Improving Autonomy and Diversity in Content Recommendations

Based on an ABC Australia Case Study

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Assignment 2: Recommender System Prototype
Personalisation of (Public) Media [INFOMPPM], 2022-2023
Utrecht University: MSc Applied Data Science

7 April, 2023

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1. Introduction

Recommender systems have become an essential part of many platforms, providing personalized recommendations to users and helping them discover new content. These systems hold the power to shape human behavior, as they can influence decisions regarding what products to buy, which documents to read, which tv shows to watch and even which people to contact (Knijnenburg et al., 2016). In many commercial settings, influencing the user's choice is their primary design goal (Milano et al., 2020; Seaver, 2019). For example, social media platforms like Facebook provide content tailored to the interests of each user to maximize engagement. However, this can result in strong control over what the user is exposed to, which can influence their attention and behavior (Wu, 2018). For example, they can create filter bubbles, where users only receive recommendations that confirm their existing beliefs and interests, leading to a lack of diversity in the information they receive (Pariser, 2011; Pariser, 2011a). Given the potential for recommender systems to impact users' behavior, it is important to consider ethical values such as **diversity** and **autonomy** when designing these systems (Anderson et al., 2018). Diversity refers to the variety of recommendations that a system provides, which ensures that users are exposed to a range of perspectives and ideas (Resnik et al., 2013). Autonomy refers to users' ability to make independent choices, which is necessary for individuals to develop their own beliefs and preferences (Beauchamp & Childress, 2019). In addition to recommending valuable content (a.k.a. 'accuracy'), the incorporation of public values such as diversity and autonomy is essential in the implementation of a recommender system.

Table 1: Overview of what values stakeholders tend to prioritize, pursue or are interested in. Note that ABC Australia describes its values diversity and transparency in a more cultural context, rather than in terms of a recommender system context. See Appendix E for more context on the stakeholders' values.

	Accuracy	**Diversity**	**Autonomy**	**Transparency**
ABC Australia		+ Inclusion		
Content providers				
Advertisers				
Users				

While ABC Australia emphasizes the promotion of diversity within their organization (Australian Broadcasting Corporation, 2016), there is no clear evidence to suggest that this value is reflected in their content. With regards to transparency, the platform considers it important to provide this, although it is not clear in what ways (Australian Broadcasting Corporation, 2022; Australian Broadcasting Corporation, 2023). ABC Australia's stance on autonomy is unclear as well. For advertisers and content providers, we found no concrete information on their interests in the values of diversity and autonomy. It is presumed that these stakeholders place more emphasis on influencing users' decisions instead, which is typical in commercial entities (Milano et al., 2020; Seaver, 2019). However, these values are crucial to users. Therefore, it is imperative to balance the interests of diverse stakeholders and integrate public values such as diversity and autonomy into the design of recommender systems to

promote ethical values in technology design (Anderson et al., 2018). This paper will examine this issue with a recommender system based on ABC Australia's data.[1]

2. Theoretical Framework

2.1 Accuracy

Accuracy is a critical factor in the design of a recommender system (Gunawardana & Shani, 2010). Accuracy measures how well the system is able to predict preferences of users for different items. It helps ensure that the recommended items are relevant to the user's interests and preferences (Gunawardana & Shani, 2010). A fundamental belief in the field of recommender systems is that users will favor a system that delivers more precise predictions (Gunawardana & Shani, 2010).

2.3 Diversity

While accuracy is undoubtedly an essential aspect of recommender systems, there are additional factors that affect user satisfaction, such as **diversity** (Castells et al., 2011; Hurley & Zhang, 2011; Smyth & McClave, 2001). Diversity can be defined as the inverse of similarity (Gunawardana & Shani, 2010). There are two primary arguments that demonstrate the importance of diversity in recommender systems for users. First of all, when an algorithm provides users only with recommendations based on their previous choices and preferences, these recommendations are limited to a narrow subset of items. Because of this lack of diversity the system may become trapped in a “filter bubble”, where users are only exposed to the same types of items and their horizons are not broadened (Pariser, 2011; Pariser, 2011a). Pariser (2011) suggested that the core of human intelligence is based on the capacity to assimilate and adjust to new information, and raised concerns about the potential of recommender systems to confine users to a fixed perspective. This concept, which he called the "filter bubble," could limit creativity, obstruct learning, and strengthen existing beliefs. Secondly, current research has highlighted the significance of incorporating diversity in recommendation lists to improve the overall user experience (Gunawardana & Shani, 2010). Solely focusing on accuracy as the primary evaluation metric may lead to a lack of variety in the recommendations and could cause users to become bored with the system (Zhang & Hurley, 2008; Zhou et al., 2010). For instance, our recommender system is designed for recommending tv shows and series to people. Recommending five different tv shows/series that are all similar in nature, such as five different romantic comedies, may not be as useful as suggesting five diverse tv shows/series, such as a romantic comedy, a reality show, a fantasy film, etc. Offering a broad array of recommendations allows users to explore varied options and choose content that match their preferences and interests, resulting in increased satisfaction and engagement (Zhang & Hurley, 2008; Zhou et al., 2010). So ensuring the public value diversity will serve the interest of the users.

2.3 Autonomy

Another important value for recommender systems is **autonomy**. Recommender systems are known to have a significant impact on human behavior, which may lead to a perceived loss of human autonomy (Milano et al., 2020). Human autonomy is partly based on the independence

[1] See Appendix E (Section 7.5) for more details on the analysis of the stakeholders’ values.

from controlling influences (i.e., *liberty*) and the ability to intentionally act (i.e., *agency*) (Beauchamp & Childress, 2019). When individuals utilize a recommender system, their liberty and agency are constrained due to controlling influences[2] and the inability to provide explicit consent for its use (Nissenbaum, 2011; Taddeo & Floridi, 2016). Therefore, human autonomy constitutes a central value in AI, including recommender systems. As such, this value must be safeguarded and protected against potential adverse effects of technology (Anderson et al., 2018). Human autonomy is often compromised when recommender systems rely solely on implicit data such as clicks and viewing behavior, and users cannot influence the recommender system through explicit data such as ratings and preferences (Unruh et al., 2022). However, research has shown that users do not make use of the feedback mechanisms, such as a rating mechanism, that streaming platforms like ABC provide, even though users may be aware that these mechanisms play a role in the recommender system's algorithm (Varela & Kaun, 2019). Therefore, we suggest that recommender systems should aim to design for more engaging, potentially more concrete, feedback mechanisms. That way, a user may be more inclined to explicitly declare their preferences and tastes. Moreover, autonomy can be ensured through transparency. Transparency in recommender systems refers to the extent to which users understand how the system operates, why certain recommendations are made, and how their data is being used (Milano et al., 2020; Tintarev & Masthoff, 2015). By providing transparency, users can make informed decisions and exercise greater control over their own personalization experience. This contributes to user autonomy by empowering them to make choices based on their own preferences and needs, rather than being manipulated by opaque algorithms. Additionally, transparency can help to build trust between users and the recommender system, which can ultimately lead to increased user satisfaction and engagement (Cramer et al., 2008).

3. Method

3.1 Personas

To identify the users' needs regarding the values diversity and autonomy, we conducted online interviews.[3] The suggestions found from the interviewees' answers were used to create personas.[4]

3.2 Content- and Collaborative-based Filtering

We used collaborative-based filtering for providing diverse recommendations by defining similar users as those with similar demographics or similar favorite titles.[5]

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[2] For example, not having (explicit) control over what the recommender system will recommend, e.g. the user may have little control over what data the recommender system uses to determine their recommendations

[3] In Section 7.2 (Appendix B), subsections 'Interview Questions' and 'Results' are given the used questions and the answers to those questions, respectively.

[4] We used open (color) coding to gain a more in-depth understanding of the results (Blandford et al., 2016). After the open coding, we roughly used axial coding to identify categories (Saldana, 2015), hence identifying common suggestions among participants.

[5] Collaborative filtering is based on recommending items which other similar users like (Ortega et al., 2013). Similar users can be defined as users that give similar ratings to the current user's likes (Ortega et al., 2013).

As shown in Table 2, we used content-based filtering by recommending titles that have the same labels to the user's preferred genres and favorite titles.[6]

Additionally, we used a hybrid approach for regular recommendations for performance reasons.[7]

Table 2: Overview of what types of filtering and clustering techniques were used in order to recommend regular as well as diverse recommendations. The filtering techniques include collaborative- and content-based filtering, and the clustering techniques include K-Modes and K-Prototypes.

	Regular recommendations	**Diverse recommendations**
Collaborative-based	-	Least similar favorites from users with similar demographics
		Least similar favorites from users with similar favorites
Content-based	Content similar to user's favorites	Least similar content from similar genre
	Most favorited content in user's preferred genre(s)	
Hybrid	Users with similar favorite titles	-
	Users with similar demographics	
	Users with similar preferences	

K-Modes K-Prototypes

3.3 Data Cleaning & Synthesizing User Data

The original dataset contains the columns 'category' and 'tags'. We cleaned these columns' contents due to inconsistencies and redundancies.[8] We separated the 'category' column into the columns *title type* and *genre*.[9] Besides the 'category' column, the 'tags' column also contained labels on genres (e.g., 'arts & culture' and 'lifestyle').[10] These labels were used to complete the new *genre* column.

[6] Content-based filtering utilizes a user's preferences and interests to suggest items in the future that align with those preferences and interests (e.g. Geetha et al., 2018).
[7] The hybrid approach is often used in order to overcome the limitations of both the content- and collaborative-based filtering approaches (Thorat et al., 2015). Introducing diversity in the recommender system could lower the accuracy, though using a hybrid approach may somewhat overcome this problem, as well as make the recommender system more efficient (Lua et al., 2012).
[8] In the **exploratory data analysis (EDA)** phase.
[9] We found in the literature that a content's title type and genre are often considered two different concepts.
[10] The 'category' column contained all kinds of labels on the genres (e.g. 'drama', and 'comedy') and the title types (e.g. 'movie').

Furthermore, the dataset included many duplicates, wherein all columns would contain the same contents except for the *category* column.[11] Due to this (hidden) duplication, we had to remove around 1000 instances.

To test the recommendation mechanisms, we created user data.[12] User data can be created with the help of the interface, but the dataset with which we tested the system consisted for the majority of manually created data. The system is connected to a database, which is kept up to date, using the cloud platform **Deta**.[13]

3.4 Regular Recommendations

For the content and user data, we apply K-Modes and K-Prototypes to get regular recommendations.[14] These regular recommendations are based on the user's preferences, including a user's favorite titles, demographics and favorite genres.[15]

We apply K-Modes to cluster users based on their favorite titles and similar content. Titles and content are categorical values, as each title is a unique item, rather than a number on a scale.

We also use K-Modes to cluster users based on their preferences. K-Modes deals more efficiently with the sparse datasets of *ratings* and *genres*. The K-Prototypes algorithm is applied to cluster user demographics, as user demographics consists of both numerical values, i.e. age, and categorical values, i.e. gender.[16]

3.5 Implementing Diversity

We loop[17] over the contents in the user's top 10 favorite titles.[18] One of a user's favorites might be the film *Roxanne*. The most important genre from any of the titles is chosen to work with. If the selected genre is 'drama', a different genre that is most commonly mentioned in combination

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[11] In other words, the dataset would include the same show more than once, but the category column would contain different labels for the show.

[12] To create helpful user data, we needed a user's date of birth (for their age), email, first name, gender, favorite genre(s), username (column *key*), location, password, preference regarding titles, release dates (*prefDate*), rating (e.g. PG-13, R), title type preference(s), genre preference(s) and top 10 favorite titles.

[13] See URL: https://docs.deta.sh/docs/home/

[14] We opted for K-Modes and K-Prototypes rather than K-Means in combination with one-hot encoding as it has been argued that the K-Means method would result in weighing the categorical values more heavily compared to the numerical/continuous values (Kemmer, 2021). In our recommender system, we want the algorithm to treat the categorical and numerical values similarly without favoring one over the other.

[15] K-Modes clustering is a type of algorithm that can be used to cluster categorical variables (e.g. Bonthu, 2021). For numerical values, it would be logical to use K-Means clustering as developed by MacQueen in 1967. Additionally, we used the K-Prototypes clustering algorithm to deal with data that is a mix of numerical and categorical variables (e.g. Aprilliant, 2021).

[16] It would have been logical to use K-Prototypes for the release date preference due to the splitting of this variable into two columns (the start year and end year). However, from our own observations, it seemed as though K-Prototypes did not perform as well in handling the sparse data columns *ratings* and *genre*, hence our decision to use K-Modes instead.
Also, note that we did not have to normalize the data as the demographics consist of 2 categorical variables and 1 numerical variable. Data typically is only normalized when having more than 1 numerical variable.

[17] With the **get_diverse_recommendations** function.

[18] To get the diverse recommendations, we use file **diverse_recommendations.py** and functions **jaccard_similarity** and **get_diverse_recommendations**.

with *drama* is retrieved. This genre could be *comedy*. After that, we search through a list of *comedy* content, excluding *Roxanne*. The items' Jaccard Similarity is computed based on their similarity to *Roxanne*.[19] The position from which 15 titles are taken from the list is based on the user input from the ***Diversity Slider***.[20]

This process is replicated for the recommendations based on user demographics and favorite titles. The least similar content is recommended from the users' favorites from the same cluster.[21]

When items had the same Jaccard Similarity, they were sorted by a second sorting mechanism based on the user preferences.[22] Table 3 provides an example of this sorting mechanism.

Table 3: Example of what it looks like to sort something -in this case movies- according to two variables: 'jac_sim' and 'pref_compliance'. Movies are first sorted by their Jaccard Similarity (the lower the similarity, the higher on the list). However, if two movies have the same similarity score, they will be sorted by their similarity to the user's provided preferences. An item similar to a user's preferences would be sorted higher on the list.

index	**title**	**jac_sim**	**pref_compliance**
1	Lalaland	0.01	1
4	Fantasia	0.01	0
2	On the Farm	0.30	1
3	Party in the USA	0.46	0

4. Results

Table 4: Details of the participants in the interview study, including their study ID, gender, age, highest completed education level, and if applicable, what they are currently studying or have studied.

Study ID	**Gender**	**Age (range)**	**Education**
P1	Male	23	Studied bachelor at University of Applied Sciences

[19] To implement diversity, we considered both Cosine Similarity and Jaccard Similarity. The reasoning to opt for Jaccard Similarity was based on the fact that Jaccard Similarity is more suitable for text analyses where duplicate items are not a concern (Gupta, 2018). In comparing two titles with one another, the repetition of words will have no influence on how the similarity is determined (Gupta, 2018).
[20] See Section 4.4 for more details on this slider.
[21] For each kind of recommendation, we first had to determine what the most optimal number of clusters was, so that this could be inputted in the K-Modes and K-Prototypes algorithms. Section 7.6, Appendix F (Figures F1-F4) provides more details on the determination of the optimal number of clusters based on Python's **KneeLocator**.
[22] An item's similarity with the user preferences was given with the help of zeroes and ones (1 meaning that the item is similar, 0 meaning it is not). Therefore, if two items with the same Jaccard Similarity, wherein one item had value 1 and the other value 0, the item with value 1 would be sorted higher in the list as it is therefore 'more similar to what the user likes'.

P2	Female	19	Following pre-university education (*VWO)*[23]
P3	Female	21	Studying bachelor at University of Applied Sciences
P4	Female	23	Completed bachelor at University
P5	Female	23	Studying master at University
P6	Female	25	Studying master at University
P7	Male	23	Studying bachelor at University
P8	Female	23	Studying master at University
P9	Male	24	Studying master at University
P10	Female	24	Studying master at University
P11	Female	28	Studying master at University
P12	Male	25	Studying master at University
P13	Male	21	Studying bachelor at University of Applied Sciences
P14	Male	25	Studying bachelor at University of Applied Sciences
P15	Male	26	Studying bachelor at University of Applied Sciences
P16	Female	55	Completed bachelor at University of Applied Sciences
P17	Male	21	Studying bachelor at University
P18	Male	57	Completed master at University

4.1 Qualitative Results

Table 4 provides the details of the participants.[24] We found that users tend to be agreeable with recommendations based on **exposure diversity**, though a nuanced opinion on diversity was expressed frequently as well. A similar pattern was found for the value of autonomy. However, participants tend to either agree or disagree with the value of transparency, with only 1 mention of a nuanced opinion.[25] The results are given in Section 7.2 (Appendix B), Table B1.

The interview findings are provided in Table B2. This table shows that the following labels were the most popular:

1. Neon yellow
2. Neon green
3. Neon red, neon purple, light orange, light yellow, light blue

Section 7.3 (Appendix C), Table C1 provides an overview of what suggestions were implemented.[26] From these suggestions, we identified 3 personas: (1) the *Lazy Young Adult*, (2) the *Adventurer*, and (3) the *Personalisation Fanatic*.[27]

[23] *VWO* stands for *Voortgezet Wetenschappelijk Onderwijs* in Dutch.
[24] Section 7.8 (Appendix H), subsection 'Descriptive Statistics' provides a summary of the sample for our interview study.
[25] Though there were also more agreeable mentions regarding transparency than disagreeable ones.
[26] We fully implemented the top 2 suggestions: *neon yellow* and *neon green*. Suggestion *light red* was implemented due to its feasibility in the given timeframe. Suggestion *neon orange* was partially indirectly implemented by providing suggestions based on what other users watch.
[27] The majority of the interviewees were young adults who have recently studied or are currently studying at a University (of Applied Sciences). Therefore, the identified personas are biased towards these demographics.

4.2 Interface Design

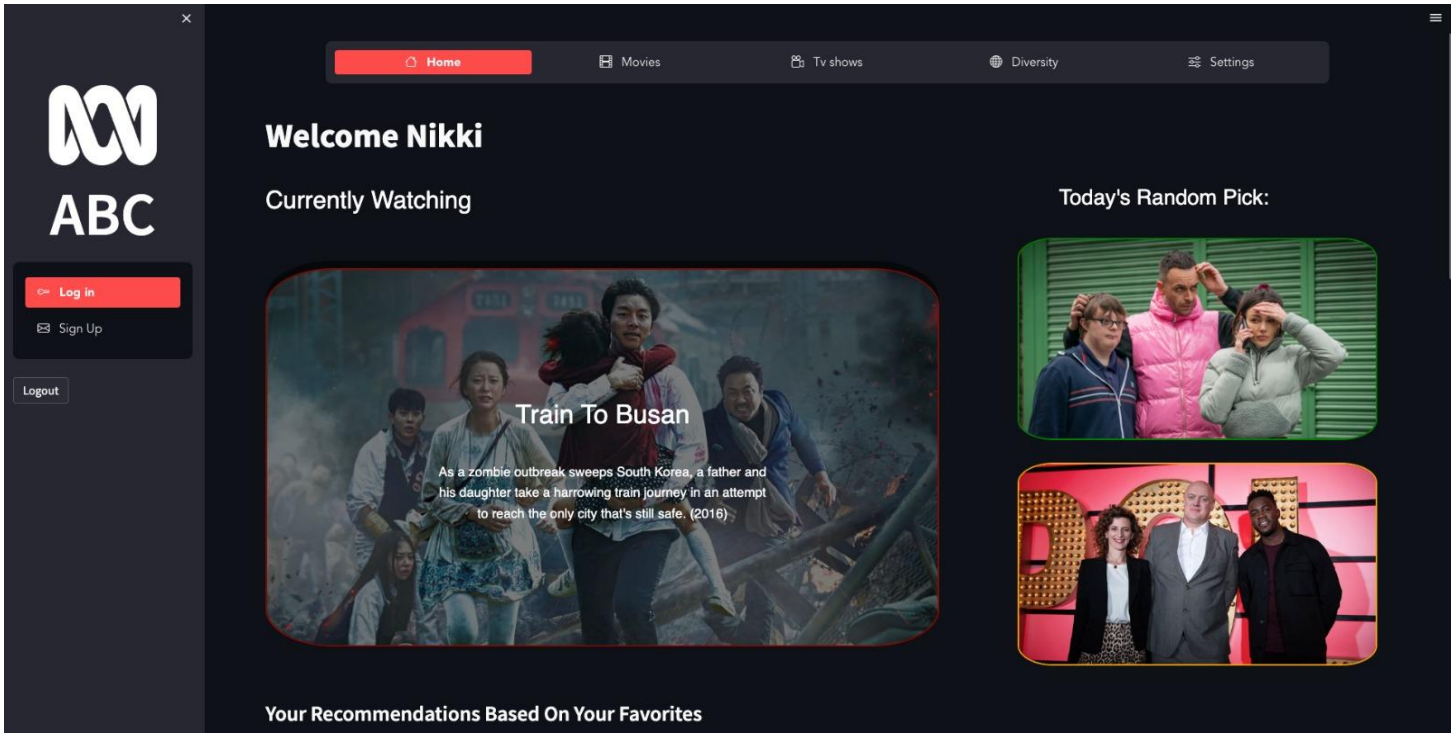

Figure 1: Homescreen of the recommender system's interface.

