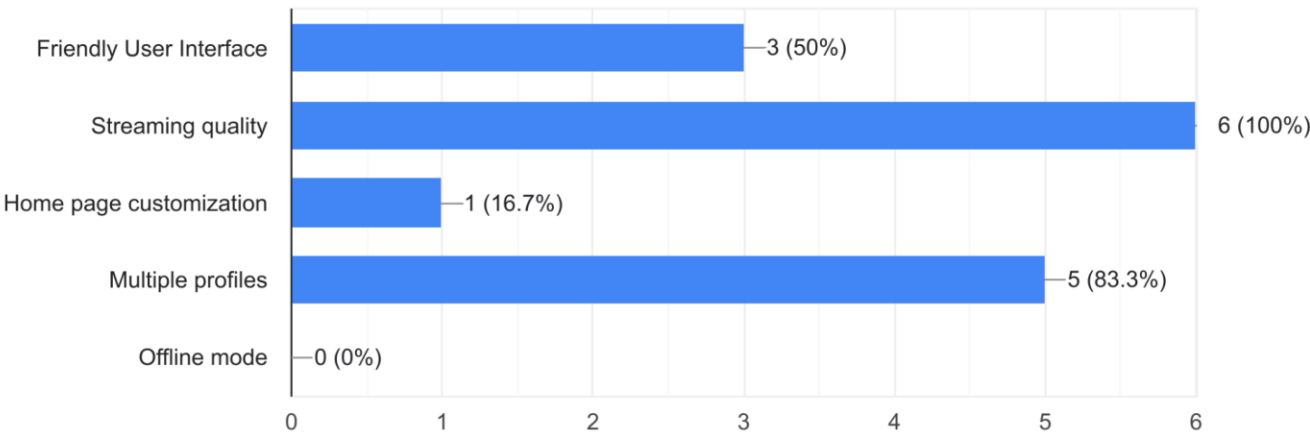


Figure 3. Results of survey question 3

Table 15. Survey results for questions 4 and 5

Results for Questions 4 and 5	
Question	Result
What features did you dislike about the service?	<p>theirs to many other sections I dont need nor want to see that distract or take me away from what I'm trying to find or get to. Hard to find watched already content at times.</p> <p>the placement of certain buttons and functions such as search where to find genres, and their slow speed of posting new content.</p> <p>can be confusing and very cluttered UI. they advertise and show a lot of things I dont care about in the home page, along with moving the features i like and use lower or some random place on the home page.</p> <p>some of the organization features aren't the best, and their options and available product is limited.</p> <p>They keep showing the same types of movies. They put on a series and do not add the new seasons</p> <p>The order the categories are listed in. Would rather see what is new at the top</p>

What features would you add to this service?	<p>History by button a make my continue watching stop moving around.</p> <p>make it easier to see what I've watched already and the listing and naming of certain functions such as series to be more obvious like TV series.</p> <p>better organization and settings to improve the UI and experience.</p> <p>easier access to history and organization features that are more obvious and clear, along with options and settings.</p> <p>Make it easier to add content to the watch list.</p> <p>When watching current show that releases an episode every week put it in continue watching when a new episode releases.</p>
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The first participant was asked less questions in a different order because after the first interview more data was required. To collect more data, more questions were asked in the rest of the interviews. The order of the questions were changed to help with the flow of the interview. All the responses from conducting the interview can be found in table 16.

Table 16. The responses from interviews

Interview Results	
Participant 1	
Question	Response
What do you struggle with while using Max?	Finding the different categories that they offer
What would you change about Max?	When watching a current show that releases an episode every week put it in continue watching when a new episode releases. Making the icons smaller to fit more on a page.

Which features are irrelevant to streaming services?	Remove top 10 or highlights section because they are the same thing
What's the first thing you check on your streaming service after logging in?	What is new to the service
Do you have a favorite show you keep coming back to rewatch?	no
If a platform offered the option to categorize your continue watching list by genre or release dates would that be helpful?	Yes
Participant 2	
What's the first thing you check on your streaming service after logging in?	What new movies or series came out.
Do you have a favorite show you keep coming back to rewatch?	Outlander, Emily in Paris, Bridgerton
What do you struggle with while using Netflix?	The looping of movies when trying to find something to watch.
What would you change about Netflix?	Show when the next season of a show is released and when it is coming out. Get rid of autoplay.
Which features are irrelevant to streaming services?	The icons underneath the description of the movie or show.

If a platform offered the option to categorize your continue watching list by genre or release dates would that be helpful?	yes
Would having the ability to customize the home page be helpful?	yes
Do you think that the service should have the same features on every platform?	yes
Do you think the interface is user friendly?	yes
Do you think all streaming services should use the same layout?	yes
Participant 3	
What's the first thing you check on your streaming service after logging in?	Check to see if there's any new shows
Do you have a favorite show you keep coming back to rewatch?	Star Trek
What do you struggle with while using Disney +?	Using the search feature
What would you change about Disney +?	Make the user interface customizable to reflect what the user wants to see
Which features are irrelevant to streaming services?	New arrivals are emphasized more than favorite shows watched by the user

If a platform offered the option to categorize your continue watching list by genre or release dates would that be helpful?	Yes. That will be helpful.
Would having the ability to customize the home page be helpful?	Yes. That would be helpful.
Do you think that the service should have the same features on every platform?	Yes. It provides a more consistent experience.
Do you think the interface is user friendly?	No. They are not user friendly.
Do you think all streaming services should use the same layout?	Yes

