Personalisation for public media – Assignment 2

1. Introduction

In recent years, media providers have increasingly used recommendation algorithms to provide personalised content to users. While this approach can enhance user experience, it can also create filter bubbles that limit users' exposure to diverse perspectives. This is a particular concern for public media providers such as the British Broadcasting Corporation (BBC), which strives to inform, educate and entertain UK citizens to encourage social cohesion in the UK (Mission, values and public purposes, n.d.). Exposure to diverse media content is crucial for mitigating polarisation and social division (Helberger, 2018; Möller et al., 2018). Simply recommending more diverse content is not enough, however, as users also need to trust the BBC and its media platform. To develop trust, a feeling of autonomy over the media content users can consume is key rather than feeling coerced to consume specific media content. *A*s the BBC is publicly funded, the taxpayers and the state also have an interest in ensuring that taxes are spent well, and the platform offers high-quality content for all users. Therefore, as the BBC strives to encourage social cohesion in the UK, promoting media diversity should be considered a priority, followed by inclusion, trust and autonomy.

Promoting media diversity is especially important for the elderly population, as they tend to be more stable in their tastes and less open to new experiences (Schwaba et al., 2018). Consequently, the elderly can easily find themselves trapped in 'filter bubbles' in which they are solely exposed to similar content. Media recommender systems can exacerbate this tendency and encourage public divisiveness (Pariser, 2011). Currently, the BBC does not focus on exposing the elderly population to diverse content.

Therefore, we suggest that the BBC implements a recommender system on top of the current BBC iPlayer that is specifically designed to encourage elderly users, defined as people aged 60 and older, to consume content beyond their filter bubbles. We propose to implement this recommender system in a modified interface for elderly users which promotes exposure to diverse content as well as a feeling of inclusion, trust and autonomy. The proposed recommender system strives to balance the needs and values of relevant stakeholders, namely the BBC, the state and the elderly.

2. Literature Review

2.1. Filter Bubbles and Elderly Users

Filter bubbles are the result of algorithms that use past user behaviour to recommend content, limiting the diversity of content presented to the user. This can lead to a narrow worldview and reinforce pre-existing biases (Pariser, 2012). Some researchers argue that users of recommender systems are less likely to end up in filter bubbles because recommender systems are less narrowing than directly looking up items (e.g. Nguyen et al., 2014). However, others are concerned about the potential negative effects of filter bubbles on information diversity (Helberger et al., 2018) and even warn of the potentially negative impact on democracy (High Level Expert Group on Media Freedom and Pluralism, 2013). As the pace of digitisation is rapidly increasing, elderly people also encounter recommender systems more frequently (Holgersson & Söderstrom, 2019). Older adults are likely particularly susceptible to filter bubbles, as they score lower on openness to experience (Schwaba et al., 2018), are less computer literate (Darejeh & Singh, 2013) and more likely to disseminate fake news (Guess et al., 2019).

To increase diversity among elderly users' content, the inclusion of the platform would also need to be improved, so that elderly users choose to access the BBC's content through the iPlayer

rather than TV channels. Similarly, ensuring trust and autonomy is necessary so that users will feel comfortable exploring the new recommendation options[1]. However, maintaining both autonomy and trust for the user and diversity in content can lead to value tensions, as creating new recommendations for the sake of diversity reduces trust, if it is not transparent, and autonomy if users cannot choose what kind of recommendations they want to see.

These public values are implemented following value sensitive design as proposed by Friedman and colleagues (2002). It is defined as "theoretically grounded approach to the design of technology that accounts for human values in a principled and comprehensive manner throughout the design process" (Friedman et al., 2002, p.2). The authors also describe the unique relationship between usability and value sensitive design. This was implemented in this project by ensuring high usability for elderly users while simultaneously applying the four key values.

2.2 Operationalisation of Public Values

Our operationalisation of diversity is mostly based on the concept of exposure diversity, which refers to the consumption of media items as opposed to their mere accessibility through a media platform (Moe et al., 2021). The objectives of our recommender system also align closely with the deliberate democracy framework (Helberger et al., 2018), which sees exposure diversity as a means to encourage rational debates and facilitate discussion between parties of conflicting opinions. Considering this work, we achieve diversity by exposing elderly users to media content outside of their filter bubble.

Given the digital nature of our project, we focus on inclusion as digital inclusion, which relates to the ability to effectively access and use information and communications technologies (ICTs) (Alamelu, 2013). Similarly, Sourbati (2012) states that inclusion is characterised by the absence of barriers and by providing universal access to today's ICTs regardless of one's age, gender or geography. In our case, inclusion is achieved by removing barriers in access for the target group of elderly users who might be disadvantaged because of their age, mostly by adapting the user interface.