Operationalizing Diversity & Autonomy

When a user selects 100% diversity on the slider, the recommendations show some resemblance to the user's regular recommendations.[28] However, within this similar type of content, the system provides the user with the content that is least similar to their favorites. Therefore, the top 15 least similar items are selected.[29] If a user selects a diversity around 50%[30], the same principle applies, but the recommendations are slightly more similar to the user's favorites compared to recommendations with 100% diversity. Fifteen recommended items are selected from the center of the dataframe where items are sorted by their similarity with the user's favorites. An *information logo* is included in the interface explaining the user how to use the slider. See Figure 4.

[28] E.g. with regards to a similar genre or content liked by people with similar demographics.
[29] As previously discussed in Section 3.6 (subsection 'Getting the Recommendations'), the recommendations based on diversity are selected from a list computed by their Jaccard Similarity.
[30] The items in the middle of the list with Jaccard Similarities will be selected.

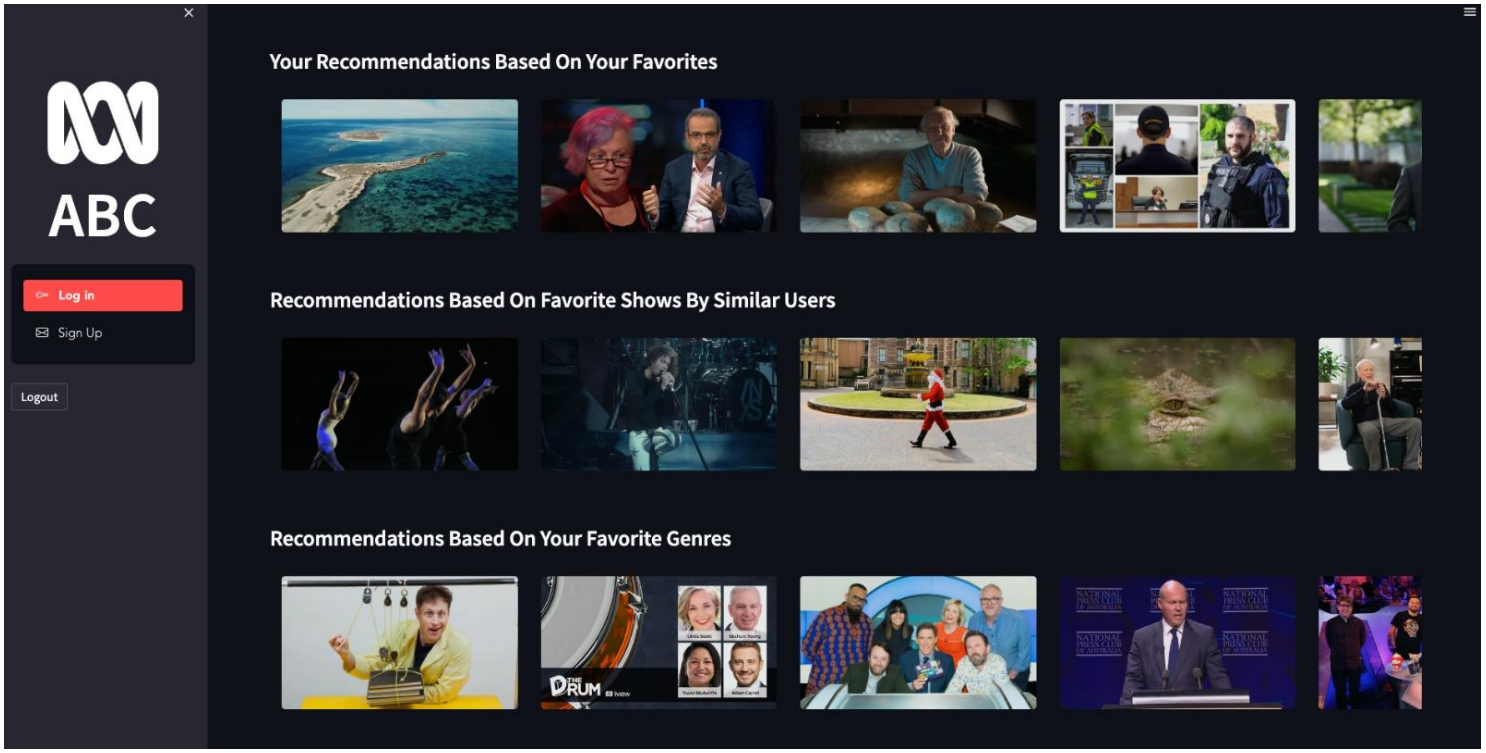

Figure 2: The three types of regular recommendations (based on the user's favorite titles, similar users and favorite genres) as displayed on the homescreen.

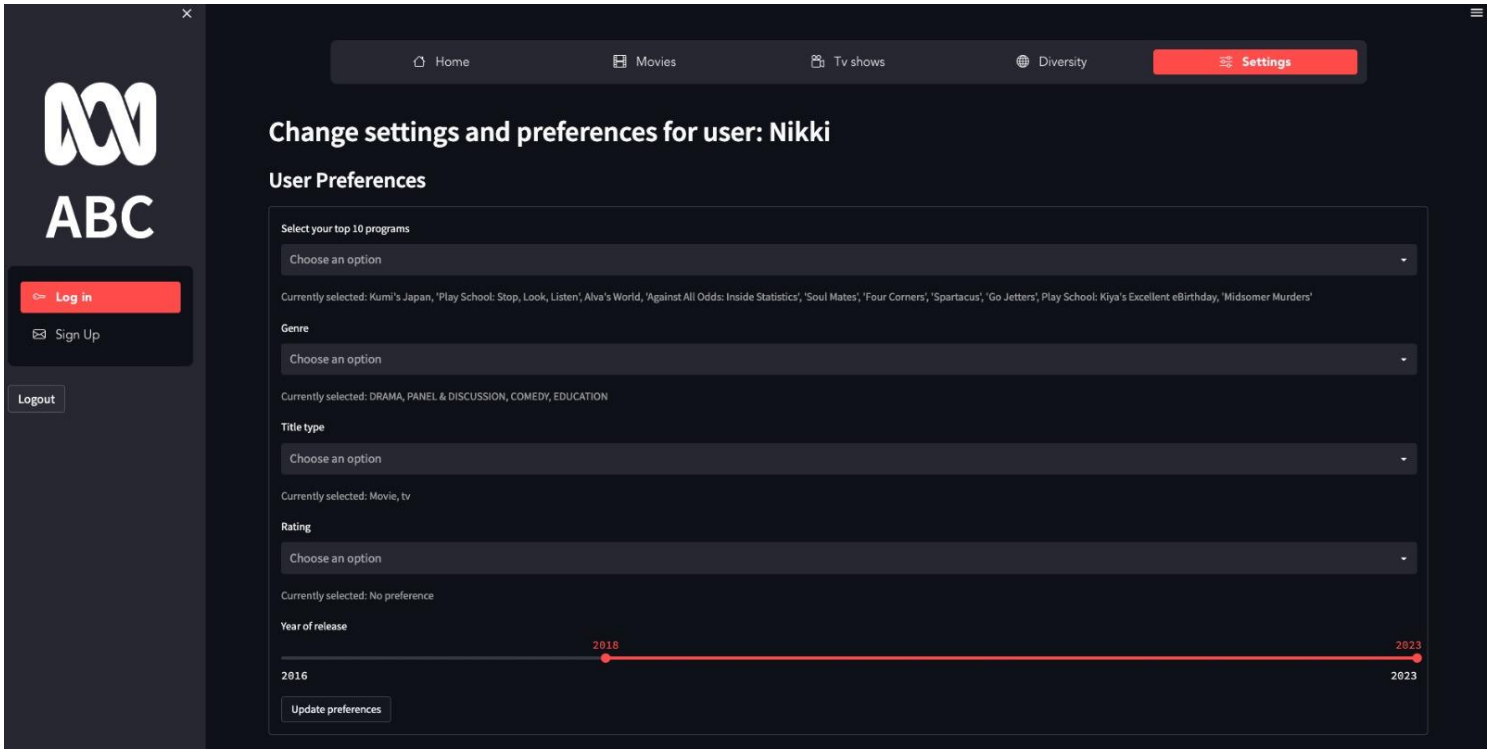

Figure 3: The screen to update one's personal settings and preferences, including your top 10 titles ('programs'), favorite genre(s), title type(s), rating(s) and range of release date (e.g. some users may prefer newer content rather than older 'classics').

The diversity slider is inspired by suggestion *light red*, wherein the interview participants described preferring autonomy over the level of diversity over the recommendations.

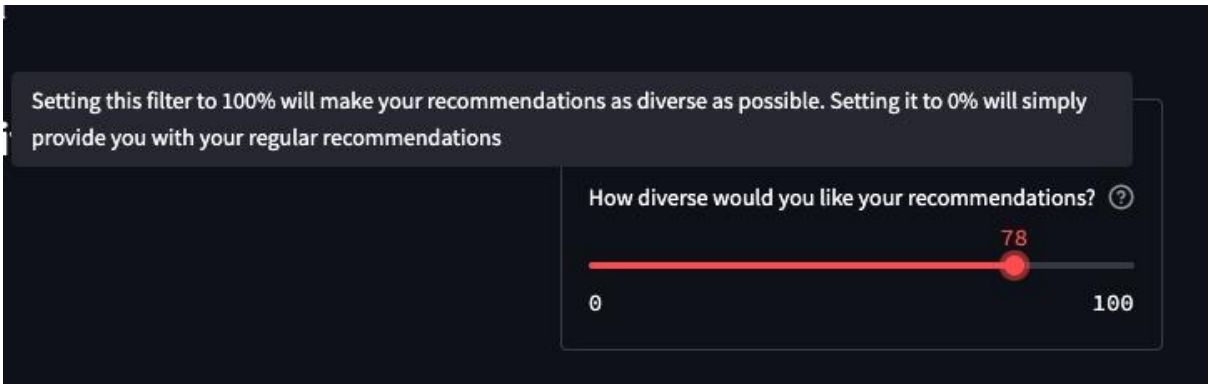

Figure 4: The diversity slider on the 'Diversity' page, including the information logo providing an explanation on how to use the slider.

Suggestion *neon yellow* is implemented by having the regular and diverse recommendations provided on different pages in the application.

Table 5: Small overview of the suggestions from Table C1 in Appendix C (Section 7.3), with the same colored label and the short description.

Color label	**Small description of what the suggestion entails.**
light red	Option to allow users to set the level of diversity.
neon yellow	Option to have an overview of recommendations based on the type of recommendation and/or recommendation 'type' signifiers per title.
neon green	Option to have an overview of recommendations based on particular categories (genres) and/or viewing guide signifiers per title.

Operationalizing Autonomy & Transparency

Users are given autonomy to indicate their preferences, like title types and genres, which we call 'personal settings'. This way, users have more control over their regular recommendations.

The home screen provides **transparency** into what the regular recommendations are based on with headers.[31] This transparency gives the user more autonomy over what content to expect. This implementation corresponds to suggestion *neon green*.

4.3 Privacy Concerns

The recommendations based on users' demographics pose some privacy issues, as a person's gender, full name and date of birth are sensitive information (Schermer et al., 2018). Therefore, we made the *last name* field optional, but future recommender systems should consider making

[31] The headers "Recommendations based on Similar Users", "Recommendations based on Preferences", and "Recommendations based on Demographics" are used.

more fields optional.[32] We did not set more fields to optional, as the demographics-based recommendations rely on three fields only, hence making them optional would deteriorate the recommendations' quality.

4.4 Validation with Intra-List Similarity

The ILS is calculated by comparing the content data[33] thirty times within the set of normal and the set of diverse recommendations, resulting in Figures 5 and 6, respectively. Our diverse recommendations have a lower ILS score on average, showing that the diverse recommendations are indeed less similar to the user's preferences compared to the regular recommendations.[34]

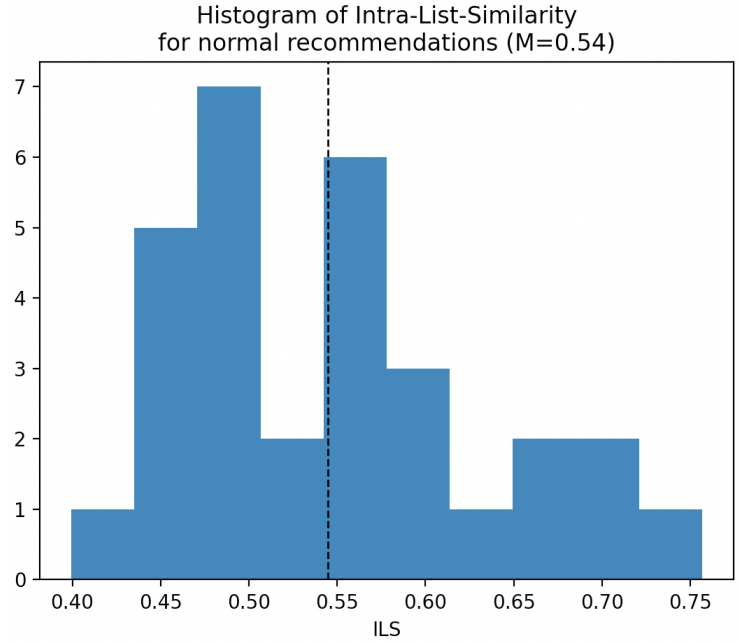

Figure 5: Histogram (N=30) of the ILS results for the regular recommendations. The mean has a score of 0.54, which is higher than the diverse recommendation's ILS mean.

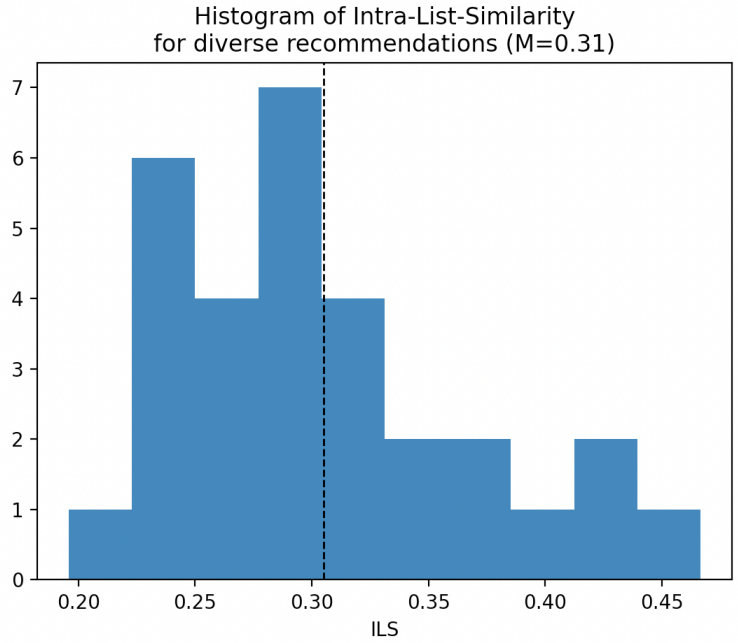

Figure 6: Histogram (N=30) of the ILS results for the diverse recommendations. The mean has a score of 0.31, which is lower than the regular recommendation's ILS mean.

5. Conclusion

All in all, we have successfully built a recommender system that improves diversity. Despite this, there is still room for improvement.

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[32] 'Optional' meaning that the field does not have to be filled in. Fields that do not ask for sensitive information can typically stay mandatory to fill in.

[33] A.k.a "genre", "tags", "tags2", "more", "rating" and "title_type".

[34] According to Jesse et al. (2022) "diversity is commonly assessed with the help of the intra-list similarity (ILS) measure" [p. 1]. With ILS, two lists are compared to one another based on their similarity by computing the 'average pairwise similarity' of all the items (Jesse et al., 2022). Items' similarity are often evaluated by comparing them based on categories (e.g. genres), or other kinds of domain-specific information (Jesse et al., 2022). The ILS scores, i.e., the average Cosine Similarity within a set of recommendations, are presented and compared for the normal and the diverse recommendations in Appendix J (Section 7.10).

5.1 Other Recommendation Methods

The first limitation is the usage of Jaccard Similarity for the diversification of recommendations. We had limited time to research all possible methods to implement diversity in a recommender system. Therefore, there may be better options than Jaccard Similarity.[35]

Second, one of K-Modes disadvantages is its sensitivity to outliers, which can result in small clusters with very few data points (Rasyid & Andayani, 2018). These small clusters may provide less accurate recommendations.[36] Also, it is difficult to validate K-Modes clusters' correctness (Rasyid & Andayani, 2018). K-Modes disadvantages are applicable to K-Prototypes as well. Besides that, we arbitrarily chose *Cao* over *Huang* as *init* for K-Prototypes. However, the chosen *init* does make a difference in how clusters are made (e.g. Zazueta, 2020).

Moreover, future systems should consider storing locations as coordinates rather than strings (of municipalities). Or, if a system were to use strings, provinces might work better than municipalities, as clustering on municipalities prevents users from being clustered together even though they live close to another.

5.2 Advanced Recommendations

Currently, a title's similarity with another title is based on their given labels. However, to introduce more sophisticated recommendations in a future system, text analysis could be introduced through **word embeddings** whereby titles' similarities are compared based on their descriptions. Future research could also explore image analysis to improve recommendations.

Furthermore, the system is inefficient when it has to update its recommendations, e.g. due to changes in the user's personal settings. Although the website's runtime has a maximum loading time of 1 second after a mouse click, the system can take up to 1.5 minutes to update its recommendations.

Also, the non-usage of interaction data[37] are not taken into consideration. Using interaction data in future recommender systems may contribute to better recommendation results.[38]

Moreover, our system has the risk of recommending completely irrelevant content (e.g. recommending kids shows to an adult).[39] What's more, some users may have a distaste for

[35] Moreover, we went through a selection of research papers to decide upon a diversification method, but not all papers were fully understandable to us, potentially partially due to our limited experience with recommender system algorithms.
[36] For example, we currently also don't provide a solution for a user that ends up in a cluster by itself. But luckily, this hypothetical scenario has not given us problems up until this point.
[37] In the form of implicit feedback, such as mouse clicks and mouse hovering, and explicit feedback, such as ratings.
[38] This limitation corresponds to suggestion *neon red* (see subsection 'Findings' in Section 7.2, Appendix B).
[39] This is caused by the way in which the diversification algorithm is implemented.

particular genres without exceptions.[40] Taking these aspects into consideration could improve users' autonomy over their recommendations.

5.3 Data Quality & Data Relevancy

Another limitation is that the content data is somewhat sparse. This sparsity was increased due to the data cleaning process, since separating columns that contained zero values would become two columns with zero values.

Additionally, the ABC database we use may be less relevant and useful for non-Australian users, as the database includes news on Australia, and might contain titles more known to Australian users.

Lastly, the recommendations from the user data may be flawed, because this data was mostly manually created. As a result, the recommendations may be somewhat inconsistent or illogical due to the users' potentially inconsistent data. To improve the recommendation model, we need data from real users.

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[40] As such, the recommender system could be improved by taking more suggestions from the interviews into consideration, such as *light orange* and *light blue* (see subsection 'Findings' in Section 7.2, Appendix B).

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7. Appendices

7.1 Appendix A: General Personas

Extra Notes on the Persona Construction

The personas were developed using information from the open coding and axial coding processes. During the open coding process, the researchers examined respondents' attitudes towards the values of diversity, autonomy, and transparency. From this, we identified 3 general 'trends' which we constructed into personas.

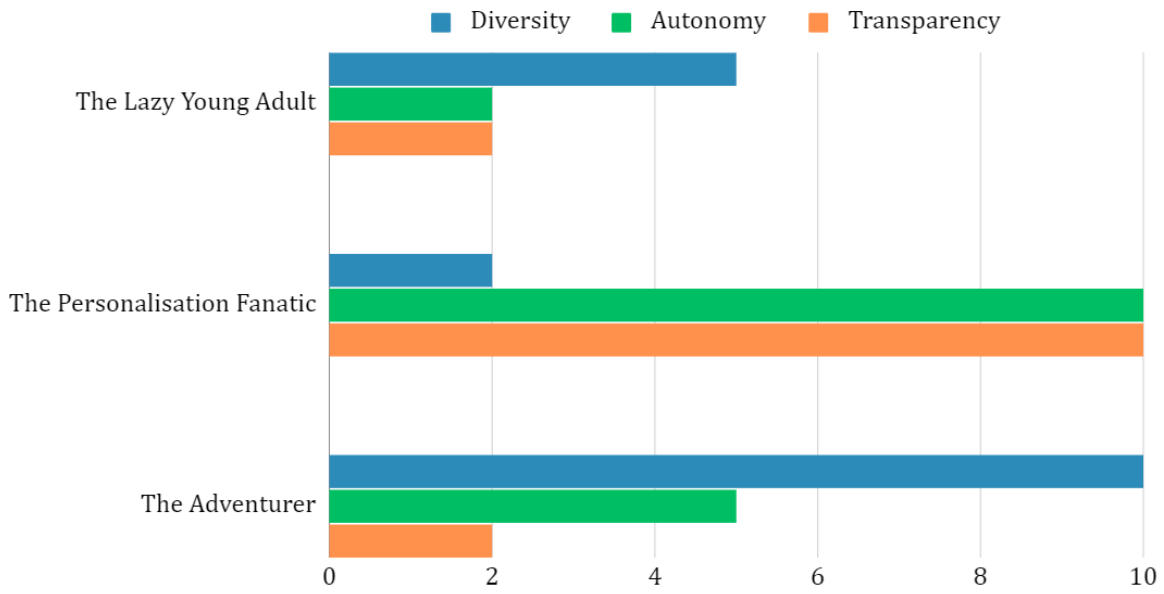

Figure A1: Importance of the values per persona: a comparison of diversity, autonomy, and transparency. The importance of these values were determined by the open coding process results, presented in Table B1 (Appendix B, Section 7.2).