D. Three Prototypes

The first prototype (Fig 4) takes inspiration and ideas from the most popular sites and combines them into a sort of all-use design. Created to cater to the modern audience with a similar design and looks to not confuse users and make the experience easy to adapt to. This tries to achieve as many tasks as possible including starting features to get shows they watched and are watching right from the start for ease of use and access along with recommendations features based on their history and views. The front page only offers a limited number of options for the genre or section but can be clicked on to view the full options available to the user with filters. Of course, the option to add shows to a watch later list is available with a filter option to see what is going to leave soon. That or they can go into customization settings and add the option to their front page. The task of customizing the home is available by choosing what is displayable, they can add or remove a section on layouts. As for seeing what they watched, the section on Watch Again will bring up a full list of what they have seen which they can then sort or filter by A-Z, etc. Lastly, an option in the setting will let one alter and change subtitles to their liking along with selecting a language right away if one wants.

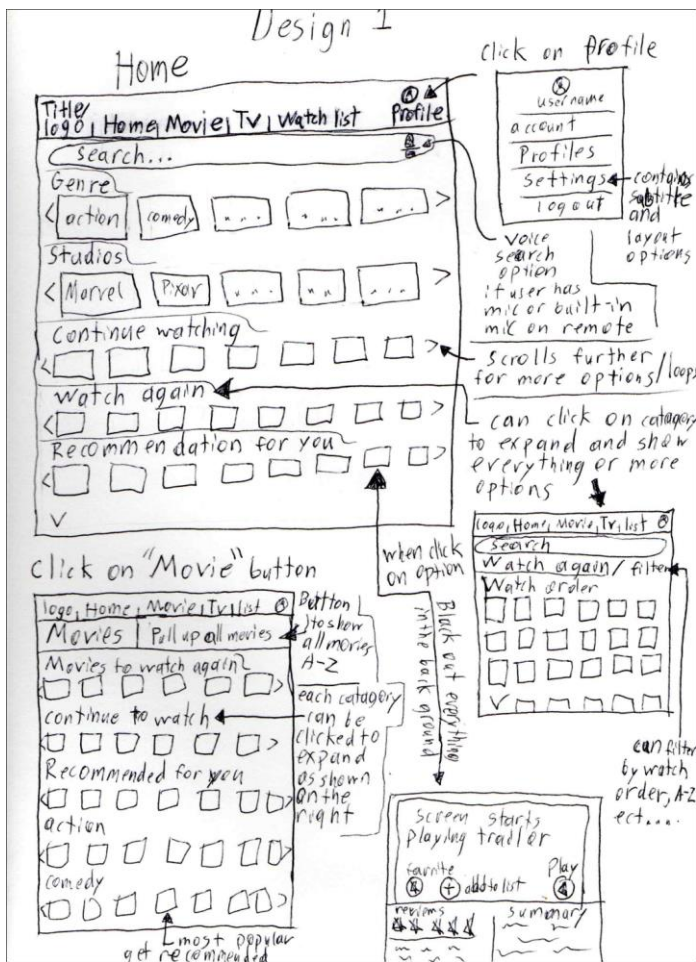


Figure 4. The first prototype

The second prototype (Fig 5) is a more free-form design focused on the user's preference and giving them control over how to set up their system. Out of all the designs, this gives the biggest customization options to users to fit their liking. Users can add all other tasks to your starting menu and choose layouts of their own. First off they will have to add the options themselves to the home screen along with how they want it laid out. The leaving service shows and movies option is available for addition to your home screen, along with a watch later, and continue watching option for ease of use and accessibility. This freedom of customization could be better for some people with certain issues but it's not all-inclusive since I can think of some disabilities it doesn't fully help and other users might not want to put up with all the work and effort it would take. And of course, subtitle customization is available in the profile under settings.