Building trust in online environments is also particularly important for elderly users, who tend to distrust unknown and emerging technologies, such as recommender systems (Knowles & Hanson, 2018)). Trust can be defined as the subjective certainty that an individual has in predicting whether another individual or group will carry out a specific action (Viljanen, 2005). An important factor for trust is decision effort, i.e., the amount of cognitive effort needed to use the interface and make decisions (Pu et al., 2011). We therefore develop trust by creating a recommender system that has a human feel to it. and that is simple enough to allow elderly users to make informed choices.

Autonomy is closely linked to trust, as an easily usable and understandable interface helps to increase autonomy (Friedman et al., 2003). Autonomy refers to "the ability to decide, plan, and act" in a manner that allows to fulfil one's goal (Friedman et al., 2003, p.5). We operationalise autonomy by allowing users to decide when to be exposed to diverse content and by facilitating the decision making through a simple user interface.

3. Method and Analysis

The design process of the recommender system and the interface was informed by value-sensitive design methods. It included the stakeholder analysis and mapping described in the introduction, interviews with users, the development of a value-centred recommendation system and interface and clear metrics for the evaluation of these values.

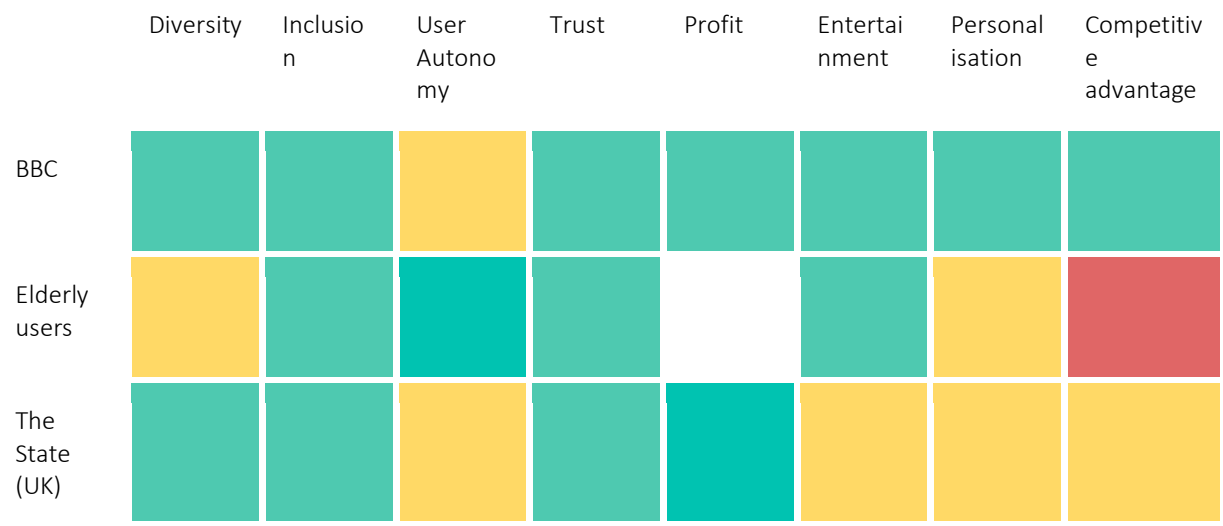
[1] As discussed by Pu et al. (2011), trust also depends on how accurate the recommendations are. As users might perceive more diverse recommendations as less accurate, increased diversity might therefore lead to decreased trust

3.1. Stakeholder mapping

The stakeholder mapping is based on the literature review and the interviews conducted with elderly users. It maps the attitudes of the three core stakeholders towards the values.

Figure 2

Stakeholder Mapping



3.2. Data collection

Semi-structured interviews were conducted with six elderly people using a questionnaire (see Appendix A) that focused on viewing behaviour and preferences as well as openness to new or diverse content. The interviewees were four men and two women between 60 and 89 years of age[2] from four different European countries.

The interviewees indicated quite established preferences for genres and specific shows. To find new content they mostly relied on recommendations from friends or family and on reviews in the newspaper. Their openness to try out new content varied between very open to quite opposed to it. However, even the most open interviewees indicated that they would prefer new content that was somewhat familiar or based on their existing preferences rather than completely random. None of the interviewees had heard the term “filter bubble” before, but they understood the concept when explained to them.

They were also shown a first version of the wireframe, which visualised the bursting of a filter bubble to introduce new content. However, as the interviewees were not familiar with filter bubbles, they found this visualisation confusing.

3.3. Personas

Informed by the data collected in the interviews, two user personas differing in their tastes and content selection were created to target the final product towards the elderly users (see Appendix B).

3.4. Synthesis of user data

[2] The exact ages were 60, 70, 77, 78, 87 and 89

Twenty-five users were simulated, each based on either persona Jane or Robert. Each user interacted with approximately 20 content items from the BBC, indicating whether they had finished watching the item and whether they liked or disliked it. The score for each item was the sum of the following values, each indicating the assumed strength of the interaction: + 0.25 for fully-watched, -0.25 for not watched (but started), + 1.0 for liked and – 1.0 for disliked.
In total, 702 ratings for 624 items were created.