The *Lazy Young Adult* has a somewhat indifferent attitude towards diversity, hence their stance is neutral. The *Lazy Young Adult* is disagreeable with autonomy and transparency to a certain extent, as they do not want to spend time on, e.g., personal settings, and evaluating why a particular item was recommended to them.

The *Personalisation Fanatic* is strongly agreeable with autonomy and transparency, as they want as much control over their recommendations as possible. This also makes them disagreeable with diversity, as this eliminates some of that control.

The *Adventurer* strongly agrees with diversity in recommender systems as they want to explore as many different kinds of content as possible. This characteristic makes them disagreeable with transparency to a certain extent, because they find it unnecessary for a system to provide them with unnecessary information on why particular recommendations were made for them, as they are naturally explorative and open-minded towards new content. An overview of the importance of the values for each persona is presented in Figure A1.

In the axial coding process, in-depth analysis was conducted on the information provided by the respondents. The results from the axial coding process were used to give the personas more details and to provide more context as to why they show (dis)agreeableness with particular values.

Based on these two processes, three personas were identified and given details in terms of their (dis)likes and interactions with a recommender system, which are described below.

The personas have been given favorite genres and title types. These are based on the clustering results of the fictional user data, presented in Appendix G (Section 7.7).

Persona 1: the Lazy Young Adult

Figure A2: Image and generic information of the *Lazy Young Adult* persona who is young, motivated and has a sufficient amount of time to watch series and films.

Eileen, 23
The Lazy Young Adult

Married No
Children No
Age group 18-34
Education Chemical Engineering (BSc)
Occupation High school chemistry teacher
Location Amsterdam, the Netherlands

Favorite genre(s)
Lifestyle, documentary, arts & culture, drama

Favorite title type(s)
News, movies and tv (series)

Keywords
Laid-back, optimistic, flexible, spontaneous, motivated.

Table A1: Detailed description of the *Lazy Young Adult* persona's personality traits, biography, frustrations, goals, motivations and current interactions with their (smart) TV and/or computer.

Bio As soon as Eileen finished her bachelor's degree in chemical engineering, she got her teaching license so she could start teaching chemistry to high school students. Eileen is motivated to do well at her job, but she also wants to make sure she does not get burned out by spending some of her free time on watching series and films to relax.	**Personality** • 70% extroverted - 30% introverted; • 45% analytical - 55% creative; • 25% thinking - 75% feeling; • 15% intuition - 85% sensing.
Goals & Needs • At least 5 years of experience as a high school teacher. • To be able to spend at least 1 weekend	**Frustrations** It frustrates her that she cannot always watch her favorite series and films on the streaming platform, especially considering that streaming

evening/night on watching good **movies/series** with friends or family. • To be able to explore new genres. • To keep up with the **news** daily. • To be able to relax each evening after work, probably by watching **(tv) series** and **films** about different **lifestyles**.	platforms frequently rotate the content. She also finds it frustrating -at times- that the platform does not offer the option to watch all seasons of a particular series, but rather delivers a portion of the seasons at a time (and rotates what seasons are available).
Motivations She is motivated to maintain her mental wellbeing, especially considering she has been prone to stress and burnout (during her student years). Currently she is successful in achieving her goals regarding relaxation, because her teaching job is not too demanding. However, she is not sure whether she can keep this up if her internal motivation towards relaxation decreases over time when she furthers her career or switches careers.	**Interactions** Since she started working as a teacher, it has been easier for her to relax in her free time as she has less deadlines and stressful activities compared to when she was a student. Therefore, she got a subscription to Netflix, and she has added several other streaming platform subscriptions over time. Currently, she has a subscription to Netflix, Amazon Prime Video and Disney+. She tends to use these streaming platforms the most after dinner.

Persona 2: the Adventurer

Figure A3: Image and generic information of the *Adventurer* persona who has a tendency to be quite hard-working and is open to new experiences.

Guinevere, 27

The Adventurer

Married	Yes
Children	No
Age group	18-34
Education	Experimental Physics (MSc)
Occupation	Mechanical engineer at ASML
Location	Utrecht, the Netherlands

Favorite genre(s)
Lifestyle, documentary, arts & culture, drama

Favorite title type(s)
News, movies and tv (series)

Keywords
Open-minded, hard-working, problem solver, precise, inventive.

Table A2: Detailed description of the *Adventurer* persona, including their personality traits, biography, frustrations, goals, motivations and current interactions with their (smart) TV and/or computer.

Bio Guinevere is a mechanical engineer at ASML, a high-tech company that supplies semiconductors. As a highly successful engineer who has to keep up with upcoming	**Personality** • 65% introverted - 35% extroverted; • 95% analytical - 5% creative; • 75% thinking - 25% feeling; • 35% intuition - 65% sensing.

technologies, she is very interested in **news items**, but she often finds herself ruminating and overthinking stuff even after she gets home from work. In order to help her relax, she tries to watch at least 1 episode of a show she is watching at that time. However, sometimes she is perfectionistic to the point that she does not take any time off at home.	
Goals & Needs • To watch at least 1 episode of a **tv (series)** after work. • To increase her relaxation time outside of her official working hours. • To get at least 7 hours of sleep every single night. •	**Frustrations** It frustrates her sometimes that the recommendations from Netflix and similar platforms seem to be a bit simple and too straightforward. For example, each time she watches a particular show, she tends to receive recommendations of a similar genre. However, she would be more interested in exploring all different kinds of genres.
Motivations When she was a teenager, she used to watch a little bit of tv over the weekends, but mostly preferred to spend her free time on sports, reading books, and hanging out with friends. Therefore, she does not have a huge interest in tv series and films. The main reason she has a subscription for Netflix is out of necessity (e.g. Netflix provides a wide variety of content that regular tv broadcasters do not provide). Due to this potential lack of internal motivation to watch Netflix and perfectionistic tendencies for her job, she tends to dislike spending lots of her time on watching content.	**Interactions** She does not visit the websites of the streaming platforms during the day when she's at work. However, she does frequently receive emails from the platforms, which she tends to read over her breaks (e.g. changed conditions regarding subscription; new contents added to the platform). She mostly looks at her emails on the mobile app on her smartphone. She rarely visits Netflix and similar platforms on her smartphone though, as she solely focuses on her job during her day. Besides, the mobile app does not provide as great an experience as a smart TV does.

Persona 3: the Personalisation Fanatic

Figure A4: Image and generic information of the *Personalisation Fanatic* persona who is middle-aged with little time and energy to spend his free time on hobbies and activities to relax, such as watching his favorite tv shows.

Lloyd, 37

The Personalisation Fanatic

Married Yes
Children Yes
Age group 34-49
Education European Law (LLM)
Occupation Consultant
Location Leiden, the Netherlands

Favorite genre(s)
Family, lifestyle, drama, kids/documentary[41]

Favorite title type(s)
Documentary, panel discussions and tv (series)

Keywords
Logical, critical, playful, responsible, curious.

Table A3: Detailed description of the *Personalisation Fanatic* persona's personality traits, biography, frustrations, goals, motivations and current interactions with his (smart) TV and/or computer.

Bio	**Personality**
After completing his Master of Laws (LLM) at Leiden University, Lloyd went on to work as a trainee lawyer at a Dutch law firm. After completing his training, he worked as a solicitor for several years before changing jobs: becoming a consultant at a tech company. During his full-time job as a solicitor, he met his current wife. They have 2 daughters who are 3 and 5 years old. Ever since his first daughter was born, Lloyd has had little energy and motivation to watch a lot of **tv** after getting home from work, as he is mostly focused on spending time with his family in his spare time, and taking care of the kids.	• 80% extroverted - 20% introverted; • 30% analytical - 70% creative; • 55% thinking - 45% feeling; • 65% intuition - 35% sensing.

[41] Genres *kids* and *documentary* have a shared 4th place according to Figure G2 in Appendix G (Section 7.7). Note that in this case, documentary was treated both as a title type and a genre.

Goals & Needs • Rather than watching **tv shows and films** alone, he wants to watch this with his family. • In his alone time, he likes to keep up to date with the world by watching **documentaries** and **panel discussions**. • To be able to watch all different kinds of content, so that there are (**family-friendly**) options, as well as content he can watch on his own or with his wife (e.g. **drama** and **lifestyle**) after the kids have gone to bed.	**Frustrations** It frustrates him that he is stuck in this vicious cycle in which he takes up enough motivation to watch the type of **tv series** and **films** he has always wanted to watch, but soon loses this motivation due to several reasons (i.e. not being able to watch multiple episodes in a row due to the possibility to be interrupted by his children).
Motivations He feels motivated to stay healthy (both physically and mentally) and energized for his family. He wants to have energy so that he can spend quality time with his children, but most importantly, so that he can actually fully enjoy his time with his kids when they are still young. However, his motivation levels to spend time on the hobbies and things he enjoys fluctuate quite a lot. His motivation levels also fluctuate due to his inner-critic (he does not always feel justified to spend his free time on himself).	**Interactions** For his 33th birthday, his wife got him a subscription to another streaming platform called Disney+ (besides Netflix) for a year, as she had noticed that he wanted to watch some shows that were not available on Netflix as these shows were Disney+ originals. Although these subscriptions give Lloyd motivation to explore new content from time to time, the motivation is never long-lasting, especially since he is not always able to finish the shows before they are being removed from the platform again. Once in a blue moon, he will watch several episodes of a show in a week.

7.2 Appendix B: Interviews

Clarification with Interview Questions

In English:
* I use Netflix as an example in most questions, but other streaming platforms are applicable as well, such as Amazon Prime Video, Disney+, etc.

For each question, we would like to hear why you have a particular opinion on the matter. We would also like to hear any (other) suggestions you may have with regards to the design and functionality of recommender systems. For example, feel free to let us know if you would like to have a particular functionality when using a recommender system.

In Dutch:
*Ik gebruik Netflix als voorbeeld in de meeste vragen, maar je kan ook denken aan platformen zoals Amazon Prime Video, Disney+, etc.

Bij elke vraag horen we graag waarom je bepaalde mening hebt, en we horen het ook graag als je (andere type) suggesties hebt voor wat jij terug zou willen zien in een recommender systeem!

Interview Questions

Questions in English:

- Question 1: What would be your response to a streaming platform, like Netflix, taking more initiative in aiming to suggest more diverse content on your feed? Think of Netflix recommending content from a particular genre you don't normally watch.
- Question 2: If Netflix were to provide more diverse content, in what ways would you like Netflix to do so? E.g. should they be more transparent in what they do; should they be clear as to what recommendations are based on 'diversity'?
- Question 3: In what ways would you like to provide Netflix with context and feedback on the kind of shows that you like? E.g. would you prefer to have personal settings and control over your recommendations, or would you like Netflix to 'deduct' your preferences by itself?

Questions in Dutch:

- Vraag 1: Wat zou je ervan vinden als een streaming platform zoals Netflix meer eigen initiatief zou nemen om diversere content aan te raden? Denk aan bijvoorbeeld shows en films die normaliter niet binnen de genres vallen die je normaliter kijkt?
- Vraag 2: Mocht een platform als Netflix dit initiatief nemen om diversere content aan te raden (zonder dat je daar meteen om gevraagd hebt), op welke manieren zou je willen dat Netflix dat doet? Bijvoorbeeld, vind je dat Netflix hier transparant in moet zijn en moet aangeven welke shows/films aangeraden zijn gebaseerd op dit 'diversiteits-principe' of is dat niet nodig?
- Vraag 3: Op welke manier zou jij willen dat Netflix zijn recommendations baseert? Bijvoorbeeld, zou jij willen dat Netflix dat baseert op jouw interacties met het systeem of zou je liever zelf willen aangeven wat jouw voorkeuren zijn?

Color Coding Scheme

Table B1: Overview of the used labels during the open coding (color coding) process, including how many times each label was mentioned among all participants.

Color	Label	# mentions	Related persona
Yellow	Agreeable with transparency	16	Personalisation Fanatic
Light green	Disagreeable with transparency	6	Adventurer, Lazy Young Adult
Light purple	Nuanced opinion on transparency	1	*NA*[42]
Light pink	Agreeable with autonomy (e.g. personal settings)	10	Personalisation Fanatic
Neon blue	Disagreeable with autonomy (e.g. personal settings)	4	Lazy Young Adult
Neon orange	Nuanced opinion on autonomy (e.g. personal settings)	8	Adventurer
Light red	Agreeable with diversity	12	Adventurer

[42] The *nuanced opinion on transparency* did not have enough votes to be of interest for the construction of the personas.

Light blue	Disagreeable with diversity	3	Personalisation Fanatic
Light orange	Nuanced opinion on diversity	7	Lazy Young Adult
Neon pink	Suggestions regarding ratings	4	Personalisation Fanatic

Results Open Coding

P1

Antwoord vraag 1: Lijkt me wel goed, maar dan zou ik dat wel graag willen zien als een aparte sectie, en niet gemengd met genres die ik al kijk.

Antwoord vraag 2: zoals mijn antwoord bij 1: ja graag expliciet weergeven, voor het bedrijf zou het echter effectiever zijn om het te mengen.

Antwoord vraag 3: ik zou een mix willen van vragen stellen aan de gebruiker en ook gebruiken naar wat voor shows/films ik kijk. maar zou bij een recommendation wel willen zien WAAROM dit aan mij wordt gerecommend, zie bijvoorbeeld steams manier van recommendations

P2

Antwoord vraag 1: Ik zou het wel leuk vinden omdat je op die manier nieuwe series/films kan ontdekken die je anders nooit een kans had gegeven. Ik vind wel dat ze dit dan in een aparte sectie moeten zetten, dus niet bij de andere recommendations die gebaseerd zijn op overeenkomsten in genres/thema's

Antwoord vraag 2: Ja, zoals ik bij vraag 1 aangaf, vind ik wel dat ze dit duidelijk apart moeten zetten van de andere recommendations zodat je weet waarop het gebaseerd is.

Antwoord vraag 3: Ik zou denk ik een combinatie van beide doen. Over het algemeen zou ik zeggen dat de recommendations sectie op streaming platformen door het platform zelf moeten worden gemaakt op basis van mijn interacties, maar daarnaast zou het bijvoorbeeld handig zijn als je zelf kan zoeken op voorkeuren (deze staan dan zegmaar niet op de homepagina als 'recommended' maar dat je zelf kan zoeken op genre/thema)

P3

Antwoord vraag 1: Ik vind het fijner om aanbevelingen te krijgen aan de hand van genre. Voornamelijk omdat ik bepaalde genres heb die ik helemaal niks vind, dus die hoeven ook niet aanbevolen te worden.

Antwoord vraag 2: Het beste vind ik eigenlijk zoals ze het nu al doen; gebaseerd op shows die je hebt gekeken/geliked hebt, en aangeven door welke show/film die ik gezien ze een show/film aanraden.

Antwoord vraag 3: Het lijkt mij wel wat als je op je profiel zelf kan aangeven welke genre's je wel en niet leuk vind. Daarnaast lijkt het mij ook handig als je warning labels kan selecteren die je niet wil zien ipv alleen een kids profiel (als je snapt wat ik bedoel).

P4

Antwoord vraag 1: Ik denk dat het wel goed is als Netflix ook dingen laat zien die niet gelijk heel erg lijken op wat je normaliter kijkt, omdat je dan ook dingen kunt ontdekken die je wel leuk vindt maar waarvan je niet wist dat het bestond.

Antwoord vraag 2: Ik denk wel dat het goed is om het onder een apart kopje te zetten, iets van 'probeer iets nieuws' oid, niet gelijk zo van je moet diversiteit maar meer van hé dit is iets anders maar misschien

vind je het ook interessant. Maar ik zou het wel apart willen hebben omdat het anders misschien wat gek is, ik bedoel als je nooit iets kijkt van een bepaald genre en opeens wordt dat voorgesteld dan lijkt dat misschien wat gek, maar als aangegeven wordt dat het iets nieuws is weet je in ieder geval dat intentioneel iets wordt voorgesteld wat je nog niet kent. Dan zou je ook als je iets nieuws zoekt om te kijken specifiek onder dat kopje kunnen kijken om te kijken of je iets nieuws kunt ontdekken wat je leuk lijkt.

Antwoord vraag 3: Ik zou het wel chill vinden als Netflix zelf gewoon op basis van mijn interacties recommendations baseert, dan hoef ik niet heel veel te doen en kan ik het gewoon gebruiken zonder dat ik constant dingen moet raten oid. Ik zou wel de optie willen om aan te geven dat ik iets specifiek wel of vooral niet leuk vind, en dan als ik aangeef dat ik iets niet leuk vind dat dat dan wordt meegenomen in de recommendations. Ik denk dat het vooral fijn is als je de optie hebt om aan te geven wat je niet leuk vind zodat je niet constant hetzelfde in je recommendations krijgt terwijl je dat niet leuk vindt.

P5

Antwoord vraag 1: ik heb het idee dat dit al zo is, maar het zou mij niet zo veel uitmaken omdat ik zelf al redelijk selectief ben. Ik klik niet zomaar wat aan maar zoek meer een bepaalde serie en die kijk ik dan (ik kijk heel weinig netflix - idem voor andere streamingdiensten)

Antwoord vraag 2: ja ik ben 100% voor transparantie mbt aanbevelingen

Antwoord vraag 3: zelf want bij mij klopt er geen hond van de 'misschien vind je dit leuk's 😟

P6

Antwoord vraag 1: Dat zou ik prima vinden. Zo kom je films of series tegen die je anders nooit gezien zou hebben.

Antwoord vraag 2: Ja er wel transparant over zijn. Bijvoorbeeld zo'n eigen rij op de homepage waar staat 'misschien wat anders'. Ook wel duidelijk aangeven om welke genre het gaat want ik heb geen zin om zomaar een horror film te kijken. Ook aangeven wat de kijkwijzers zijn en op een kids account wel bij de kinderfilms blijven. Je wilt natuurlijk niet dat daar iets fout gaat als ouders even niet opletten.

Antwoord vraag 3: Voor gewoon normale recommendations vind ik het prima als dat gebaseerd wordt op wat ik al gekeken heb maar misschien zou het wel handig zijn om aan de kunnen geven welke genres je vooral niet wilt. Er zijn zoveel films dat je soms gewoon niet meer weet wat je wilt kijken. Films weghalen die je zeker niet gaat kijken zal helpen. Ook niet films/series voorstellen die ik al gezien heb. Het maakt mij niet uit dat die nu populair is, ik heb het al gezien.

P7

Antwoord vraag 1: ik heb ffkes nagedacht hoort, en ik denk dat ik het wel prima vind als Netflixt of andere streamingsdiensten diversere shows of films zouden aanbevelen

Antwoord vraag 2: gewoon als soort subkopje of variant op "Omdat je _[X] ook hebt gekeken…"_ right. in de zin van een soortvan "Misschien tijd voor iets anders?"

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Antwoord vraag 1: Ik vind het wel leuk als Netflix me dingen zou aanraden die ik normaliter nooit zou kijken. Dan is het een positieve verrassing als het leuk blijkt te zijn! Ik zou dan benieuwd zijn waarom ze bepaalde dingen aanraden.

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P9

Antwoord vraag 1: Ik kan me hier eigenlijk niet zo veel bij inbeelden omdat ik eigenlijk al heel veel verschillende genres kijk, zeker agz netflix veel biedt. Het is echter wel leuk hier en daar een aanrader te krijgen die buiten je normale genres en onderwerpen valt.

Antwoord vraag 2: Het zou denk ik fijn zijn een los kopje hier voor te hebben, dus echt specifiek "Ontdek / Andere genres" oid. Als dit niet helemaal weg verstopt zit zou dit waarschijnlijk het fijnst zijn.

Antwoord vraag 3: Handmatig voorkeuren invoeren vind ik nooit zo fijn, liever heb ik iets zoals het huidige systeem, waarbij je kijk interacties en gedrag, zoals opslaan in lijsten of bekijken van serie beschrijvingen, en natuurlijk kijktijd en waardering van wat je hebt gezien, gebruikt wordt om aanraders te vinden.