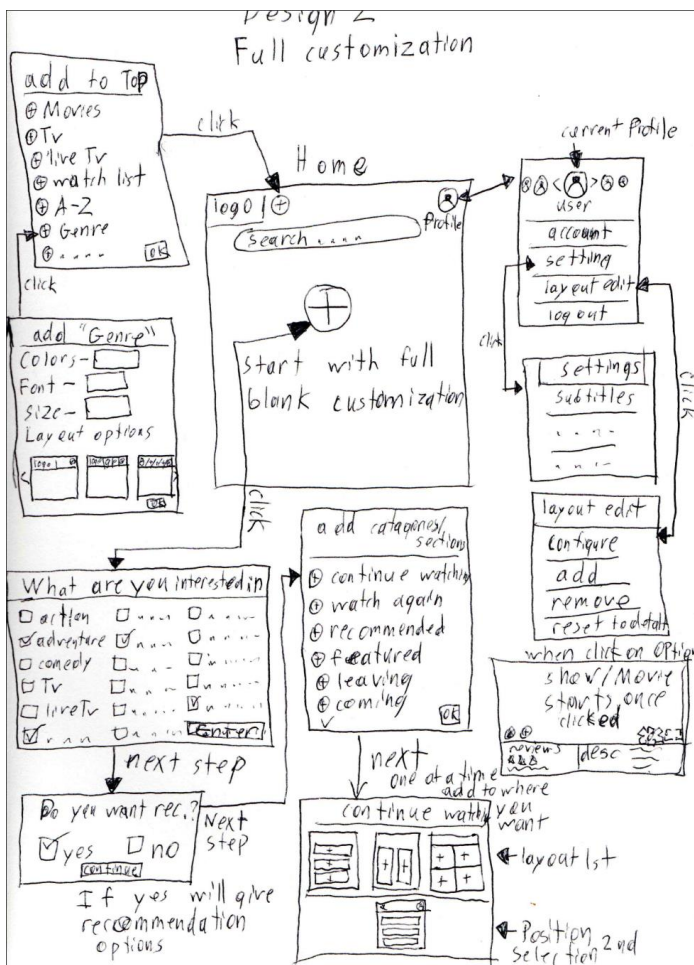


Figure 5. The second prototype

The third prototype (Fig 6) is the simplest of all of them made to get to the point, or reach the goal or target the user wants to see. It ditches the more nice and fancy layouts with all the recommendations and to search or find whatever it is they want or are interested in browsing. All options for finding their history, to continue watching, what's leaving, and their watch list are on the front page ready to be clicked on to open up a new page to select what they want and however they wish to filter it. There is a setting icon in the top right to click on and go to subtitle settings and layout settings to either remove, add, or move up a section on their home screen. This entire design is all about organization and function over anything else.

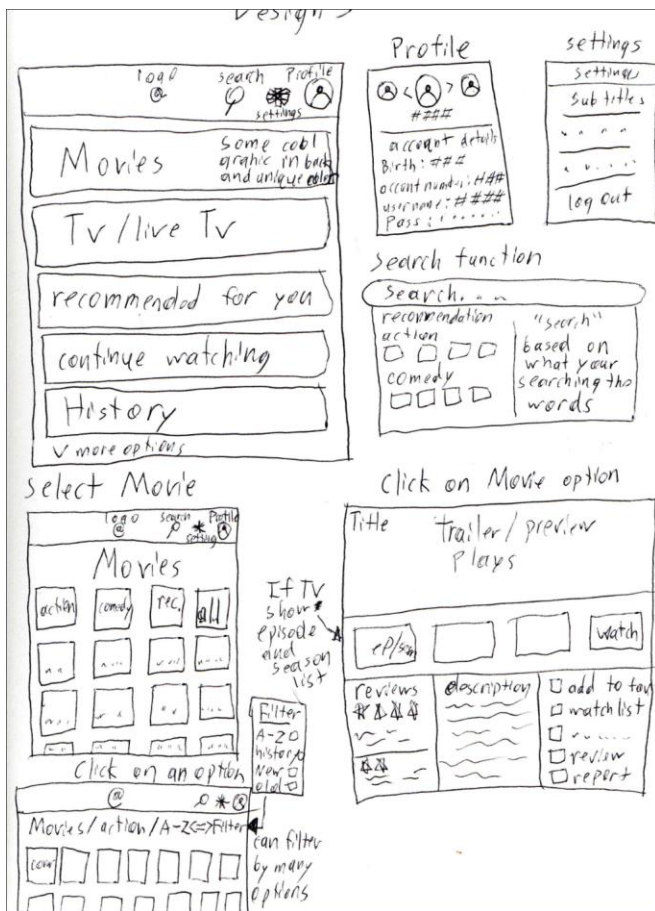


Figure 6. The third prototype

We decided as a group to focus on and develop the first prototype (Fig 4) of our sketches. This design resonated with us the most and fills most if not all of the tasks and needs we want in the website. Along with this, it will connect best with our users since it's similar enough to other services just putting forward their wants and needs more than other designs, along with the easiest and straightforward use and access to things they wish to do with a streaming service. The tasks we selected to use focus on making the experience for the user easier and faster for a more streamlined experience. This is based on the study and triangulation of common practices and habits of users and what they first do or wish to do when accessing a streaming site. This will make the learning process smoother and increase efficiency and ease of use since everything most users search for or want is upfront and not advertising or pushing forward new or major shows/movies.