P10

Antwoord transcribed van audio recording vraag 1: Ik zou het goed vinden als Netflix eigen initiatief zou nemen als ze diversere content zouden aanbieden, maar dan het liefst wel dat de content terug te linken is aan de onderwerpen die ik interessant vind. Ik kijk bijvoorbeeld zelf nooit een science-fiction film, maar ik vind docu's wel leuk, dus als in een docu iets naar boven komt dat ik innovatie leuk vind -of iets met de natuur- dan zou ik het wel oke vinden als ik een science-fiction aangeboden zou krijgen die te maken hebben daarmee [natuur en innovatie]. Maar dan zou ik niet een random science-fiction film willen omdat ik dat genre gewoon niet leuk vind. Dus diversiteit maar wel gelinkt aan bepaalde interesse [van me].

Antwoord transcribed van audio recording vraag 2: Nee, ik zou niet per se verwachten van Netflix dat ze aan mij vermelden, want ik weet momenteel ook niet helemaal waarop ze mij dingen aanraden. Ik denk dat je mensen daar ook niet heel veel op hoeft te informeren. Ik zou het goed vinden als de content wat diverser is, maar niet per se waarom.

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P11

Antwoord vraag 1: mogen ze doen, maar meestal kijk ik wat ik aangeraden krijg van de mensen om me heen en niet van wat netflix me aanraad. Als ik wel zou kijken naar wat aangeboden wordt zou ik het wel fijn vinden als dit niet binnen 1 genre blijft, omdat ik het prettig vind om afwisseling te hebben en niet altijd soortgelijke films en series te kijken

Antwoord vraag 2: ik denk dat het goed is om de optie te hebben om het uit te schakelen, daarnaast werkt bijvoorbeeld de top10 van de dag die netflix heeft ook al een beetje om andere dingen aan te raden. Verder hoeft er wat mij betreft niet expliciet bij te staan dat het vanuit het diversiteits principe komt.

Antwoord vraag 3: wat mij betreft op basis van interactie, want dat scheelt moeite ;). Maar zelf voorkeuren aan kunnen geven is ook prettig, voor het geval je iets anders wilt of net nieuw bent en er dus nog geen voorkeur op basis van interactie mogelijk is.

P12

Antwoord vraag 1: Ik zou het interessant vinden om ook dingen te krijgen die buiten mijn patroon vallen. Echter zouden deze dingen wel enigszins moeten aansluiten bij iets wat ik leuk zou kunnen vinden. Daarnaast zijn nieuwe suggesties welkom als het maar niet ten koste gaat van de standaard aanbevelingen.

Antwoord vraag 2: Voor mij is het niet nodig om iets aan te geven. Mocht de verandering zo groot zijn dat je normale aanbevelingen wegvallen zou het handig zijn dit te laten weten bv door een mail en ook met informatie hoe je het platform nog normaal kan gebruiken voor het geval je normale aanbevelingen wilt.

Antwoord vraag 3: Ik denk dat interactie voldoende is. Ik heb geen zin om iedere keer een voorkeur door te geven. Een of twee keer per jaar zou kunnen maar niet meer dan dat. Het zou bv wel handig kunnen zijn dat je je eigen smaak profiel zou kunnen vinden en bv iets kan verwijderen als je daar geen interesse meer in hebt. Een voorbeeld Spaanse series of bv superhelden

P13

Antwoord vraag 1: Ik zou het niet erg vinden, echter de kans dat ik het ga kijken is klein aangezien het genres zijn wat mij minder raken of aanspreken

Antwoord vraag 2: Geen idee wat diversiteits principe is. Like elk programma raad je shit aan en licht je daar niet over in, waarom zou Netflix dat wel moeten? Ik word dagelijks volgegooid met reclames met wat ik eventueel leuk kan vinden, ook ongevraagd right?

Antwoord vraag 3: Combinatie van beide, wat geef ik aan qua interesses gecombineerd met wat ik daadwerkelijk kijk

P14

Antwoord vraag 1: Ligt er aan hoe dicht ze bij mijn gebruikelijke genre zitten, als ik bijv horror kijk zou ik thriller genre mischien ook wel leuk vinden maar romantische comedy dan weer niet

Antwoord vraag 2: Ik zou een extra categorie toevoegen of een random pick knop waarbij iets buiten de comfortzone wordt aangeraden

Antwoord vraag 3: Ik zou het aan de hand van voorkeur in combinatie met mijn huidige mood, bijv dat je een aantal genres kan aanklikken en hierbinnen een voorstel wordt gedaan. Of dat er aan de hand van wat andere mensen met een soortgelijk profiel kijken leuk vonden buiten hun comfortzone

P15

Antwoord vraag 1: Als het goed is doen ze dat al. Ze verzamelen op basis van je kijkgeschiedenis wat jouw mogelijk interessant kan lijken

Antwoord vraag 2: Als je deze vraag echt doelgericht stelt om diversiteit dan vind ik dat dit niet hoeft, waarom? We zijn allemaal gelijk, iedereen hoort dezelfde behandeling te krijgen. Als je onderscheid gaat maken, dan kan het zo zijn in de toekomst dat mensen zich minderwaardig gaan voelen omdat ze net wat anders worden behandeld. Daarnaast niet iedereen is pro diversiteit, zo jaag je misschien zelfs trouwe klanten weg die helemaal niet in de diversiteit-principe zijn

Antwoord vraag 3: Niet, als ik met de oog van een IT-ernaar kijk dan ben ik gratis data aan het weggeven. Dit soort data levert Facebook (die het trouwens illegaal doorverkoopt) miljarden euro's op. Dus als ik nu een keuze vaak uit de vragen hierboven dan accepteer ik dat ik een dief ben van mijn eigen zak.

P16

Antwoord vraag 1: Dat vind ik prima. Eigenlijk zelfs beter. Anders raak je gekokerd in je waarneming en dus ook in je denken en hoe gediferencieerde het aanbod is des te breder je blik kan worden.

Antwoord vraag 2: Nee, maar ik hoop wel dat ze het gestructureerd aanbieden. Dus per genre en leeftijdsgroep.

Antwoord vraag 3: Ik geef liever aan wat mijn voorkeuren zijn.

P17

Antwoord vraag 1: Ik zou het ergens wel prettig vinden maar dan wel in de vorm van een aparte categorie. Dan krijg ik nog steeds aanbevolen wat ik normaliter zou kijken en heb ik ook de optie om af en toe compleet nieuwe dingen te bekijken.

Antwoord vraag 2: Ik zou het prettig vinden als het in de vorm van een aparte categorie zou komen. Dat je tussen de categorieën: verder kijken, aanbevolen enzovoort ook een categorie hebt nieuwe diverse content.

Antwoord vraag 3: Een combinatie van zou prettig zijn echter denk ik wel dat wanneer je zelf je voorkeuren aangeeft het willekeurige aspect verdwijnt.

P18

Antwoord vraag 1: Prima, dan kan je ook andere input geven. Soms denk je ook goh ik wil niet altijd één van mijn voorkeuren en kunnen zich ook andere interessante films zich voordoen. Kan misschien leiden tot verbreiding interessegebied of verassende films.

Antwoord vraag 2: Ik kan me wel voorstellen een sectie van “wellicht ook interessant voor u buiten uw interessegebied/voorkeursinteresse”. Dan weet je oke dan bieden ze dat extra aan, maar hoef je er niet naar te kijken als je gewoon je gebruikelijke interesses wilt. Stel dat het een film is die 50% van de mensen die film heeft gekeken en ook heeft afgekeken dan wil ik dat wel weten dat het een goede film is. Dan mag dat wel bij mij in een aparte sectie voorkomen.

Antwoord vraag 3: Ik kan me voorstellen dat het een en-en situatie. Dat je dat zelf kan ingeven maar dat netflix dat ook doet op basis van je kijkgedrag.

Findings

Table B2: Overview of the findings identified from the interviews with the axial coding process, including what color was used for the corresponding finding/suggestion, and how many times the corresponding suggestion was made.

# mentions	Suggestion / finding
5	***The recommender system should use a mix of both implicit and explicit feedback mechanisms to determine their recommendations.***
2	***Option to allow users to see what others are watching so that they can base their choices on others.***
12	***Option to have an overview of recommendations based on the type of recommendation and/or recommendation 'type' signifiers per title.*** Such as, having recommendations based on diversity separate from regular recommendations and/or personal settings. This way, it is also clearer what the recommendations are based on. ● E.g. placing diverse titles under headers like *'try something new'*.
6	***Option to have an overview of recommendations based on particular categories (genres) and/or viewing guide signifiers per title.*** For example, a clarification or signifier that particular content is specifically interesting for particular age groups. Also, for a recommendation based on a diversity algorithm, it would be beneficial for the user to see in the blink of an eye what genre the title falls into, so that the user can prevent watching genres they really do not want to watch (e.g. horror). ● It was also mentioned that it might be interesting to specify what percentage of users tend to 'finish' a title, as this may provide an indication into the quality of the title.
2	A company/organization may not benefit much from providing transparency into how their recommender system works.
1	***Some accounts may need restrictions / limits on the level of possible diversity.*** For example, an account for small kids should not be allowed to recommend horror and shows with violence, thus enforcing a restriction on the exposure diversity.
5	Some users may like diversity, but prefer having the recommender system provide extra explicit reasoning for recommending something different. ● E.g. Why would this title be relevant for the user despite being somewhat different from what they normally watch? ● It was also suggested that it would be beneficial to send the user an email in case the diverse recommendations start outnumbering the regular ones.
3	***Option to allow users to set the level of diversity.*** For example, some users are quite picky in what they want to watch, so providing more diverse content (partially) independent of a user's preferences may be undesirable for the user. ● Moreover, some users may prefer more variation in their recommendations, and a touch of diversity could help. ● Additionally, some users may want to turn off the diversity

		mechanism entirely (temporarily).
5		***Provide users with the option to indicate whether or not they like or dislike a (particular) title***, so that recommendations can be based on the likings, but also so that the system knows what title(s) categories to ignore or disregard in the future. Users may want to clarify what particular titles they dislike, without exceptions. For example, some users may always want to avoid the American tv series *Friends*, as not everyone likes that type of humor. ● It was also suggested that it might be nice to have default 'taste' profiles, so that a user does not have to search for titles by themselves. It would then also need to be possible to titles from the profile so that the user gets a 'personalized' profile anyway.
5		***Would be beneficial if the recommender system could infer the user's preferences without explicit feedback.***
4		***Option to allow users to easily filter on genres, current mood, title types, and more in the homescreen.***
5		***Option to indicate both likes and dislikes (e.g. in personal settings).*** Users may want to clarify what their dislikes are, without exceptions. For example, some users may always want to avoid horror, as that is quite a unique genre that not everyone likes. ● One user suggested placing *'warning labels'* on titles with a genre that the user has clarified they want to avoid.
1		***Ask questions to the user to deduct their preferences and tastes, or directly ask users what their preferences are (such as genre).*** This may be more efficient and easier than having users update their personal settings.
1		***Option to allow users to 'save' lists of content (Netflix has this functionality as well).***

Results Axial Coding

P1

Antwoord vraag 1: Lijkt me wel goed, maar dan zou ik dat wel graag willen zien als een aparte sectie, en niet gemengd met genres die ik al kijk.

Antwoord vraag 2: zoals mijn antwoord bij 1: ja graag expliciet weergeven, voor het bedrijf zou het echter effectiever zijn om het te mengen.

Antwoord vraag 3: ik zou een mix willen van vragen stellen aan de gebruiker en ook gebruiken naar wat voor shows/films ik kijk. maar zou bij een recommendation wel willen zien WAAROM dit aan mij wordt gerecommend, zie bijvoorbeeld steams manier van recommendations

P2

Antwoord vraag 1: Ik zou het wel leuk vinden omdat je op die manier nieuwe series/films kan ontdekken die je anders nooit een kans had gegeven. Ik vind wel dat ze dit dan in een aparte sectie moeten zetten, dus niet bij de andere recommendations die gebaseerd zijn op overeenkomsten in genres/thema's

Antwoord vraag 2: Ja, zoals ik bij vraag 1 aangaf, vind ik wel dat ze dit duidelijk apart moeten zetten van de andere recommendations zodat je weet waarop het gebaseerd is.

Antwoord vraag 3: Ik zou denk ik een combinatie van beide doen. Over het algemeen zou ik zeggen dat de recommendations sectie op streaming platformen door het platform zelf moeten worden gemaakt op basis van mijn interacties, maar daarnaast zou het bijvoorbeeld handig zijn als je zelf kan zoeken op voorkeuren (deze staan dan zegmaar niet op de homepagina als 'recommended' maar dat je zelf kan zoeken op genre/thema)

P3

Antwoord vraag 1: Ik vind het fijner om aanbevelingen te krijgen aan de hand van genre. Voornamelijk omdat ik bepaalde genre's heb die ik helemaal niks vind, dus die hoeven ook niet aanbevolen te worden.

Antwoord vraag 2: Het beste vind ik eigenlijk zoals ze het nu al doen; gebaseerd op shows die je hebt gekeken/geliked hebt, en aangeven door welke show/film die ik gezien ze een show/film aanraden.

Antwoord vraag 3: Het lijkt mij wel wat als je op je profiel zelf kan aangeven welke genre's je wel en niet leuk vind. Daarnaast lijkt het mij ook handig als je warning labels kan selecteren die je niet wil zien ipv alleen een kids profiel (als je snapt wat ik bedoel).

P4

Antwoord vraag 1: Ik denk dat het wel goed is als Netflix ook dingen laat zien die niet gelijk heel erg lijken op wat je normaliter kijkt, omdat je dan ook dingen kunt ontdekken die je wel leuk vindt maar waarvan je niet wist dat het bestond.

Antwoord vraag 2: Ik denk wel dat het goed is om het onder een apart kopje te zetten, iets van 'probeer iets nieuws' oid, niet gelijk zo van je moet diversiteit maar meer van hé dit is iets anders maar misschien vind je het ook interessant. Maar ik zou het wel apart willen hebben omdat het anders misschien wat gek is, ik bedoel als je nooit iets kijkt van een bepaald genre en opeens wordt dat voorgesteld dan lijkt dat misschien wat gek, maar als aangegeven wordt dat het iets nieuws is weet je in ieder geval dat intentioneel iets wordt voorgesteld wat je nog niet kent. Dan zou je ook als je iets nieuws zoekt om te kijken specifiek onder dat kopje kunnen kijken om te kijken of je iets nieuws kunt ontdekken wat je leuk lijkt.

Antwoord vraag 3: Ik zou het wel chill vinden als Netflix zelf gewoon op basis van mijn interacties recommendations baseert, dan hoef ik niet heel veel te doen en kan ik het gewoon gebruiken zonder dat ik constant dingen moet raten oid. Ik zou wel de optie willen om aan te geven dat ik iets specifiek wel of vooral niet leuk vind, en dan als ik aangeef dat ik iets niet leuk vind dat dat dan wordt meegenomen in de recommendations. Ik denk dat het vooral fijn is als je de optie hebt om aan te geven wat je niet leuk vind zodat je niet constant hetzelfde in je recommendations krijgt terwijl je dat niet leuk vindt.

P5

Antwoord vraag 1*:* ik heb het idee dat dit al zo is, maar het zou mij niet zo veel uitmaken omdat ik zelf al redelijk selectief ben. Ik klik niet zomaar wat aan maar zoek meer een bepaalde serie en die kijk ik dan (ik kijk heel weinig netflix - idem voor andere streamingdiensten)

Antwoord vraag 2*:* ja ik ben 100% voor transparantie mbt aanbevelingen

Antwoord vraag 3*:* zelf want bij mij klopt er geen hond van de 'misschien vind je dit leuk's 😟

P6

Antwoord vraag 1: Dat zou ik prima vinden. Zo kom je films of series tegen die je anders nooit gezien zou hebben.

Antwoord vraag 2: Ja er wel transparant over zijn. Bijvoorbeeld zo'n eigen rij op de homepage waar staat 'misschien wat anders'. Ook wel duidelijk aangeven om welke genre het gaat want ik heb geen zin om zomaar een horror film te kijken. Ook aangeven wat de kijkwijzers zijn en op een kids account wel bij de kinderfilms blijven. Je wilt natuurlijk niet dat daar iets fout gaat als ouders even niet opletten.

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P9

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Antwoord vraag 1: Ik zou het interessant vinden om ook dingen te krijgen die buiten mijn patroon vallen. Echter zouden deze dingen wel enigszins moeten aansluiten bij iets wat ik leuk zou kunnen vinden. Daarnaast zijn nieuwe suggesties welkom als het maar niet ten koste gaat van de standaard aanbevelingen.

Antwoord vraag 2: Voor mij is het niet nodig om iets aan te geven. Mocht de verandering zo groot zijn dat je normale aanbevelingen wegvallen zou het handig zijn dit te laten weten bv door een mail en ook met informatie hoe je het platform nog normaal kan gebruiken voor het geval je normale aanbevelingen wilt.

Antwoord vraag 3: Ik denk dat interactie voldoende is. Ik heb geen zin om iedere keer een voorkeur door te geven. Een of twee keer per jaar zou kunnen maar niet meer dan dat. Het zou bv wel handig kunnen zijn dat je je eigen smaak profiel zou kunnen vinden en bv iets kan verwijderen als je daar geen interesse meer in hebt. Een voorbeeld Spaanse series of bv superhelden

P13

Antwoord vraag 1: Ik zou het niet erg vinden, echter de kans dat ik het ga kijken is klein aangezien het genres zijn wat mij minder raken of aanspreken

Antwoord vraag 2: Geen idee wat diversiteits principe is. Like elk programma raad je shit aan en licht je daar niet over in, waarom zou Netflix dat wel moeten? Ik word dagelijks volgegooid met reclames met wat ik eventueel leuk kan vinden, ook ongevraagd right?

Antwoord vraag 3: Combinatie van beide, wat geef ik aan qua interesses gecombineerd met wat ik daadwerkelijk kijk

P14

Antwoord vraag 1: Ligt er aan hoe dicht ze bij mijn gebruikelijke genre zitten, als ik bijv horror kijk zou ik thriller genre mischien ook wel leuk vinden maar romantische comedy dan weer niet

Antwoord vraag 2: Ik zou een extra categorie toevoegen of een random pick knop waarbij iets buiten de comfortzone wordt aangeraden

Antwoord vraag 3: Ik zou het aan de hand van voorkeur in combinatie met mijn huidige mood, bijv dat je een aantal genres kan aanklikken en hierbinnen een voorstel wordt gedaan. Of dat er aan de hand van wat andere mensen met een soortgelijk profiel kijken leuk vonden buiten hun comfortzone

P15

Antwoord vraag 1: Als het goed is doen ze dat al. Ze verzamelen op basis van je kijkgeschiedenis wat jouw mogelijk interessant kan lijken

Antwoord vraag 2: Als je deze vraag echt doelgericht stelt om diversiteit dan vind ik dat dit niet hoeft, waarom? We zijn allemaal gelijk, iedereen hoort dezelfde behandeling te krijgen. Als je onderscheid gaat maken, dan kan het zo zijn in de toekomst dat mensen zich minderwaardig gaan voelen omdat ze net wat anders worden behandeld. Daarnaast niet iedereen is pro diversiteit, zo jaag je misschien zelfs trouwe klanten weg die helemaal niet in de diversiteit-principe zijn

Antwoord vraag 3: Niet, als ik met de oog van een IT-ernaar kijk dan ben ik gratis data aan het weggeven. Dit soort data levert Facebook (die het trouwens illegaal doorverkoopt) miljarden euro's op. Dus als ik nu een keuze vaak uit de vragen hierboven dan accepteer ik dat ik een dief ben van mijn eigen zak.

P16

Antwoord vraag 1: Dat vind ik prima. Eigenlijk zelfs beter. Anders raak je gekokerd in je waarneming en dus ook in je denken en hoe gediferencieerde het aanbod is des te breder je blik kan worden.

Antwoord vraag 2: Nee, maar ik hoop wel dat ze het gestructureerd aanbieden. Dus per genre en leeftijdsgroep.

Antwoord vraag 3: Ik geef liever aan wat mijn voorkeuren zijn.

P17

Antwoord vraag 1: Ik zou het ergens wel prettig vinden maar dan wel in de vorm van een aparte categorie. Dan krijg ik nog steeds aanbevolen wat ik normaliter zou kijken en heb ik ook de optie om af en toe compleet nieuwe dingen te bekijken.

Antwoord vraag 2: Ik zou het prettig vinden als het in de vorm van een aparte categorie zou komen. Dat je tussen de categorieën: verder kijken, aanbevolen enzovoort ook een categorie hebt nieuwe diverse content.

Antwoord vraag 3: Een combinatie van zou prettig zijn echter denk ik wel dat wanneer je zelf je voorkeuren aangeeft het willekeurige aspect verdwijnt.

P18

Antwoord vraag 1: Prima, dan kan je ook andere input geven. Soms denk je ook goh ik wil niet altijd één van mijn voorkeuren en kunnen zich ook andere interessante films zich voordoen. Kan misschien leiden tot verbreiding interessegebied of verassende films.