E. Prototype Revisions and Testing

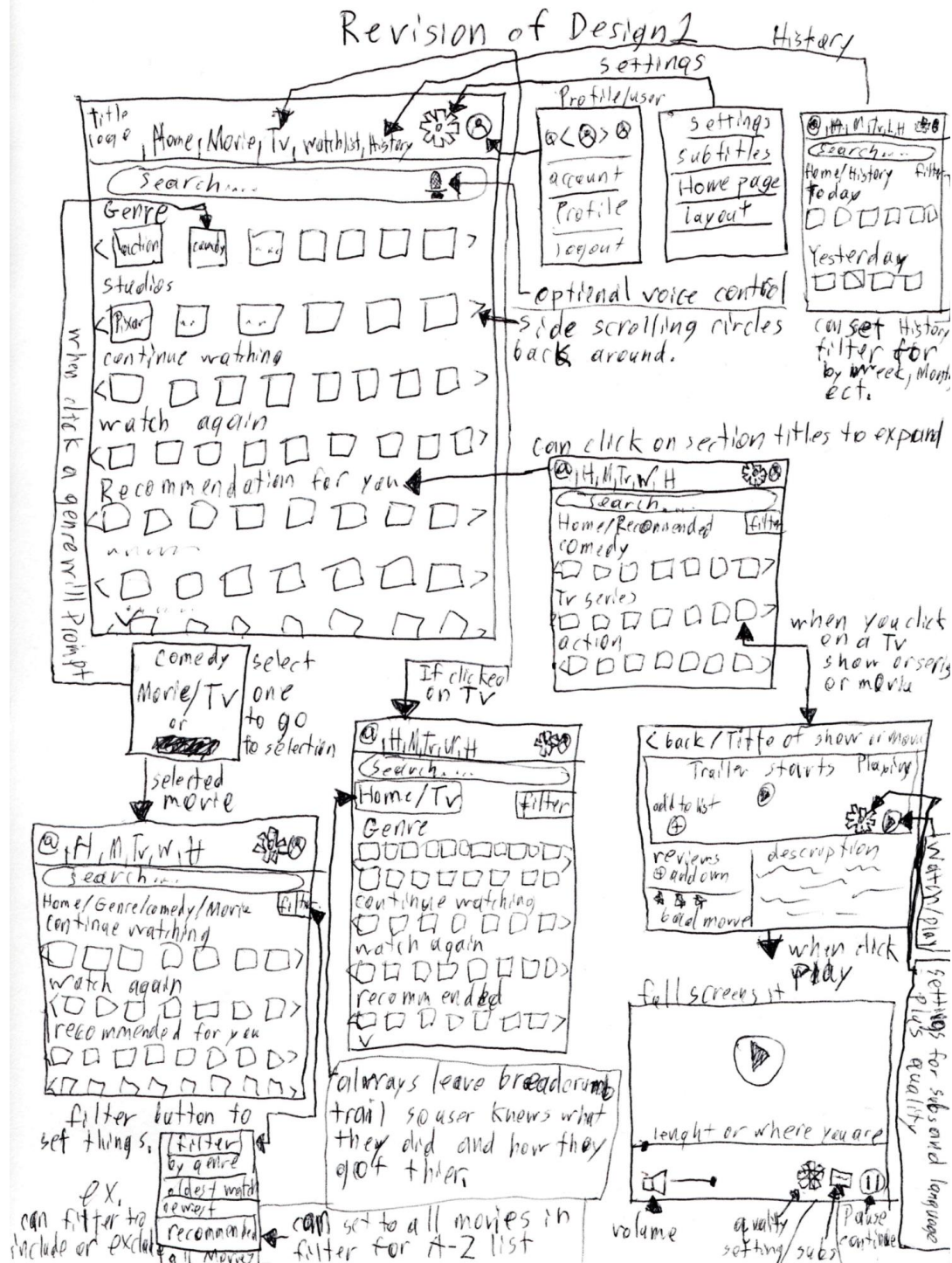


Figure 7. The first revision of prototype 1

Doing a heuristic evaluation using our personas we compared the results for each area and came to the conclusion that we have a severity rating 0 (Fig 8).

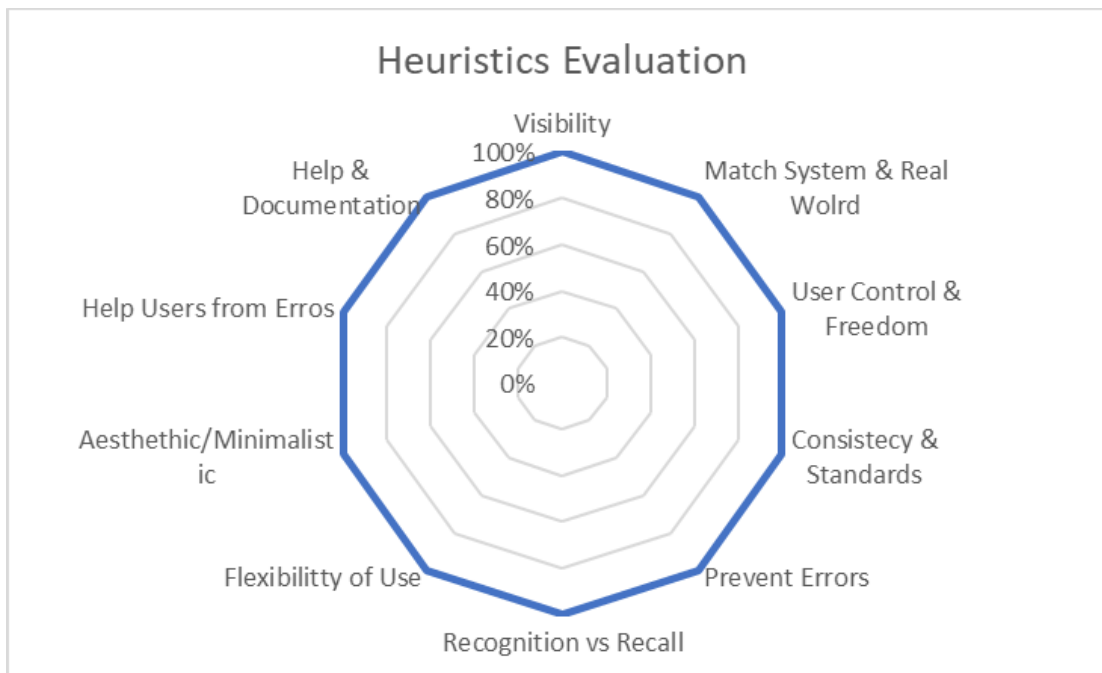


Figure 8. The results of the heuristic evaluation using two personas.