Antwoord vraag 2: Ik kan me wel voorstellen een sectie van "wellicht ook interessant voor u buiten uw interessegebied/voorkeursinteresse". Dan weet je oke dan bieden ze dat extra aan, maar hoef je er niet naar te kijken als je gewoon je gebruikelijke interesses wilt. Stel dat het een film is die 50% van de mensen die film heeft gekeken en ook heeft afgekeken dan wil ik dat wel weten dat het een goede film is. Dan mag dat wel bij mij in een aparte sectie voorkomen.

Antwoord vraag 3: Ik kan me voorstellen dat het een en-en situatie. Dat je dat zelf kan ingeven maar dat netflix dat ook doet op basis van je kijkgedrag.

7.3 Appendix C: Implementation

Implementation of Interview Findings

Table C1: Overview of the findings identified from the interviews with the axial coding process, including what color was used for the corresponding finding/suggestion, and to what extent the suggestion was implemented in the final prototype. Green indicates that the functionality is fully implemented, yellow indicates that the functionality is partially implemented.

Implemented	Suggestion / finding	
		The recommender system should use a mix of both implicit and explicit feedback mechanisms to determine their recommendations.
		Option to allow users to see what others are watching so that they can base their choices on others.
		Option to have an overview of recommendations based on the type of recommendation and/or recommendation 'type' signifiers per title. Such as, having recommendations based on diversity separate from regular recommendations and/or personal settings. This way, it is also clearer what the recommendations are based on. ● E.g. placing diverse titles under headers like *'try something new'*.
		Option to have an overview of recommendations based on particular categories (genres) and/or viewing guide signifiers per title. For example, a clarification or signifier that particular content is specifically

		interesting for particular age groups. Also, for a recommendation based on a diversity algorithm, it would be beneficial for the user to see in the blink of an eye what genre the title falls into, so that the user can prevent watching genres they really do not want to watch (e.g. horror). ● It was also mentioned that it might be interesting to specify what percentage of users tend to 'finish' a title, as this may provide an indication into the quality of the title.
NA		A company/organization may not benefit much from providing transparency into how their recommender system works.
		Some accounts may need restrictions / limits on the level of possible diversity. For example, an account for small kids should not be allowed to recommend horror and shows with violence, thus enforcing a restriction on the exposure diversity.
		Some users may like diversity, but prefer having the recommender system provide extra explicit reasoning for recommending something different. ● E.g. Why would this title be relevant for the user despite being somewhat different from what they normally watch? ● It was also suggested that it would be beneficial to send the user an email in case the diverse recommendations start outnumbering the regular ones.
		Option to allow users to set the level of diversity. For example, some users are quite picky in what they want to watch, so providing more diverse content (partially) independent of a user's preferences may be undesirable for the user. ● Moreover, some users may prefer more variation in their recommendations, and a touch of diversity could help. ● Additionally, some users may want to turn off the diversity mechanism entirely (temporarily).
		Provide users with the option to indicate whether or not they like or dislike a (particular) title, so that recommendations can be based on the likings, but also so that the system knows what title(s) categories to ignore or disregard in the future. Users may want to clarify what particular titles they dislike, without exceptions. For example, some users may always want to avoid the American tv series *Friends*, as not everyone likes that type of humor. ● It was also suggested that it might be nice to have default 'taste' profiles, so that a user does not have to search for titles by themselves. It would then also need to be possible to titles from the profile so that the user gets a 'personalized' profile anyway.
		Would be beneficial if the recommender system could infer the user's preferences without explicit feedback.
		Option to allow users to easily filter on genres, current mood, title types, and more in the homescreen.
		Option to indicate both likes and dislikes (e.g. in personal settings). Users may want to clarify what their dislikes are, without exceptions. For example, some users may always want to avoid horror, as that is quite a

		unique genre that not everyone likes. • One user suggested placing *'warning labels'* on titles with a genre that the user has clarified they want to avoid.
		Ask questions to the user to deduct their preferences and tastes, or directly ask users what their preferences are (such as genre). This may be more efficient and easier than having users update their personal settings.
		Option to allow users to 'save' lists of content (Netflix has this functionality as well).

7.4 Appendix D: User Data and Content Data

Content Data Screenshots

	category	title	series	episode_name	description	description2	tags	image	more	tags2	publication_date	rating	duration_sec
0	Arts	Bangar	Bangarra	Return to Count	Join the dan	In Yirrkala, No	['ABC TV	https://c	Director	['abc1', 'a	07/07/2021 22:00	G	626
1	Arts	Going (	Going Co	Series 1 Episode	Justine Clark	Justine Clarke	['ABC TV	https://c	Host Jus	['abc1', 'd	02/11/2021 20:30	PG	3244
2	Arts	Mission	Mission S	Surrare	Jessie Lloyd':	A song from th	['ABC TV	https://c	No mor	['abc1', 'd	07/11/2020 07:00	G	313
3	Arts	The Sto	The Story	Episode 5 Post-'	A worldwide	1939-1952 Th	['ABC TV	https://c	Host Ma	['abc1', 'a	11/06/2021 07:00	M	3728
4	Arts	Ballet I	No data	Ballet Now	This film cap	This film captu	['ABC TV	https://c	No mor	['abc2', 'd	30/06/2021 21:59	M	3555
5	Arts	The Sto	The Story	Episode 15 Cine	A worldwide	The 2000s Cin	['ABC TV	https://c	Host Ma	['abc1', 'a	11/06/2021 07:00	MA	3754
6	Arts	Julia Ze	Julia Zem	Series 7 Costa G	Julia Zemiro	Julia Zemiro tr	['ABC TV	https://c	Host Jul	['abc1', 'a	09/10/2019 20:31	PG	1677
7	Arts	Classic	Classic C	1986	Classic Coun	Countdown pr	['ABC TV	https://c	No mor	['abc1', 'a	09/01/2018 19:00	PG	3408
8	Arts	Julia Ze	Julia Zem	Series 3 Waleed	Julia Zemiro	Waleed Aly is	['ABC TV	https://c	Host Jul	['abc1', 'a	04/06/2021 07:00	G	1619
9	Arts	Julia Ze	Julia Zem	Series 6 Raelene	Julia Zemiro	Former track a	['ABC TV	https://c	Host Jul	['abc1', 'a	04/06/2021 07:00	PG	1655
10	Arts	Stan Gr	Stan Gra	Kodie Bedford	Stan Grant p	Kodie Bedford	['ABC TV	https://c	Host Sta	['abc1', 'n	18/01/2021 20:32	No data	1700
11	Arts	Anh's E	Anh's Bru	Series 6 Tara M	Anh Do paint	Best-selling au	['ABC TV	https://c	Host An	['abc1', 'a	30/06/2021 07:00	PG	1684
12	Arts	Classic	Classic C	1976	Classic Coun	Wilbur Wilde t	['ABC TV	https://c	No mor	['abc1', 'a	09/01/2018 19:00	PG	3424
13	Arts	Garder	Gardenin	Series 31 Episoc	Gardening Au	We meet a ga	['ABC TV	https://c	No mor	['abc1', 'a	12/02/2021 07:00	G	366
14	Arts	Freddie	No data	Freddie Mercury	The extraorc	The extraordir	['ABC TV	https://c	No mor	['abc1', 'd	15/03/2022 20:31	M	5377
15	Arts	Rewinc	Rewind	Series 4 Mick Ja	This archive-	In this tongue-	['ABC Af	https://c	No mor	['abcarts',	18/06/2019 02:00	No data	368
16	Arts	Compa	Compass	Series 33 Wome	Compass exp	Before womer	['ABC TV	https://c	Host Ge	['abc2', 'a	03/01/2020 17:00	G	1634
17	Arts	Compa	Compass	Series 32 Sacrec	Compass exp	Geraldine Doc	['ABC TV	https://c	Host Ge	['abc2', 'a	23/07/2021 17:00	G	1649
18	Arts	Garder	Gardenin	Series 31 Episoc	Gardening Au	We meet a ho	['ABC TV	https://c	No mor	['abc1', 'a	12/02/2021 07:00	G	372
19	Arts	Recove	Recovery	Vika and Linda E	On air from 1	Inductees to t	['ABC TV	https://c	No mor	['abc1', 'a	27/11/2019 22:08	G	248
20	Arts	Anh's E	Anh's Bru	Series 2 Rosie B	Anh Do paint	Rosie Batty ha	['ABC TV	https://c	Host An	['abc1', 'a	30/06/2021 07:00	PG	1700
21	Arts	Julia Ze	Julia Zem	Series 1 Shane J	Julia Zemiro	Julia takes act	['ABC TV	https://c	Host Jul	['abc1', 'a	04/06/2021 07:00	M	1727
22	Arts	Rewinc	Rewind	Series 4 Birth of	This archive-	Find out why M	['ABC Af	https://c	No mor	['abcarts',	08/10/2019 02:00	No data	2291
23	Arts	Rewinc	Rewind	Series 4 40 Year	This archive-	In August 1975	['ABC Af	https://c	No mor	['abcarts',	13/08/2019 02:00	No data	436
24	Arts	Anh's E	Anh's Bru	Series 1 Charlie	Anh Do paint	Anh Do has be	['ABC TV	https://c	Host An	['abc1', 'a	30/06/2021 07:00	M	1687
25	Arts	Shakes	Shakespe	Series 2 A Midsu	In this critica	Hugh Bonnevil	['ABC TV	https://c	No mor	['abc1', 'iv	23/07/2021 10:00	PG	3138

Figure D1: Example of what the content data looks like for file arts.csv.

	category	title	series	episode_name	description
0	Movies	The Way We We	No data found	The Way We Were	A love story that begins wi
1	Movies	Starman	No data found	Starman	An alien stranded on Earth
2	Movies	Mr Deeds Goes T	No data found	Mr Deeds Goes To T	A small-town poet inherits
3	Movies	On The Road	No data found	On The Road	Aspiring writer Sal Paradise
4	Movies	The Boys Are Bac	No data found	The Boys Are Back	Journalist Joe Warr and his
5	Movies	On A Clear Day	No data found	On A Clear Day	Frank determines to salvag
6	Movies	Secret Men's Bus	No data found	Secret Men's Busines	Four former private schoo
7	Movies	Another Year	No data found	Another Year	Follow happily-married co
8	Movies	Stand By Me	No data found	Stand By Me	After learning that a strang
9	Movies	The Sorcerer and	No data found	The Sorcerer and the	A master monk tries to pro
10	Movies	The Lost Aviator	No data found	The Lost Aviator	Set in the Golden Age of A
11	Movies	Trust The Man	No data found	Trust The Man	Two New York couples; a
12	Movies	A Raisin In The Su	No data found	A Raisin In The Sun	When a recently widowed
13	Movies	Little Fish	No data found	Little Fish	After a turbulent time in h
14	Movies	Triangle	No data found	Triangle	Yacht passengers encount
15	Movies	The Death And Li	No data found	The Death And Life C	The chronicle of the life ar
16	Movies	Splinter	No data found	Splinter	A young couple and an esc
17	Movies	On The Waterfro	No data found	On The Waterfront	Terry Malloy, an ex-prizefi
18	Movies	Oliver!	No data found	Oliver!	Young orphan, Oliver Twis
19	Movies	The Dinner	No data found	The Dinner	How far would you go to p
20	Movies	Five Easy Pieces	No data found	Five Easy Pieces	After rejecting his wealthy

Figure D2: Example of what the content data looks like for the columns 'category', 'title', 'series', 'episode_name' and 'description' from the movies.csv file.

description2
A love story that begins with the attraction of opposites, Katie and Hu
An alien stranded on Earth clones himself into the form of a young wo
A small-town poet inherits a vast fortune and finds himself in New Yo
Aspiring writer Sal Paradise has his world rocked following the introdu
Journalist Joe Warr and his two sons, from different marriages, find th
Frank determines to salvage his self-esteem and tackle his demons by
Four former private school boys' reunite to attend the funeral of their
Follow happily-married couple Tom and Gerri and their friends and fa
After learning that a stranger has been accidentally killed near their ru
A master monk tries to protect a naive young physician from a thousa
Set in the Golden Age of Aviation, Andrew Lancaster follows the life a
Two New York couples a successful actress, her househusband, her ne
When a recently widowed matriarch receives a large sum of money fr
After a turbulent time in her 20s, Tracy Heart is now trying to live the s
Yacht passengers encounter mysterious weather conditions that force

Figure D3: Example of what the content data looks like for the column 'description2' from the movies.csv file.

tags	image
['ABC TV', 'ABC TV Plus', 'DRAMA', 'MOVIES']	https://cdn.iview.abc.net.au/thumbs/i/zy/ZY9
['ABC TV', 'ABC TV Plus', 'DRAMA', 'MOVIES']	https://cdn.iview.abc.net.au/thumbs/i/zw/ZW
['ABC TV', 'ABC TV Plus', 'DRAMA', 'MOVIES']	https://cdn.iview.abc.net.au/thumbs/i/zw/ZW
['ABC TV', 'ABC TV Plus', 'DRAMA', 'MOVIES']	https://cdn.iview.abc.net.au/thumbs/i/zw/ZW
['ABC TV', 'ABC TV Plus', 'DRAMA', 'MOVIES']	https://cdn.iview.abc.net.au/thumbs/i/zw/ZW
['ABC TV', 'ABC TV Plus', 'DRAMA', 'MOVIES']	https://cdn.iview.abc.net.au/thumbs/i/zw/ZW
['ABC TV', 'DRAMA', 'COMEDY', 'MOVIES']	https://cdn.iview.abc.net.au/thumbs/i/dr/DR9
['ABC TV', 'ABC TV Plus', 'DRAMA', 'MOVIES']	https://cdn.iview.abc.net.au/thumbs/i/zw/ZW
['ABC TV', 'ABC TV Plus', 'DRAMA', 'MOVIES']	https://cdn.iview.abc.net.au/thumbs/i/zw/ZW
['ABC TV', 'ABC TV Plus', 'DRAMA', 'MOVIES']	https://cdn.iview.abc.net.au/thumbs/i/zw/ZW
['ABC TV', 'ABC TV Plus', 'DOCUMENTARY', 'MC	https://cdn.iview.abc.net.au/thumbs/i/zw/ZW
['ABC TV', 'ABC TV Plus', 'COMEDY', 'DRAMA', 'I	https://cdn.iview.abc.net.au/thumbs/i/zw/ZW
['ABC TV', 'ABC TV Plus', 'DRAMA', 'MOVIES']	https://cdn.iview.abc.net.au/thumbs/i/zw/ZW
['ABC TV', 'ABC TV Plus', 'DRAMA', 'MOVIES']	https://cdn.iview.abc.net.au/thumbs/i/zy/ZY9
['ABC TV', 'ABC TV Plus', 'DRAMA', 'MOVIES']	https://cdn.iview.abc.net.au/thumbs/i/zw/ZW
['ABC TV', 'DRAMA', 'MOVIES']	https://cdn.iview.abc.net.au/thumbs/i/zw/ZW
['ABC TV', 'ABC TV Plus', 'DRAMA', 'MOVIES']	https://cdn.iview.abc.net.au/thumbs/i/zw/ZW
['ABC TV', 'ABC TV Plus', 'DRAMA', 'MOVIES']	https://cdn.iview.abc.net.au/thumbs/i/zy/ZY9
['ABC TV', 'ABC TV Plus', 'DRAMA', 'MOVIES']	https://cdn.iview.abc.net.au/thumbs/i/zw/ZW

Figure D4: Example of what the content data looks like for the columns 'tags' and 'image' from the movies.csv file.

more	tags2
Director Sydney Pollack	['abc1', 'abc2', 'drama', 'classic', 'film', 'feature-length', 'ro
Director John Carpenter	['abc1', 'abc2', 'drama', 'sci-fi', 'fantasy', 'romance', 'love',
Cast Gary Cooper, Jean Arthur, Douglas Du	['abc1', 'abc2', 'drama', 'comedy-drama', 'film', 'feature-le
Director Walter Salles	['abc1', 'abc2', 'usa', 'drama', 'adaptation', 'adventure', 'ro
Director Scott Hicks	['abc1', 'abc2', 'drama', 'comedy-drama', 'film', 'single-par
Director Gaby Dellal	['abc1', 'abc2', 'uk', 'drama', '2000s', 'family', 'countryside',
Director Ken Cameron	['abc1', 'australia', 'drama', 'comedy', 'film', '1990s', 'sydne
Director Mike Leigh	['abc1', 'abc2', 'drama', 'comedy-drama', 'relationships', 'r
Director Rob Reiner	['abc1', 'abc2', 'drama', 'coming-of-age', 'film', 'feature-le
Director Siu-Tung Ching	['abc1', 'abc2', 'action', 'drama', 'fantasy', 'romance', 'film'
Director Andrew Lancaster	['abc1', 'abc2', 'docs', 'film', 'feature-length', 'australia', '1
Director Bart Freundlich	['abc1', 'abc2', 'comedy', 'drama', 'film', 'rom-com', 'love',
Director Daniel Petrie	['abc1', 'abc2', 'drama', 'film', 'feature-length', 'classic', 'en
Director Rowan Woods	['abc1', 'abc2', 'drama', 'film', 'feature-length', '2000s', 'rel
Director Christopher Smith	['abc1', 'abc2', 'drama', 'fantasy', 'sci-fi', 'thriller', 'horror',
Cast Xavier Samuel, Rachel Ward, Matilda E	['abc1', 'drama', 'film', 'fantasy', 'love', 'romance', 'coming
Director Toby Wilkins	['abc1', 'abc2', 'horror', 'sci-fi', 'thriller', 'drama', 'film', 'ed
Director Elia Kazan	['abc1', 'abc2', 'drama', 'crime-drama', 'film', 'feature-leng
Director Carol Reed	['abc1', 'abc2', 'drama', 'musical', 'period-drama', 'classic',
Director Oren Moverman	['abc1', 'drama', 'film', 'suspense', 'family-relationships', 'n
Director Bob Rafelson	['abc1', 'abc2', 'usa', 'americana', '1970s', 'film', 'family-dy

Figure D5: Example of what the content data looks like for the columns 'more' and tags2' from the movies.csv file.

publication_date	rating	duration_sec
25/06/2021 07:00	PG	6802
25/06/2021 07:00	PG	6612
25/06/2021 07:00	G	6649
01/06/2021 07:00	MA	8014
11/06/2021 07:00	M	5950
01/06/2021 07:00	PG	5649
25/06/2021 07:00	M	5768
01/06/2021 07:00	M	7426
01/07/2021 07:00	M	5092
01/06/2021 07:00	M	5876
01/06/2021 07:00	M	5410
01/06/2021 07:00	M	5711
25/06/2021 07:00	G	7352
01/06/2021 07:00	MA	6536
01/06/2021 07:00	MA	5662
01/12/2021 07:00	M	4777
01/06/2021 07:00	MA	4697

Figure D6: Example of what the content data looks like for the columns 'publication_date', 'rating' and 'duration_sec' from the movies.csv file.

User Data Screenshots

age	email	first_name	gender	genre	key	location	password
03/09/1996	xnikkikramer@h	Nikki	Female	['EDUCATION']	kramernikki	Amsterdam	020forlive
26/04/1994	rickert@hotmail.	Rick	Male	['DRAMA', 'DOCUMENTARY'	rickertjuh	Enschede	rickiscool3
31/12/1996	fien_keim@hotm	Josephine	Female	['FAMILY', 'EDUCATION', 'AR	yousofine	Amsterdam	idemdito23
24/01/1900	lisanne_lageweg	lisanne	Female	['REGIONAL AUSTRALIA', 'C	lisannel	Hengelo	lisannexoxo
04/05/2000	Sarah_123@gm	Sarah	Female	['KIDS', 'FAMILY', 'DRAMA']	Sarah_123	Amsterdam	Passw0rd!
18/12/1978	Alex_456@hotm	Alex	Male	['INDIGENOUS', 'DOCUMEN	Alex_456	Rotterdam	Al3x_456
03/08/1990	TomSmith789@l	Tom	Male	['EDUCATION', 'ARTS & CUL	TomSmith789	Utrecht	T0mSmith!
29/11/2004	EmilyBaker01@	Emily	Female	['PANEL & DISCUSSION', 'S	EmilyBaker01	Den Haag	3milyBaker
03/02/1996	JohnDoe1234@	John	Male	['DRAMA', 'DOCUMENTARY'	JohnDoe1234	Groningen	J0hnDoe1234
26/07/1986	JaneDoe5678@	Jane	Female	['COMEDY']	JaneDoe5678	Eindhoven	J@neDoe5678
15/06/1978	MichaelTaylor90	Michael	Male	['KIDS', 'FAMILY']	MichaelTaylor90	Amsterdam	Mich@elTaylor
05/11/1993	RachelGarcia23	Rachel	Female	['EDUCATION', 'DRAMA']	RachelGarcia23	Rotterdam	R@chelGarcia
25/10/1996	DavidJohnson56	David	Male	['ARTS & CULTURE', 'DOCUI	DavidJohnson56	Utrecht	D@vidJohnson
11/04/2000	JenniferBrown89	Jennifer	Female	['FAMILY']	JenniferBrown89	Apeldoorn	Jenn!ferBrown
06/03/1972	RobertDavis123	Robert	Male	['COMEDY', 'LIFESTYLE']	RobertDavis123	Groningen	R0bertD@vis
21/12/1990	JessicaMiller456	Jessica	Male	['DRAMA', 'ARTS & CULTURI	JessicaMiller456	Veghel	J3ssicaMiller
04/10/1997	DanielWilson789	Daniel	Male	['LIFESTYLE', 'DOCUMENTA	DanielWilson789	Amsterdam	D@nielWils0n
21/02/1975	ElizabethClark0	Elizabeth	Female	['SCIENCE', 'KIDS']	ElizabethClark0	Rotterdam	ElizabethC@rk
12/10/1985	MatthewThomas	Matthew	Male	['REGIONAL AUSTRALIA']	MatthewThomas	Uden	M@tthewTh0m@
01/04/1992	AmandaAllen567	Amanda	Female	['COMEDY', 'FAMILY', 'EDUC	AmandaAllen567	Den Haag	@m@nd@Allen
22/03/2003	ChristopherGree	Christopher	Male	['INDIGENOUS', 'DOCUMEN	ChristopherGree	Hengelo	ChristopherGree
19/05/1969	AshleyCampbell	Ashley	Female	['DRAMA', 'EDUCATION', 'AR	AshleyCampbell	Soest	AshleyC@m0be
18/10/1982	WilliamJackson4	William	Male	['PANEL & DISCUSSION', 'LI	WilliamJackson4	Nijmegen	Willi@mJ@cksо
04/01/1994	StephanieYoung	Stephanie	Female	['DRAMA', 'DOCUMENTARY'	StephanieYoung	Blaricum	Steph@nieY0un
03/08/1991	JamesLee234@	James	Male	['COMEDY']	JamesLee234	Amsterdam	Z2#jK9@x

Figure D7: Example of what the user data looks like for the columns 'age', 'email', 'first_name', 'gender', 'genre', 'key', 'location' and 'password' from the final_users.csv.

prefDate	rating	title_type	genre	top5
[2018, 2023]	['No preference']	['Movie', 'tv']	['EDUCATION']	["Kumi's Japan", 'Play School: Stop, Look, Listen', "Al
[2016, 2023]	['No preference']	['Movie', 'Documentar	['DRAMA', 'DOCUMENTARY', 'COME	["The Last Picture Show (Director's Cut)", 'Dot.', 'Burie
[2016, 2023]	['PG', 'M', 'MA']	['Documentary', 'Movi	['FAMILY', 'EDUCATION', 'ARTS & CU	["Kumi's Japan", 'Athleticus', 'Four Corners', 'Spartacu
[2016, 2023]	['No preference']	['Movie']	['REGIONAL AUSTRALIA', 'COMEDY	['The Art of Collecting', "I'm A Fish", 'Create', 'Advice
[2018, 2022]	['No preference']	['Documentary', 'Pane	['KIDS', 'FAMILY', 'DRAMA']	['Opera On Sydney Harbour: La Boheme', 'Ties That E
[2018, 2019]	['No preference']	['News', 'Documentar	['INDIGENOUS', 'DOCUMENTARY']	['Boyer Lecture 2017: Professor Genevieve Bell', 'Tom
[2016, 2017]	['No preference']	['tv', 'Panel_Discussio	['EDUCATION', 'ARTS & CULTURE', '	['ABC News ACT', 'ABC News SA', 'Alan Kohler Expla
[2020, 2023]	['No preference']	['tv', 'Documentary']	['PANEL & DISCUSSION', 'SCIENCE'	['Census 2021: Why We Count', 'Census: Why We Co
[2016, 2021]	['No preference']	['News', 'Panel_Discu	['DRAMA', 'DOCUMENTARY']	['Re-Frame 2020', 'The Office', 'Pride: Live at The Apo
[2018, 2023]	['No preference']	['Panel_Discussion']	['COMEDY']	['All My Friends Are Racist', 'How Good Is Christmas?
[2016, 2018]	['No preference']	['tv', 'News', 'Documer	['KIDS', 'FAMILY']	["What's For Dinner?", 'Odd Squad', 'Nowhere Boys',
[2019, 2020]	['No preference']	['Movie']	['EDUCATION', 'DRAMA']	['Deadly Family Portraits: Crombie Crew', "triple j's Or
[2016, 2022]	['No preference']	['tv', 'News']	['ARTS & CULTURE', 'DOCUMENTAR	['Intimate Encounters: 20 Years On', 'La Sylphide', 'Au
[2018, 2021]	['No preference']	['Documentary']	['FAMILY']	['Ballet Now', 'Basketball: WNBL', 'War On Waste', 'Op
[2017, 2019]	['No preference']	['tv', 'Documentary', 'M	['COMEDY', 'LIFESTYLE']	['Help! My Kid Is A Gamer!', "David Attenborough's Ki
[2016, 2020]	['No preference']	['News', 'Panel_Discu	['DRAMA', 'ARTS & CULTURE', 'REGI	['Ask The Doctor', 'Strong Women', 'Dementia & Us', '
[2017, 2021]	['No preference']	['Panel_Discussion']	['LIFESTYLE', 'DOCUMENTARY', 'ED	["Griff's Great Australian Rail Trip", 'Fake Or Fortune?
[2016, 2019]	['No preference']	['Movie']	['SCIENCE', 'KIDS']	['The Art of Collecting', "I'm A Fish", 'Create', 'Advice
[2017, 2022]	['PG', 'M']	['tv']	['REGIONAL AUSTRALIA']	['Opera On Sydney Harbour: La Boheme', 'Ties That E
[2016, 2023]	['M']	['News', 'Documentar	['COMEDY', 'FAMILY', 'EDUCATION']	['Would I Lie To You?', 'Whovians', 'Mock The Week', '
[2019, 2023]	['MA']	['News']	['INDIGENOUS', 'DOCUMENTARY']	['The Journey Home: Reconciliation Through Repatria
[2016, 2017]	['G']	['tv', 'Documentary']	['DRAMA', 'EDUCATION', 'ARTS & CU	['Australia Remastered: Wild Treasures', 'What Is Mus
[2018, 2020]	['PG']	['News', 'Panel_Discu	['PANEL & DISCUSSION', 'LIFESTYLI	['The Pirates Of Penzance (1994)', 'The Story of Film:
[2016, 2021]	['MA', 'M']	['tv']	['DRAMA', 'DOCUMENTARY']	['Paris', 'Upstart Crow: Christmas Lockdown 1603', 'C
[2017, 2018]	['M', 'G', 'PG']	['Documentary']	['COMEDY']	['Hunger', "St. Elmo's Fire", '100 Bloody Acres', 'Strum
[2020, 2022]	['PG', 'G']	['News', 'Documentar	['KIDS', 'FAMILY']	['Flight To Freedom', '9/11 Stories', 'The Dengineers', '
[2016, 2018]	['No preference']	['News', 'Documentar	['DRAMA', 'EDUCATION', 'SCIENCE']	['Big Weather (and how to survive it)', "David Attenbor
[2019, 2021]	['No preference']	['tv', 'News', 'Movie']	['ARTS & CULTURE', 'DOCUMENTAR	['Re-Frame 2020', 'The Office', 'Pride: Live at The Apo
[2016, 2022]	['No preference']	['Movie']	['FAMILY']	['The Dengineers', 'PJ Masks', 'The Penguins Of Mad
[2018, 2023]	['No preference']	['News', 'Documentar	['COMEDY', 'LIFESTYLE']	['Songs Of Praise: Gospel Singer Of The Year 2021 F
[2016, 2019]	['No preference']	['News', 'Documentar	['DRAMA', 'ARTS & CULTURE', 'REGI	['Innocent', 'Belgravia', 'The Heights', 'SeaChange', 'T

Figure D8: Example of what the user data looks like for the columns 'prefDate', 'rating', 'title_type', 'genre' and 'top5' from the final_users.csv.

7.5 Appendix E: Extra Information on Stakeholder Values

In this section, we describe in more detail what the stakeholder values entail, and why.

ABC Australia

ABC Australia greatly values diversity (Australian Broadcasting Corporation, 2016), and has been taking steps in order to become a more ***inclusive*** and ***diverse*** corporation. In ABC Australia's Annual Diversity & Inclusion Report from 2021-2022, they report having set in place a governance structure which aims to ensure that the corporation takes accountability for their outcomes regarding the diversity and inclusion of the company (Australian Broadcasting Corporation, 2022). ABC Australia has a diversity and inclusion program in place, and they track how diverse their company is by sending out anonymous surveys to employees (Australian Broadcasting Corporation, 2022). Additionally, they post the results of this survey to be as ***transparent*** as possible (Australian Broadcasting Corporation, 2022). They report a strong workforce diversity with regards to the women-man ratio in executive and technologist roles, an

increase in CALD[43] representation (though they have not reached their goal yet of reaching a representation percentage of 15% in executive roles), but a slight decline in Indigenous representation (Australian Broadcasting Corporation, 2022).

Additionally, ABC Australia reports its initiatives for reducing carbon emissions and its overall effect on the environment by abiding by the *GHG Protocol Corporate Account and Reporting Standard* and the *Climate Active Standard* (Australian Broadcasting Corporation, 2023). Moreover, ABC Australia puts emphasis on being transparent and integral in their content delivery (Australian Broadcasting Corporation, 2023).

We could not find value autonomy in the ABC's reports or website pages. Therefore, autonomy is given the color yellow in Table 1.

Table E1: Overview of what values the ABC prioritizes as a stakeholder. This overview includes more values than Table 1.

The ABC's values	**Accuracy**
	Diversity
	Autonomy
	Transparency
	Sustainability
	Innovation / creativity
	Integrity
	Inclusion

Content Providers and Advertisers

There is a lack of research on diversity concerning social media advertising (Chu et al., 2020). Hence, this makes it harder to determine whether or not advertisers pay attention to social values like diversity and inclusion. In Chu et al.'s (2020) literature review, values such as autonomy, transparency, sustainability, innovation and integrity were not mentioned.

In an essay by Petit & Zakon from 1962, none of the values mentioned in Tables E1 and E2 are included.

Naturally, advertisers' main aim is to make profits. Hence, it is probable that these companies have a lower inclination towards integrating social values, such as diversity, into their business strategies and subsequently, their promotional campaigns.
Therefore, businesses may be less likely to be interested in incorporating social values, such as diversity, in their business models and therefore their advertisements.

[43] CALD stands for *Cultural and Linguistic Diversity.*

On the other hand, content providers may be more interested in social values like diversity, integrity and inclusion, as it has been argued that authentic content (that may resonate with a more diverse audience) may be more interesting to the user/consumer than content that merely aims to sell (Lisa Montenegro, one of DMX's Digital Marketing Experts, via Forbes Expert Panel, 2021).

Table E2: Overview of what values the content providers and advertisers prioritize as stakeholders. This overview includes more values than Table 1.

Content provider values	**Accuracy**	**Advertiser values**	**Accuracy**
	Diversity		**Diversity**
	Autonomy		**Autonomy**
	Transparency		**Transparency**
	Sustainability		**Sustainability**
	Innovation / creativity		**Innovation / creativity**
	Integrity		**Integrity**
	Inclusion		**Inclusion**

7.6 Appendix F: Knee Plots

Extra Notes on the KneeLocator Graphs

Figure F4 shows a clear and distinct knuckle or bend in its graph at *K=4* for clustering with K-Prototypes. However, the knee plots for the K-Modes (Figures F1, F2 and F3) show less distinct bends in the graphs, making it harder to establish the most optimal number of clusters. Figure F2 especially shows an awfully unclear bend in the graph. To tackle this issue, we ran the clustering algorithm several times for each type of recommendation mechanism, i.e. metadata, demographics, and favorite titles, and took the *K* value which was the most common among all runs.

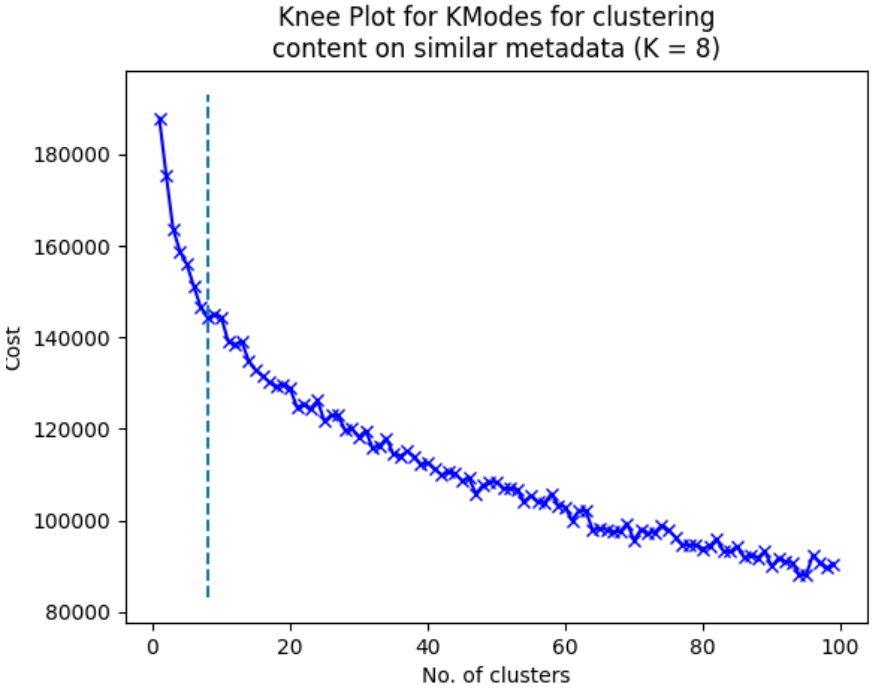

Figure F1: Knee plot for the K-Modes clustering algorithm to determine what the most optimal number of clusters is for determining a user's recommendations based on the content's characteristics, such as their genre, tags, or title type. The most optimal number of clusters is 8 (K=8).

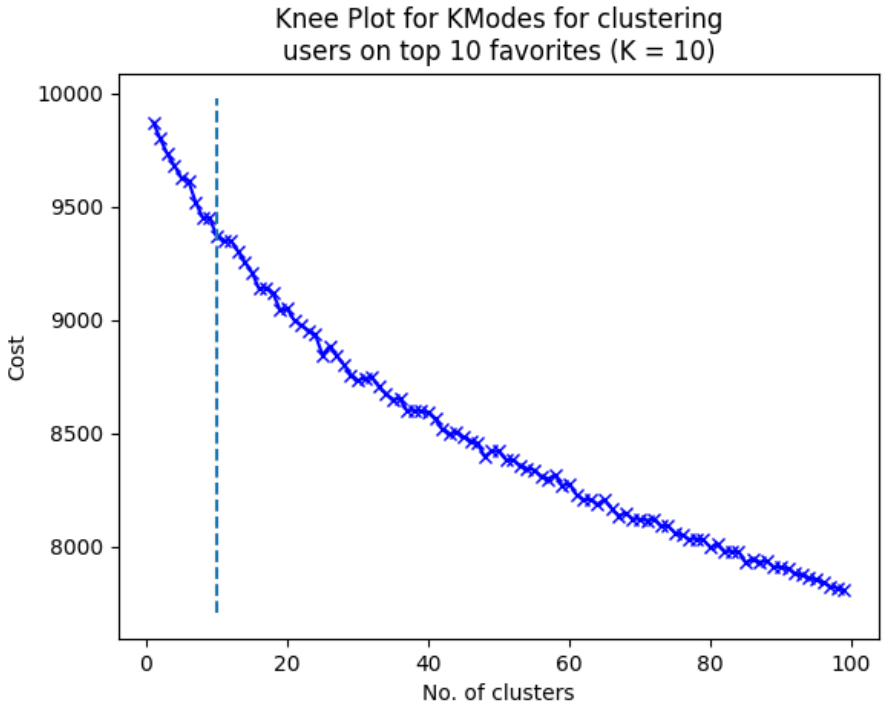

Figure F2: Knee plot for the K-Modes clustering algorithm to determine what the most optimal number of clusters is for determining a user's recommendations based on their top 10 favorites. The most optimal number of clusters is 10 (*K=10*).

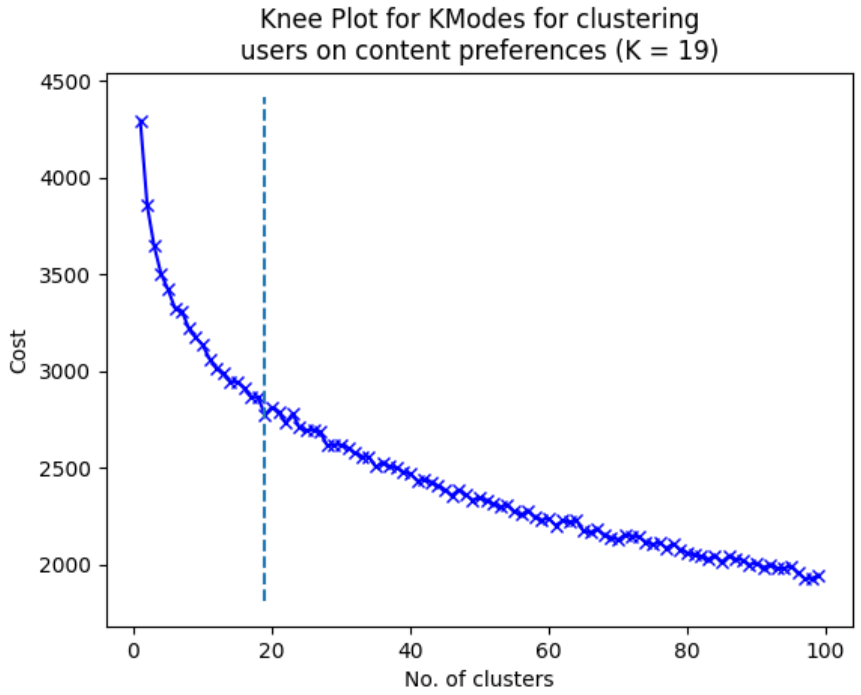

Figure F3: Knee plot for the K-Modes clustering algorithm to determine what the most optimal number of clusters is for determining a user's recommendations based on their personal settings, such as their favorite genres, title types, etc. The most optimal number of clusters is 19 (*K=19*).

Knee Plots for the K-Prototypes Clustering

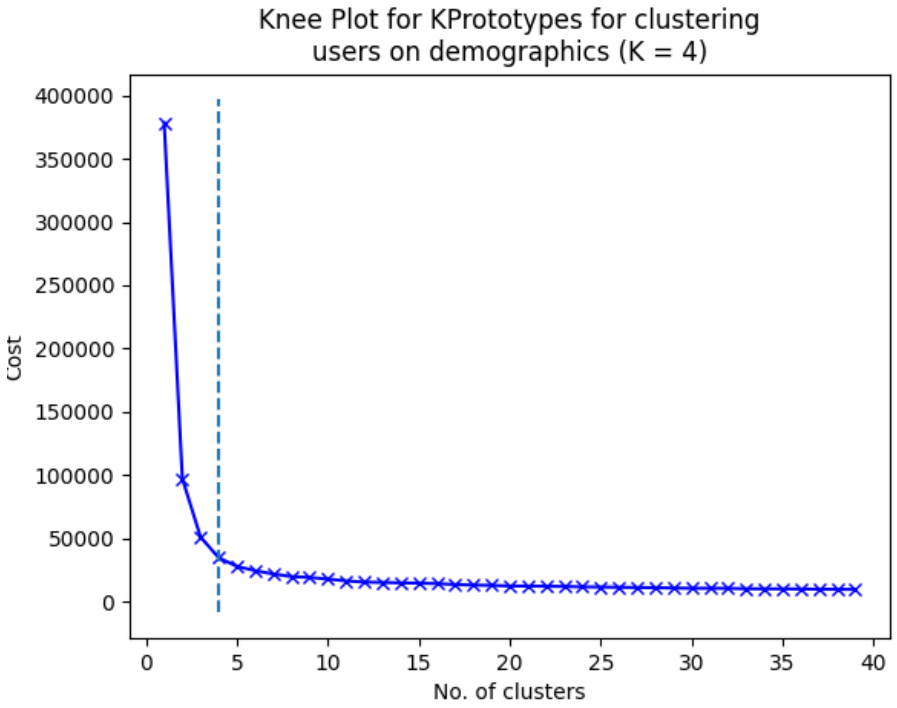

Figure F4: Knee plot for the K-Prototypes clustering algorithm to determine what the most optimal number of clusters is for determining a user's recommendations based on their demographics. The most optimal number of clusters is 4 (*K=4*).