Table 17 summarizes the results from the cognitive walkthrough using the personas, and the violated heuristics that were identified by team 11.

Table 17. Results from inspection-based methods

Type	Violated Heuristic	Description	Rating
Persona walkthrough. Results shown in figure 6	None	Our personas would not have an issue navigating the interface and completing tasks	0
Team 11 evaluation of prototype	Error Prevention	Create a warning when the user decides to logout of the service	1
Team 11 evaluation of prototype	Aesthetic and Minimalist Design	The home page has a lot of options and they are very small boxes with many rows which can be overwhelming for users. Making the boxes and rows larger can help resolve this potential issue.	1

Table 18. Cognitive Walkthrough results

Cognitive Walkthrough	
Task	Action Sequences
The user selects 'resume watching' on the home page.	<ol style="list-style-type: none"> 1. The user presses the down arrow on the control 3 times <ul style="list-style-type: none"> • Yes. The correct action is evident to the user. • Yes. The user will notice the correct action is available because the text for the headings lights up. • Yes. The user will interpret the action correctly since the headings are organized in a top-bottom hierarchy. 2. The user presses the 'okay' button on the remote control <ul style="list-style-type: none"> • Yes, the action is evident to the user. • Yes the user will notice the action is available since boxes get highlighted under the genre headings • Yes
The user clicks on a movie of interest. They then click the + button on the preview screen to add.	<ol style="list-style-type: none"> 1. The user presses the right arrow button on the remote once and selects 'Movie'. <ul style="list-style-type: none"> • Yes. Headings are highlighted which provide feedback for the user. • Yes • yes 2. The user looks for 'add to list' and presses the left arrow button on the + icon <ul style="list-style-type: none"> • Yes • yes • yes
The user selects watch again on the home screen.	<ol style="list-style-type: none"> 1. The user presses the down arrow key on the remote 4 times <ul style="list-style-type: none"> • Yes. The headings will be highlighted as the user scans them with the TV remote. • Yes • Yes

	<ol style="list-style-type: none"> The user sees that 'watch again' is highlighted and presses 'okay' on the remote <ul style="list-style-type: none"> Yes Yes No. The text must be slightly enlarged as the user hovers over the heading.
The user selects 'profile' on the top right corner, clicks on settings, and then scrolls down to subtitles.	<ol style="list-style-type: none"> The user scans the top right corner of the site and finds the profile icon <ul style="list-style-type: none"> Yes No. The profile icon needs a status message. Yes The user presses the right arrow key on the remote 6 times sees the profile icon highlighted and presses 'okay' on it <ul style="list-style-type: none"> Yes Yes Yes The user sees a drop-down menu and presses the down arrow key on the remote 4 times, selects settings, and then selects subtitles from the sub-menu <ul style="list-style-type: none"> Yes Yes Yes

Table 19. Usability testing results

Usability Testing Results	
Participant Number	Results
1	<ol style="list-style-type: none"> Commented on how he likes the new design better than what he is currently using Commented that he likes the ability to customize the homepage to his preference All the tasks were easily completed with minimal questions asked Likes the ability to filter content Said that making the headings clickable should be more clear Thinks continue watching should be first and then followed by what is new as default

Figure 9 depicts the revised paper prototype after completing the first usability test.

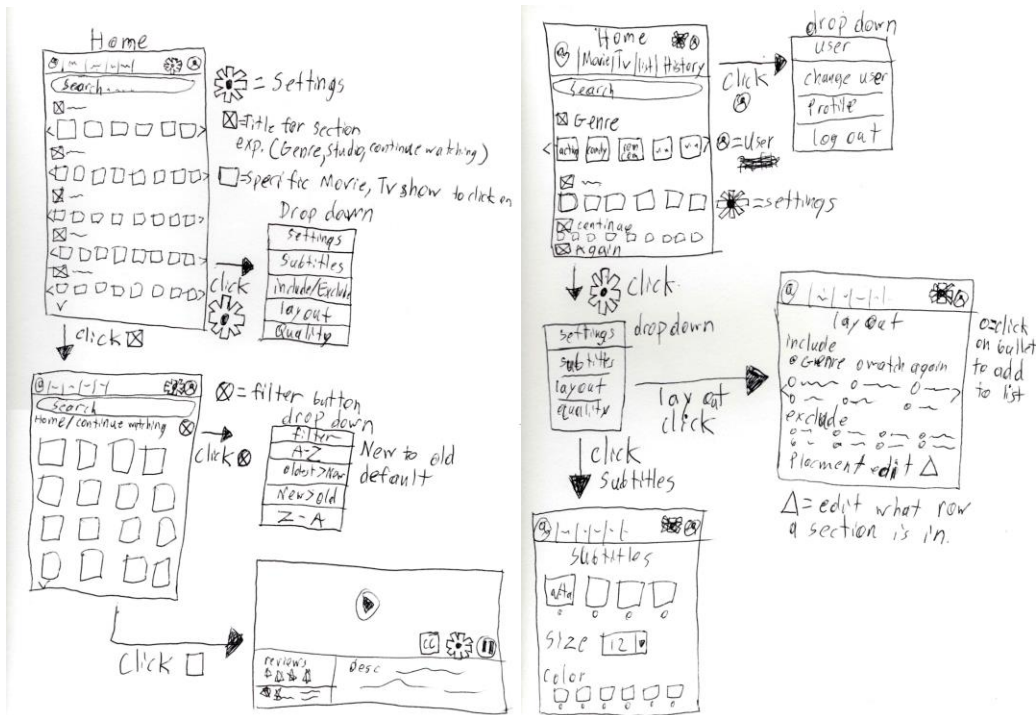


Figure 9. Revised paper prototype after the usability testing.

F. Digital Prototype

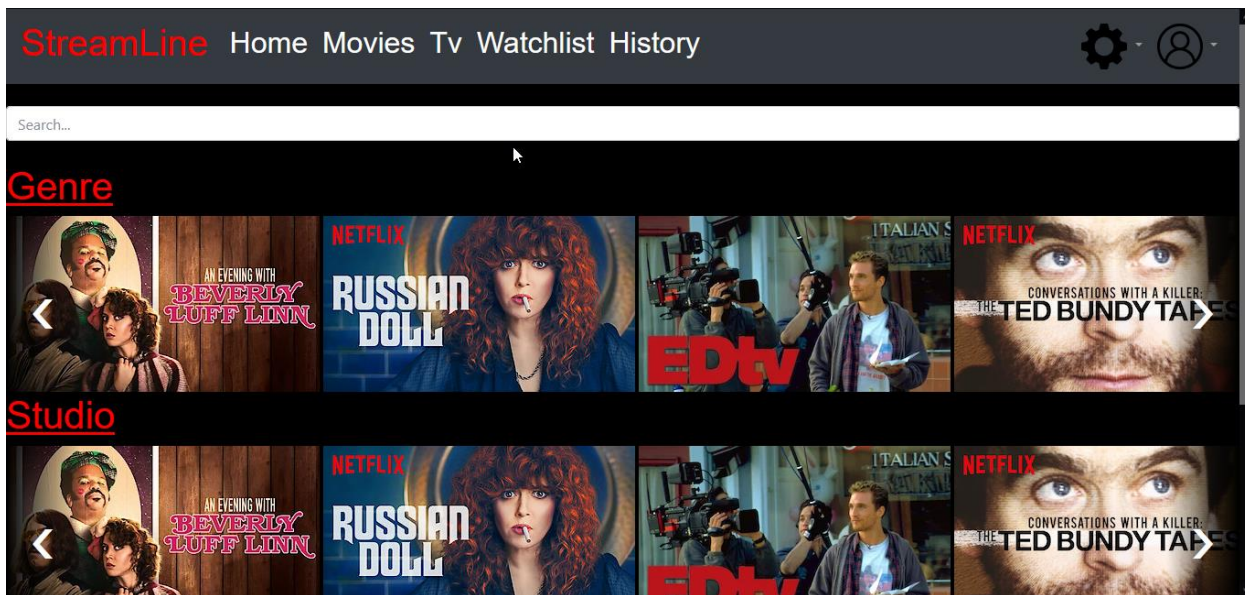


Figure 10. Home Page

Results from figure 10 are listed below.

- **Familiar feel:** we took inspiration from popular streaming services for a seamless user experience
- **Easy navigation:**
 - **Carousel magic** rotating content keeps things fresh without overwhelming you
 - **Clickable titles:** underline titles guide you to explore further

- **Customization at your fingertips:** a dedicated setting button saves time searching for options
- **Subtitle superpower:** edit subtitles directly from the homepage for personalized viewing experiences!

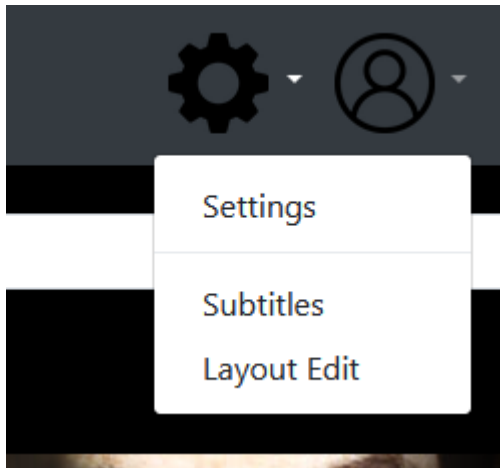


Figure 11 Settings drop-down menu

Results from figure 11 are listed below.

- **No more hunting:** unlike other services finding your watch history is a breeze!
- **One-click wonder:** simply click in the history section at the top for instant access
- **Organized for you:** your history defaults from newest to oldest but filters let you easily adjust the order
- **Breadcrumbs guide your way:** new breadcrumbs show your navigation path making it easy to backtrack and find what you need