7.7 Appendix G: Finding Fictional Personas in User Data

Extra Notes on the Clustering Evaluation Results

To analyze the clusters created by the code, we analyzed the column **sim_demo_labels** in the user data. This column was created based on the users' demographics, such as their age and gender. This column shows in what cluster each user is categorized. For each label in the **sim_demo_labels**, we evaluated their values in the **sim_favo_label** column which tells us what each group's favorite genres are. As such, Figures G1 and G2 were created.

Additionally, we experimented a bit with the fictional user data to see what the data looked like. From this, we identified some 'fictional' personas, which we took inspiration from for our personas that were based on real users.

To identify these 'fictional personas', we looked at the column sim_demo_labels in the user data, as we recognised that the differences between these fictional users might be based more on their age and therefore living situation.

Interestingly, we did seem to recognise persona 3, *the Personalisation Fanatic*, in this fictional data. Group 2 for *sim_demo_label* in the age group 34-49 favorited the genre *family*. The genre *kids* was in a shared fourth place with another category.
Originally, we did not expect genres such as *news* and *documentary* necessary to be included for the personas, as the personas that we created were based on a biased sample of real users between the ages of 18 to 30.

Personas 1 and 2 fall in the same age group (label ***18 tm 34*** in the graphs). Slightly unexpectedly, their favorite title type is *news*, rather than *films*. This may not be representative of real-life users in the same age group. This may indicate that our manually created data is a bit inconsistent and/or illogical. However, a reason why this genre would not be unreasonable, is when the young adults' interests for new technologies and innovations are taken into consideration. These interests may make them more inclined to follow the news.
However, these two personas do have *lifestyle* as their most favorite genre, which is consistent with what we would expect of this age group. Genre *documentary* in the 2nd spot as favorite genre is potentially unrepresentative. Genres *arts & culture* and *drama* in the 3rd and 4th spots, respectively, are expected.

Everything described above can be seen in Figures G1 and G2. Although the fictional user data includes users in older age groups, we decided not to dedicate our personas to these age groups, as our sample from the interviews was biased towards lower age groups.

All in all, our fictional data has room for improvement.

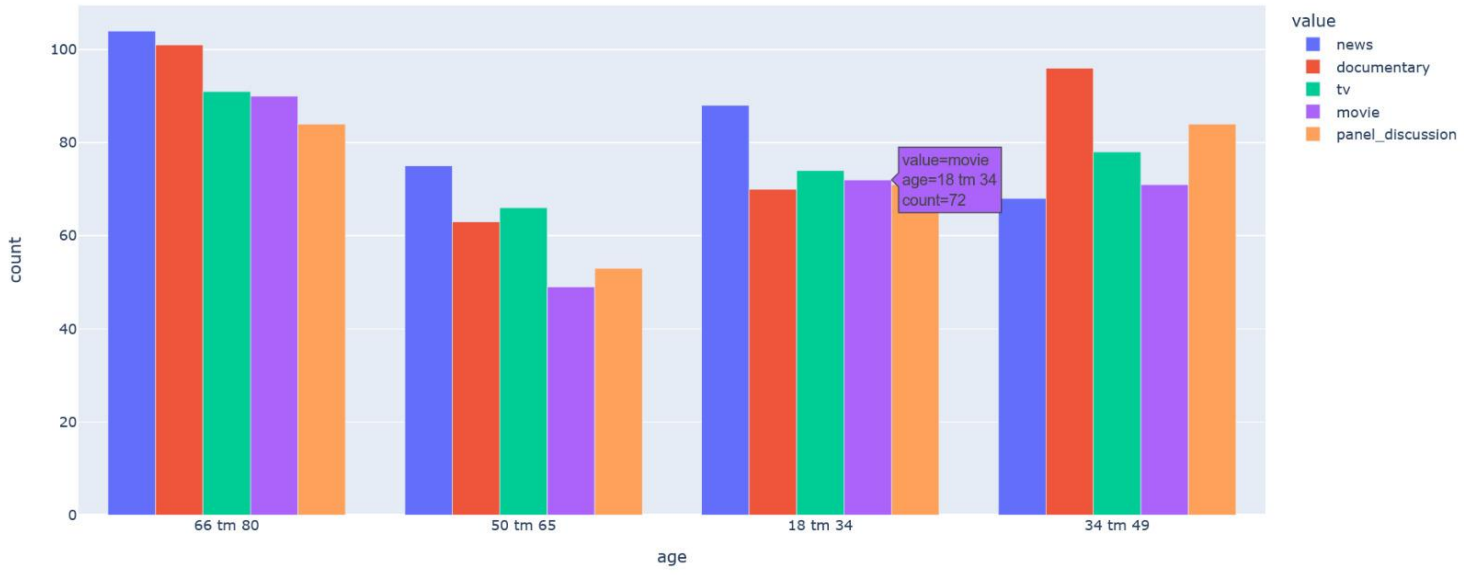

Figure G1: Overview to what extent the different age groups like to consume particular title type categories. This graph is made with the help of our (fictional) user data. Note that the age 34 is included in both age group 18-34 and age group 34-49, as male users were put in one of the age groups, and females in the other age group.

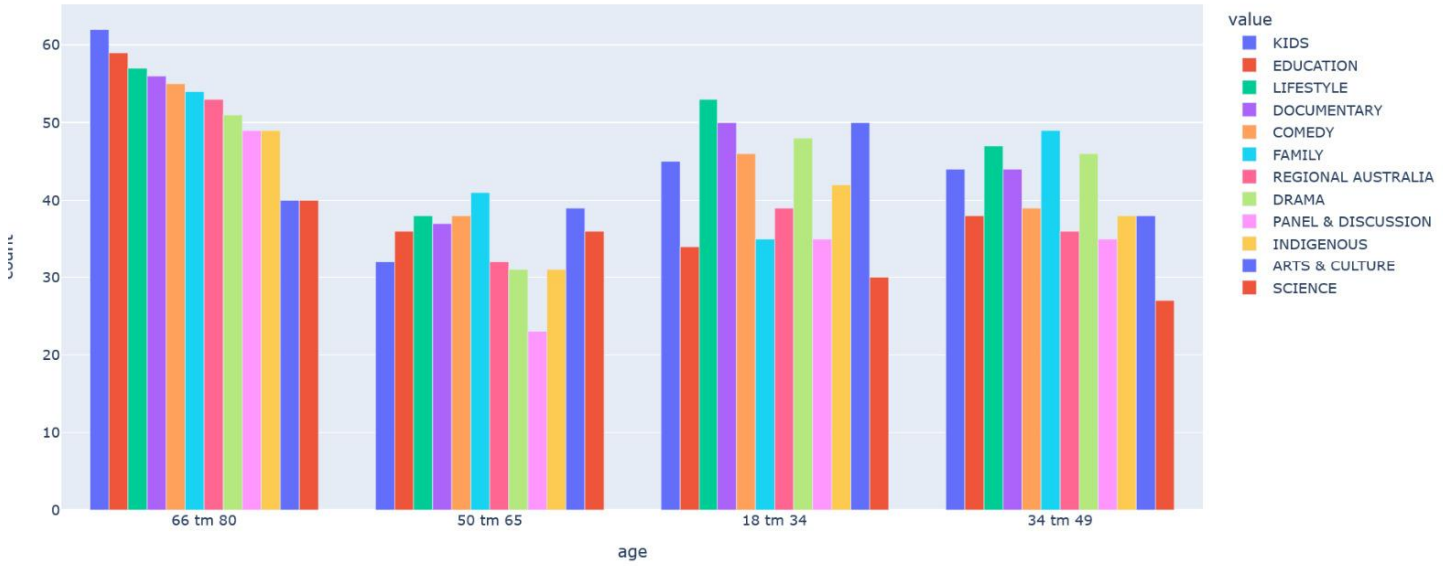

Figure G2: Overview to what extent the different age groups like to consume particular genres. This graph is made with the help of our (fictional) user data. Note that the age 34 is included in both age group 18-34 and age group 34-49, as male users were put in one of the age groups, and females in the other age group.

7.8 Appendix H: Extra Context Information on Data Analysis Techniques

In this section, we describe in more detail what particular algorithms and techniques entail.

Content- and Collaborative-based Filtering, and Hybrid Filtering

Collaborative-based filtering is a commonly used method in recommender systems (Adomavicius et al., 2005; Ricci et al., 2011).

The hybrid approach is often used in order to overcome the limitations of both the content- and collaborative-based filtering approaches (Thorat et al., 2015).

Loading the User and Content Data

The regular recommendation implementation can be found in the file **recommendations.py**. In ***main()***, we load manually made user data (**final_users.pkl**), and the ABC's content data (**programs_abc.csv**). Both datasets are then preprocessed (**data_preprocessing** function) so that they are usable to make recommendations on.

Getting the Regular Recommendations

To get the regular recommendations (**get_recommendations** function), we either use the function **k_modes_recs** or the **k_prototypes_recs**, or both. These functions are used to retrieve the actual contents that should be selected by the similarity (1) based on other contents' genre(s), tag(s) and more (function **get_sim_content_recs**), (2) based on the user's favorite titles (function **get_sim_faves_recs**), (3) based on users' preferences regarding genre(s) (function **get_sim_prefs_recs**), (4) based on the user's demographics (function **get_sim_demo_recs**), or (5) based on the user's most favorite content from their favorite genres (function **get_most_faved_recs**), or based on several of these 5 options. In any kind of scenario, the **get_recommendations** function always returns 5 dataframes.

Jaccard Similarity

Jaccard Similarity is computed by taking two types of sets we want to compare: the intersection of the sets and the union of the sets. For both the intersection and union sets, we take their cardinality, and divide the intersection's cardinality over the union's (e.g. Fernando & Herath, 2021).

Descriptive Statistics

The participants in the sample were recruited through convenience sampling. The sample consists solely of Dutch adults. We recruited 18 participants (*n = 18*), with 9 females (50%) and 9 males (50%). The participants are aged from 19 to 57 years old (*M = 27, SD = 10.7594*). Table 4 provides an overview of the details about the participants.

7.9 Appendix I: Extra Images of the Interface Design

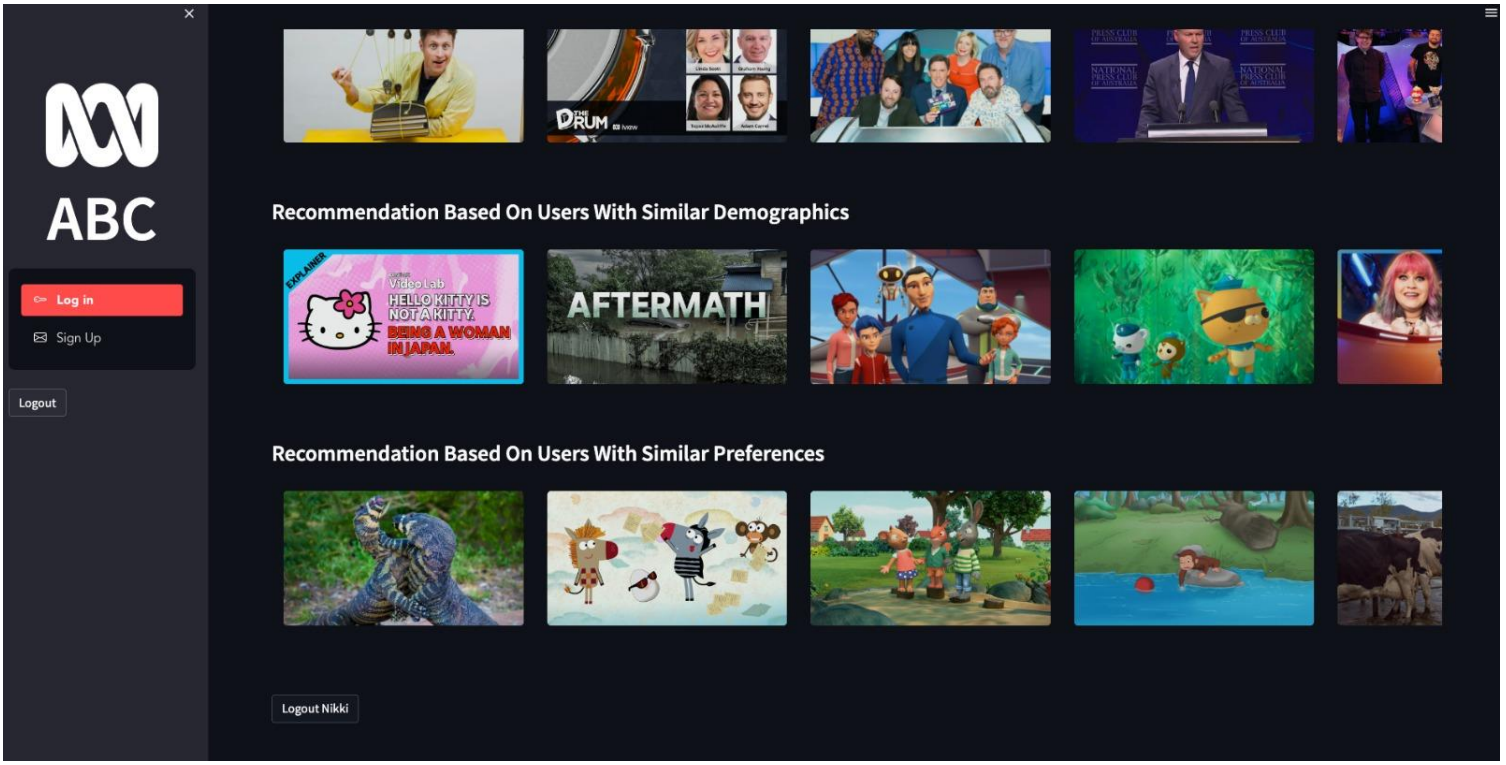

Figure I1: At the end of the homescreen, where we can see the 'logout <username>' button to log out of your account.

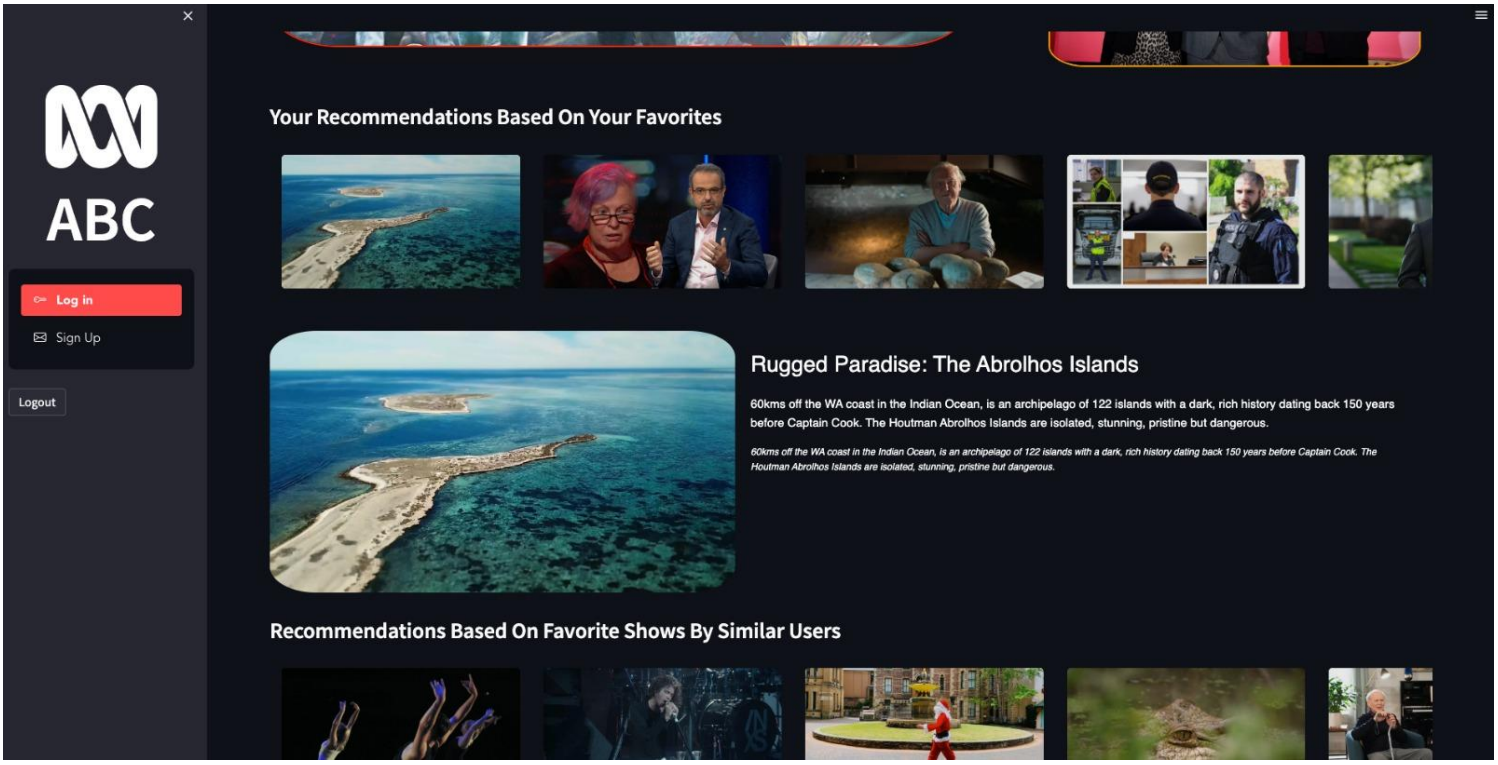

Figure I2: By clicking on a title, the title gets selected which is represented with a white border around the title's corresponding image. The application then provides more details with a description.

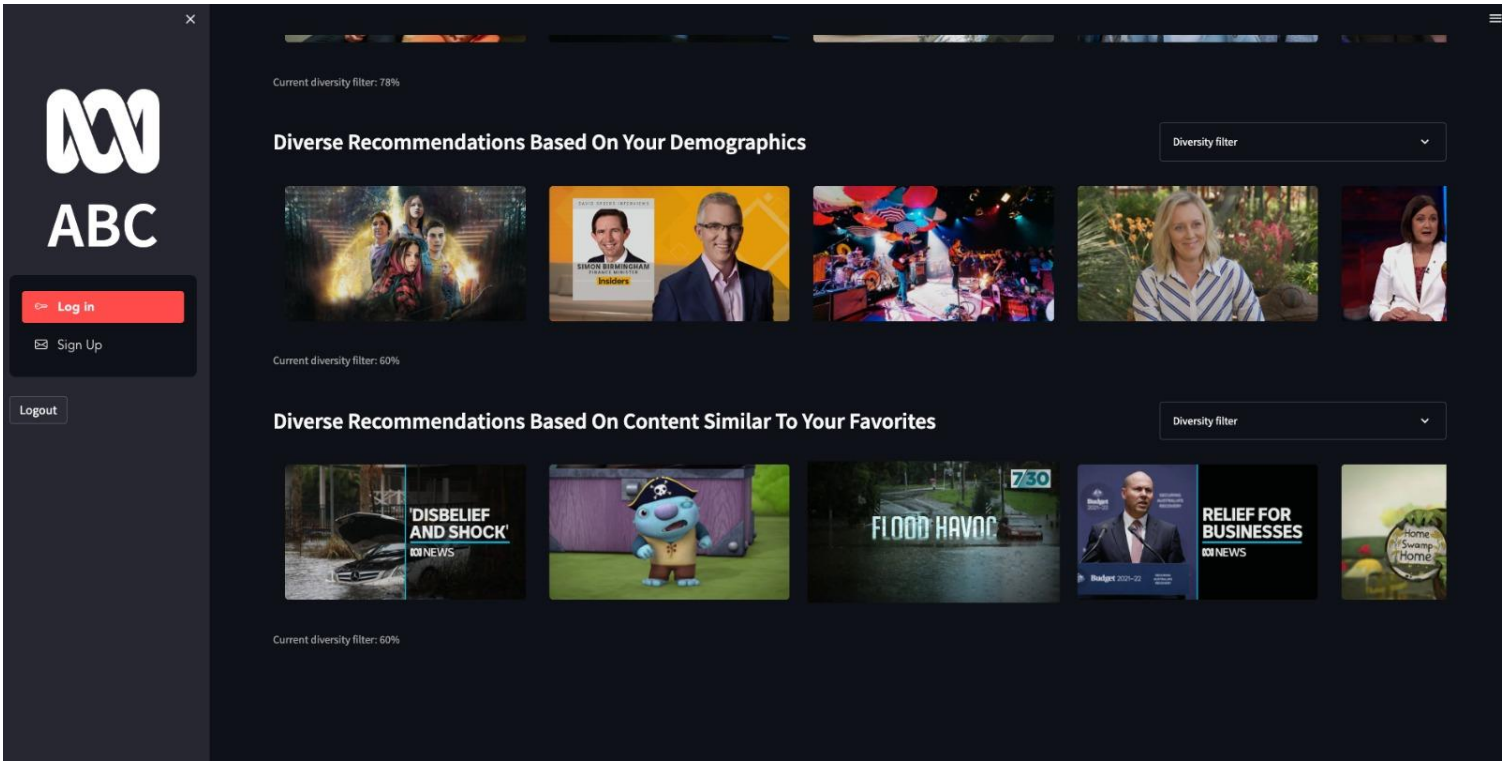

Figure I3: The different kinds of recommendations (e.g. based on demographics or similar content to the user's favorites), including what diversity level has been applied in small grey letters below the images.