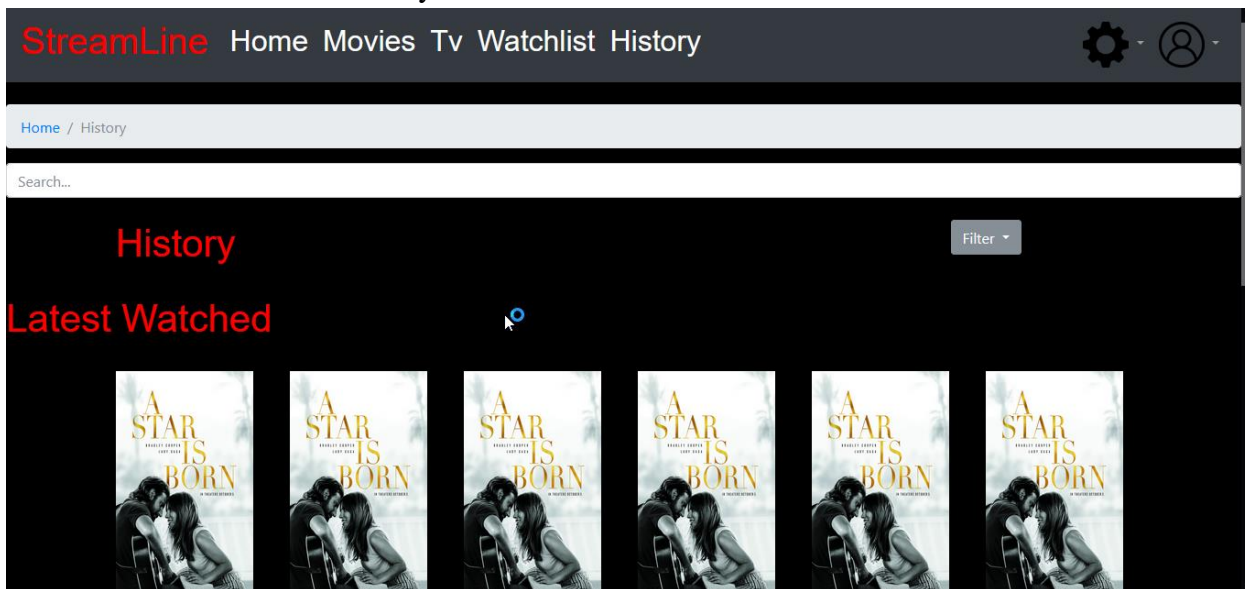


Figure 12. History Page

Results from figure 12 are listed below.

- **Fast find:** unlike other services getting back to your in-progress show is a snap
- **Prime placement:** we placed the continue watching section prominently on the homepage
- **Less scrolling more watching:** no more hunting find your show in just 2-3 scrolls on most devices

IV.DISCUSSION

The key takeaways from reviewing the services are that search, profile, continue watching, recommendations, watchlist, and original content are common between all streaming services. Having an a-z section and being able to customize subtitles is not available on every service. Streaming services do not have an easy way to view all the already watched content in one place.

The key findings were that some services offer features that others do not and that Netflix is the service that users struggled with the most. Some users did not have problems with the service they used, but others did. Amazon Prime has redundant search options and Netflix lacks an a-z category. Max and Netflix need the most changes to provide a better user experience. Disney+ is in the middle ground because some users struggled while others did not. One Max user found that having highlights and top 10 categories is not necessary, and they find it hard to locate all the different channels offered such as Food Network, DC, and HBO. Some services offer a feature on one platform but not on another one. Max allows subtitle customization on PC but not on the TV app. The lack of consistency between different services and their platforms causes a usability issue. An interesting thing is that in the survey the participants said that the service is user-friendly, but when interviewed they mentioned things that do not make the service user-friendly. They could be contradicting themselves because they are used to using the service. There could be different results with participants who are new to the service.

The open-ended section of the survey reveals that users do not like the default order of how the interface is designed. They also think that it is not clear how to add content to a watch list, and they are frustrated that new seasons of shows are not added to the service even though they exist on another service they do not have.

Participant 1 is a retired middle-aged male who used Max in their living room. He struggled with finding the different categories that were offered and thought that there was unnecessary information on the home page. He prefers to look for what is new to the service and thinks that Max has redundant categories.

Participant 2 is a middle-aged female who used Netflix in their living room. She did not use the search function and did not realize right away that each category looped around when the end was reached. She also looks for new content. She thinks that every service should have the same features and layout. She also thinks that being able to customize the home page would be helpful.

Participant 3 is a middle-aged male who used Disney + in their living room. The user gravitated toward using the search bar to search for shows. When prompted to search for a show using the a-z category feature they were confused. They eventually found the feature underneath the movies and series tabs. The feature was more tedious than helpful because it took longer to scroll through the list of movies versus using the search bar to enter the first letter of a movie. When prompted to create a watchlist of their favorite shows they didn't scan for the (+) icon right away. It was observed that the user does not like to tinker with extra menu options. What they saw right in front of them is what's most important.

Participant 4 is a middle-aged male who used Disney +, Netflix, and Prime in their living room on a TV, and on a laptop. They possessed an average competency in technology and had high self-efficiency and risk tolerance. They usually only use the search function when they look for something specific but they mostly browse for shows and movies that catch their interest. They use the watch again and continue watching the function many times since sometimes they fall asleep watching something and wish to watch it again or continue to watch the movie or show. They mainly look at genres or recommendations made by the service to them. Outside of that they just go watch what is newest or released and if not that they just scroll till they see something that interests them.

Participant 5 is a middle-aged woman who used Disney +, Netflix, and Prime in their living room on a TV, and on a laptop. They possess low technology skills and experience and are risk averse. They mainly say with watching again and looking at things similar to what they normally watch. Admittedly they use the services a lot less than most other participants and not regularly. The only other task or time they go into the services is to look up a specific show they were told about or are interested in watching.

The method of observing first and then giving a survey before an interview works well. Since the method works well, the researchers decided not to modify the method of collecting data from participants.

KLM reveals that it takes a longer time to complete tasks when using Amazon Prime Video. The KLM data also proves that not every service has the same features because some categories are marked N/A. This supports the usability problem with streaming services. An issue when performing KLM that the researchers ran into is the constant updating of the applications. Disney + had an a-z category when observing the participants, but when conducting KLM a recent update removed the category from Disney +. KLM also revealed that our prototype required less or about the same time and keystrokes for a majority of the common tasks users perform. This proves that our design is more efficient and effective as the already existing interfaces.

The themes that emerged from the data analysis include accessibility issues, poor UI design, and difficulties in finding categories. One of the observed participants was a middle-aged man who happened to be a retired family member of one of our team members. Notably, this participant exhibited high computer self-efficacy and a remarkable tolerance for exploring new technology. The observation took place in a familiar environment—the participant's living room—and with a family member present, which facilitated excellent feedback. Several issues with the streaming service were highlighted, including scrolling problems, missing categories, the absence of a 'continue watching' feature, and concerns about the size of icons.

Three prototypes have been developed before pursuing one of them. Each one has a focus on specific tasks. Ultimately the first prototype was selected to be pursued. One of the main reasons it was selected is because of its similarities to existing streaming services. This helps improve the learnability of our interface and it reduces the cognitive load for new users that already use streaming services. Also, it was more aesthetically pleasing to all members and was the most likely to achieve and reach our intended goal of reducing time spent on tasks and making the user experience more straightforward. The second design was just too complicated and in order to work for the everyday user required some experience with technology and was not the most obvious to use. Most people just want a usable and accessible site right from the start without too much work and editing needing to be done by themselves. Prototype 2 was more appealing to experienced and more technical users which is a minority. As for the 3rd prototype, the visuals were a bit lacking according to the participants and our group, it got the job done but lacked some of that more refined

and professional look that other sites had. This can be a fairly important aspect of the prototype because if people don't like the visual or look they won't use it or just lose interest.

Using the personas we thought that they would have an easy time using the service, but we thought wrong. The heuristic evaluation and cognitive walkthrough revealed some problems. The heuristic evaluation revealed that the design was complex, and there were no signs of error prevention. The cognitive walkthrough revealed the need to increase the font size and the need for status messages. The prototype needed to be revised. The usability test with Participant 1 reveals that the prototype is well-designed. Most of the negative feedback was personal preference which would not cause a major usability problem. Participant 1 prefers using our interface and thinks being able to customize the homepage is great and useful. Participant 4 was happy with the overall look and feel of the prototype and was happy it was so familiar to already used programs and services they were used to. They also enjoyed the option to add or move around what sections they can keep, delete, and move around since their experience with Netflix annoyed them with many random recommendations to shows and sections they have no interest in. Plus the access to history up front and an obvious settings section was great for them. As for Participant 5, they were happy just to have upfront access to their most used and needed features to complete the tasks they wish to such as continue watching, history, and genres right up front. This made their experience much better and easier along with using a look/design they are used to.

For the final prototype design that was created in the end and used to test usability and review with participants we believe it was passable to achieve our goals, there were still a lot of visual improvements and details we could have added but it got the job done for KLM and to test for future improvement. The biggest inspiration was Netflix for the design since it is the site most people have at least seen or used so makes the transaction or learning process the easiest, netflix has a good base/groundwork but it's just some finer details and options they are lacking in or they just push their recommendation software to much. People enjoy the carousel of options so we stuck to that but the big decision was how to put up the genres at the top which would just be a giant list of boxes or just throw it all on a carousel. In the end, we went with the carousel since it looked better, took up less space, and did not overload the user, plus put the other options users wanted to see up front and not force people to scroll down so far to get past the genres. Biggest add on we needed to include was ease of access to history and settings since most sites hid the settings under the profile section, which we almost did to but was caught in early prototyping to change and improve on, and finding history of what you watched on these sites are hidden or in convoluted ares or options taking forever to find or needing even google searches to find how. Also ease of navigation between different sections and parts was another big inclusion in the site so you know where you are and how to go back and reach different parts.

The researchers wanted to review more streaming services, but decided not to because of time and the size of the team. They also thought it would be better to use the more popular and well known streaming services for this research project. The team also would have liked to perform usability testing with the final prototype to identify more usability problems that might still exist. Some fine tuning and design or improvements to looks were a possible addition to make it look more professional but time constraints and other factors lead to having to use what we had on hand for testing. More users to help with research and testing would have been nice and preferable but we could only get what we had to work with, which was a shame since more improvements and data could have been gathered from more users to further refine the final product.

V.CONCLUSION

The usability problem with streaming services is their interfaces are inconsistent with which features are provided to users. The inconsistencies cause them to be ineffective and inefficient to use and cause a cognitive overload on new users. Using observations, surveys, and interviews it is revealed that users struggle with using streaming services. Users also like to look for new content first. A heuristic evaluation and cognitive walkthrough revealed issues with the prototype that were later fixed in a revision. It is hard to collect data because streaming services receive updates that may add or remove features. The usability test with participant 1 reveals that the prototype was designed well and most of the feedback was personal preference and would not cause a usability problem. The usability problem has been solved because the KLM data reveals that our service takes the least amount of time and the least amount of keystrokes to complete the tasks.

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