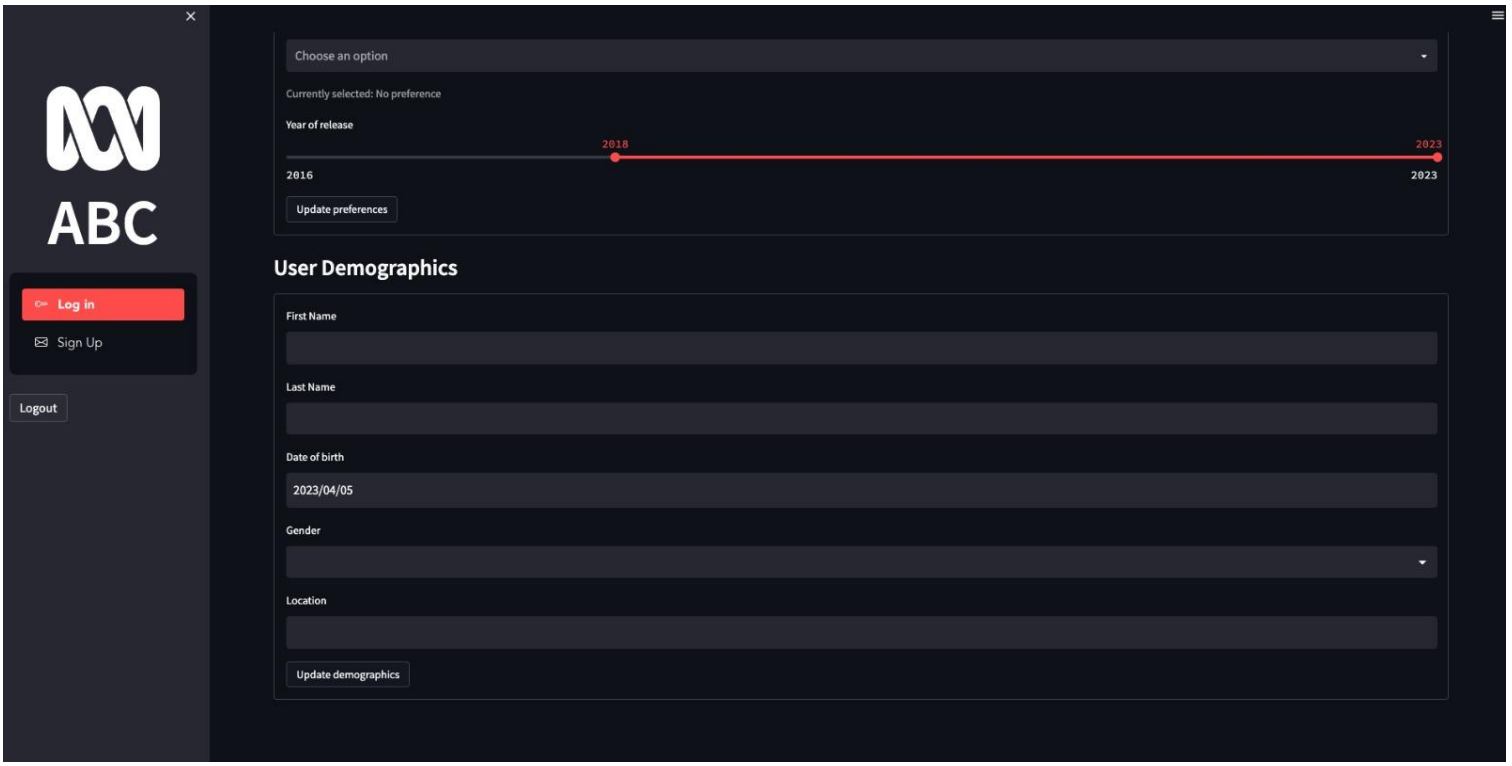

Figure I4: A part of the screen wherein a user can update their demographics' information. The user can update/save their preferences and their demographics by clicking on the 'Update preferences' and 'Update demographics' buttons respectively.

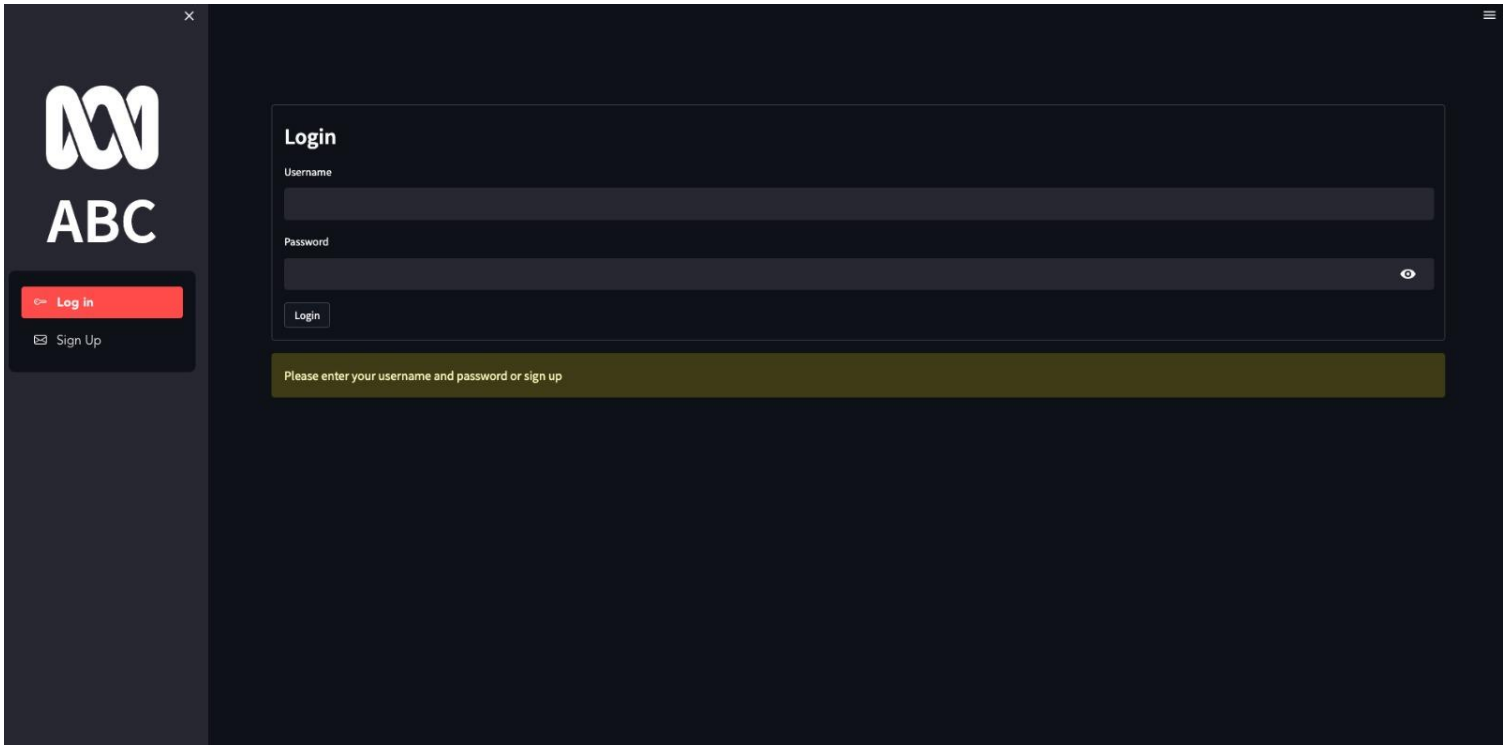

Figure I5: The Log In page where a user can log in on the condition that the user has already made an account previously. Similarly to other applications nowadays, the Log In page displays a message (in yellow) that describes what the user can do (either login or make an account). Note that the 'Log In' tab on the left is marked with red to signify that the user is on the 'Log In' page.

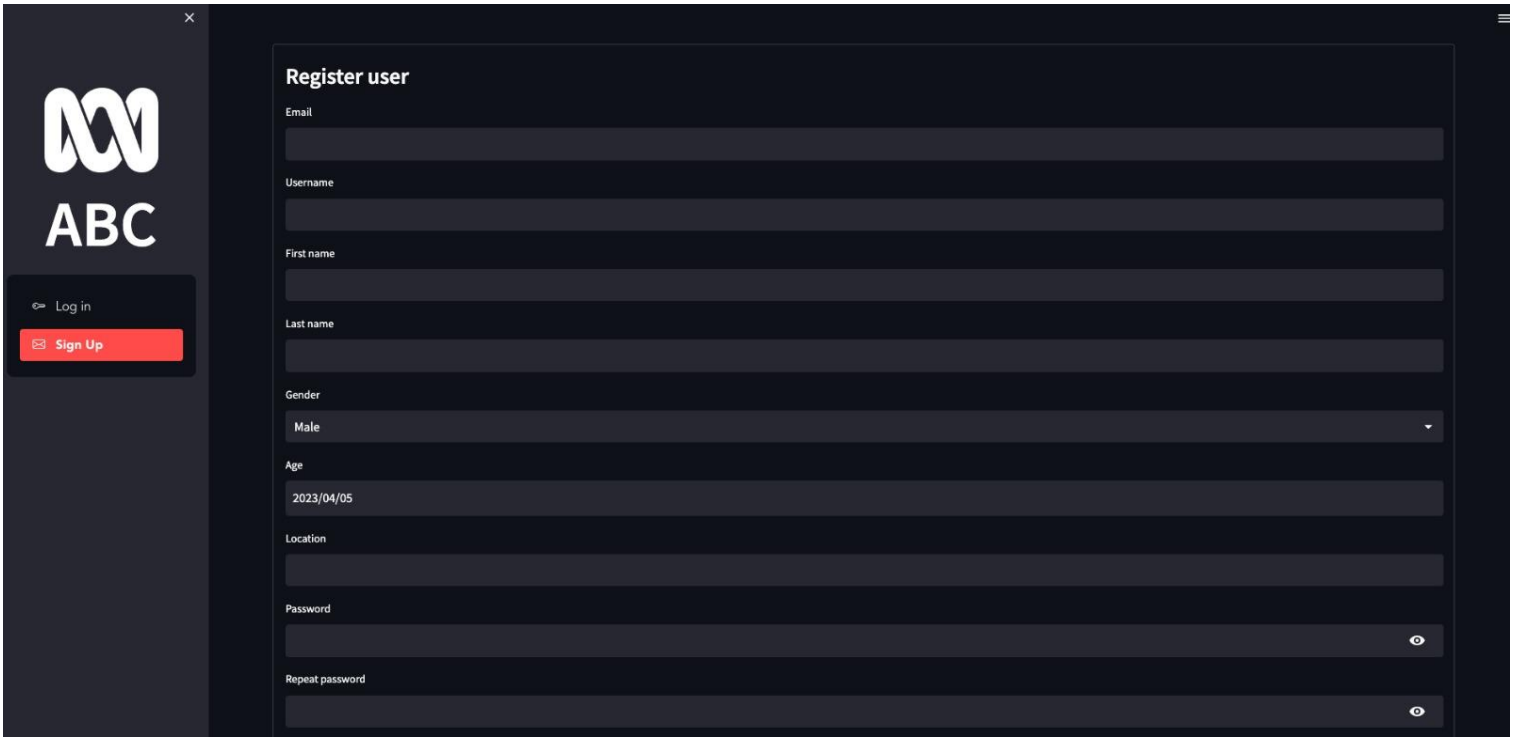

Figure I6: Part 1 of the screen where a user can register their new account. To register their new account, the application will ask for information such as their email, username and password.

Note that the 'Sign Up' tab on the left is marked with red to signify that the user is on the 'Sign Up' page.

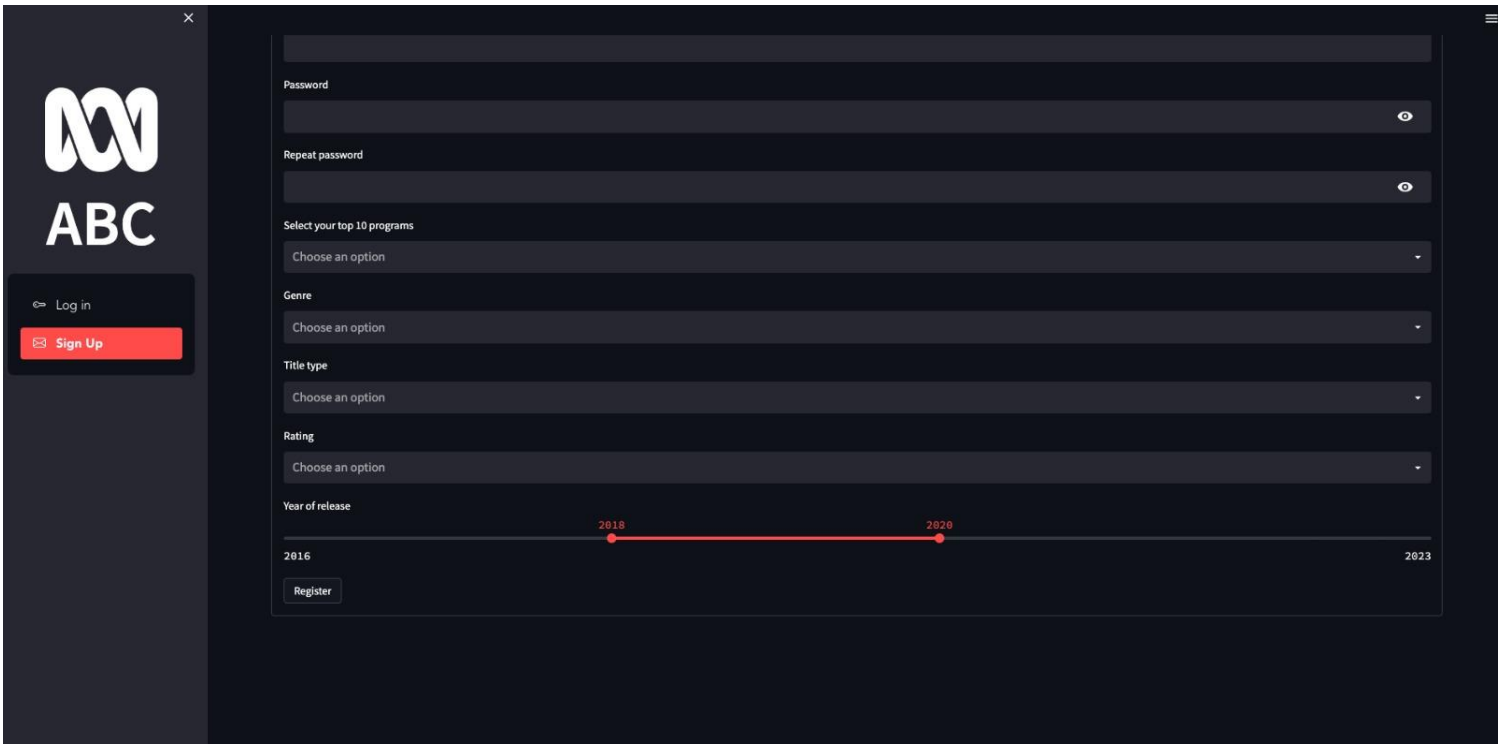

Figure I7: Part 2 of the screen where a user can register their new account. When registering an account, the application will immediately ask for aspects such as the user's favorite genres, favorite titles, and favorite title types, so that the application can make recommendations when a user logs in the first time as well.

7.10 Appendix J: Pairwise Cosine Similarity Results

In the folder 'plots', we provide two .csv files with the results from calculating pairwise similarities between titles from the content data with the **Cosine Similarity** method. See Figures J1 and J2.

	The Art of C	Phenomen	Warumuk	Opera On	Spartacus	Thomas Ar	Charlie An	Dog Loves	Molly And	storyTree	Ana Pumpl	Languages	Shaun The	The Parker	Olobob Top
The Art of	1	0.32	0.39	0.37	0.35	0.12	0.14	0.14	0.14	0.12	0.16	0.12	0.08	0.13	0.16
Phenomen	0.32	1	0.39	0.37	0.35	0.12	0.14	0.14	0.14	0.12	0.16	0.12	0.08	0.13	0.16
Warumuk	0.39	0.39	1	0.47	0.6	0.2	0.23	0.23	0.23	0.2	0.27	0.19	0.13	0.21	0.27
Opera On	0.37	0.37	0.47	1	0.67	0.16	0.19	0.19	0.19	0.16	0.22	0.15	0.1	0.17	0.22
Spartacus	0.35	0.35	0.6	0.67	1	0.23	0.27	0.27	0.27	0.23	0.31	0.22	0.15	0.24	0.31
Thomas Ar	0.12	0.12	0.2	0.16	0.23	1	0.64	0.75	0.64	0.55	0.74	0.52	0.41	0.38	0.74
Charlie An	0.14	0.14	0.23	0.19	0.27	0.64	1	0.75	0.75	0.64	0.87	0.61	0.42	0.45	0.87
Dog Loves	0.14	0.14	0.23	0.19	0.27	0.75	0.75	1	0.75	0.64	0.87	0.61	0.49	0.45	0.87
Molly And	0.14	0.14	0.23	0.19	0.27	0.64	0.75	0.75	1	0.64	0.87	0.61	0.42	0.45	0.87
storyTree	0.12	0.12	0.2	0.16	0.23	0.55	0.64	0.64	0.64	1	0.74	0.78	0.35	0.38	0.74
Ana Pumpl	0.16	0.16	0.27	0.22	0.31	0.74	0.87	0.87	0.87	0.74	1	0.71	0.48	0.52	1
Languages	0.12	0.12	0.19	0.15	0.22	0.52	0.61	0.61	0.61	0.78	0.71	1	0.45	0.55	0.71
Shaun The	0.08	0.08	0.13	0.1	0.15	0.41	0.42	0.49	0.42	0.35	0.48	0.45	1	0.56	0.48
The Parker	0.13	0.13	0.21	0.17	0.24	0.38	0.45	0.45	0.45	0.38	0.52	0.55	0.56	1	0.52
Olobob To	0.16	0.16	0.27	0.22	0.31	0.74	0.87	0.87	0.87	0.74	1	0.71	0.48	0.52	1

Figure J1: Cosine Similarity for the average pairwise comparisons for the diverse recommendations.

	Spicks And	Would I Lie	Whovians	Spicks And	Would I Lie	Gruen	One Plus C	Barrie Cas	The Brothe	Spicks And	Would I Lie	Whovians	Spicks And	Would I Lie	Whovians
Spicks And	1	0.51	0.34	1	0.51	0.55	0.32	0.32	0.45	1	0.51	0.34	1	0.51	0.34
Would I Lie	0.51	1	0.65	0.51	1	0.65	0.21	0.21	0.58	0.51	1	0.65	0.51	1	0.65
Whovians	0.34	0.65	1	0.34	0.65	0.45	0.24	0.24	0.53	0.34	0.65	1	0.34	0.65	1
Spicks And	1	0.51	0.34	1	0.51	0.55	0.32	0.32	0.45	1	0.51	0.34	1	0.51	0.34
Would I Lie	0.51	1	0.65	0.51	1	0.65	0.21	0.21	0.58	0.51	1	0.65	0.51	1	0.65
Gruen	0.55	0.65	0.45	0.55	0.65	1	0.28	0.28	0.57	0.55	0.65	0.45	0.55	0.65	0.45
One Plus C	0.32	0.21	0.24	0.32	0.21	0.28	1	0.94	0.33	0.32	0.21	0.24	0.32	0.21	0.24
Barrie Cas	0.32	0.21	0.24	0.32	0.21	0.28	0.94	1	0.29	0.32	0.21	0.24	0.32	0.21	0.24
The Brothe	0.45	0.58	0.53	0.45	0.58	0.57	0.33	0.29	1	0.45	0.58	0.53	0.45	0.58	0.53
Spicks And	1	0.51	0.34	1	0.51	0.55	0.32	0.32	0.45	1	0.51	0.34	1	0.51	0.34
Would I Lie	0.51	1	0.65	0.51	1	0.65	0.21	0.21	0.58	0.51	1	0.65	0.51	1	0.65
Whovians	0.34	0.65	1	0.34	0.65	0.45	0.24	0.24	0.53	0.34	0.65	1	0.34	0.65	1
Spicks And	1	0.51	0.34	1	0.51	0.55	0.32	0.32	0.45	1	0.51	0.34	1	0.51	0.34
Would I Lie	0.51	1	0.65	0.51	1	0.65	0.21	0.21	0.58	0.51	1	0.65	0.51	1	0.65
Whovians	0.34	0.65	1	0.34	0.65	0.45	0.24	0.24	0.53	0.34	0.65	1	0.34	0.65	1

Figure J1: Cosine Similarity for the average pairwise comparisons for the regular recommendations.