3.5. Recommender system

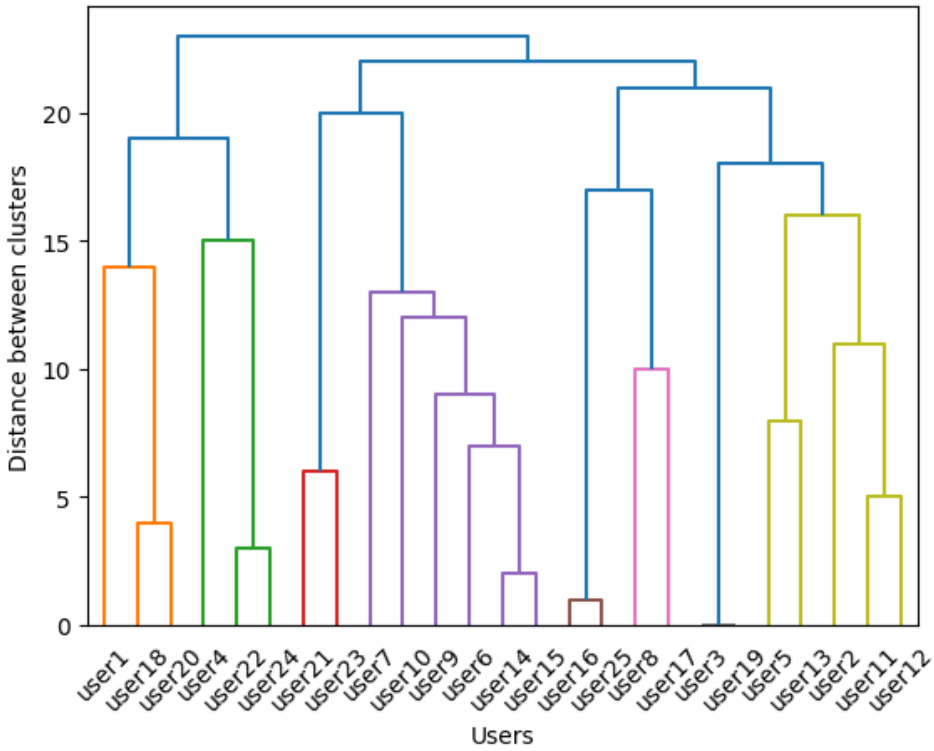
To reduce the sparsity of the users' ratings matrix, the user's mean rating of a series was applied to all episodes of the same series, assuming the user's attitude towards one episode would reflect that of the whole show.This led to 4,400 rows with at least two users' ratings. The ratings were then normalised by subtracting the user's mean (total) rating from each rating.

The similarity between users was then calculated using cosine similarity, resulting in a 25x25 matrix. To cluster them, hierarchical clustering was chosen because it can be applied to pre-computed distances. The similarity matrix was therefore converted to a distance matrix by subtracting it from 1 and the AgglomerativeClustering function from scikit-learn was applied to it, resulting in the dendrogram shown in Figure 3. Based on the dendrogram, four clusters were chosen, each containing 4 to 8 users.

K-means clustering on the normalised rating was also tried as an alternative approach but did not lead to meaningful clusters, as most users were assigned to one cluster.

Figure 3

Dendrogram of the users and their corresponding clusters



The content recommendations for the specific user (i.e. without the Explore feature) were then calculated by multiplying the mean of the shows other users in the same cluster rated with the similarity score to that user. Ratings were thus weighed so that more similar users' tastes had a stronger effect on recommendations. Recommendations for the Explore feature were based on the

nearest other cluster to the one the user was in. To find that cluster, the similarity between the four clusters was calculated and the cluster with the most similar ratings was chosen. The recommendations were then calculated based on the ratings of all users in that nearest cluster.

3.6. The User Interface (UI)

The UI, built on top of the current iPlayer's UI, is designed to help older users navigate the platform easily and to encourage them to try out new content. Based on the results from our interviews, the elderly are more likely to try new content when someone recommends it to them. Therefore, the "Explore Feature" in the UI is presented by a fictional character Jack, who offers new content suggestions. Jack's homepage also aims to provide users with an intuition about the existence of filter bubbles and that other users see different content. Jack is designed to emulate a realistic person with favourite genres the elderly can relate to. However, to ensure transparency and users' trust, they are informed that he is a fictional character.

Jack's recommendations are separate from the user's personal recommendation to ensure that users have the autonomy to choose or ignore the more diverse recommendations. Moreover, since the elderly have strong preferences for their favourite genres, genre information and content description with run-time is provided for the content when selected.

Lastly, the easy navigation is afforded using clear, large pictures and large clickable buttons displaying content titles.

Figure 4:

Expand Your Horizons section with the possibility to see Jack's recommendations

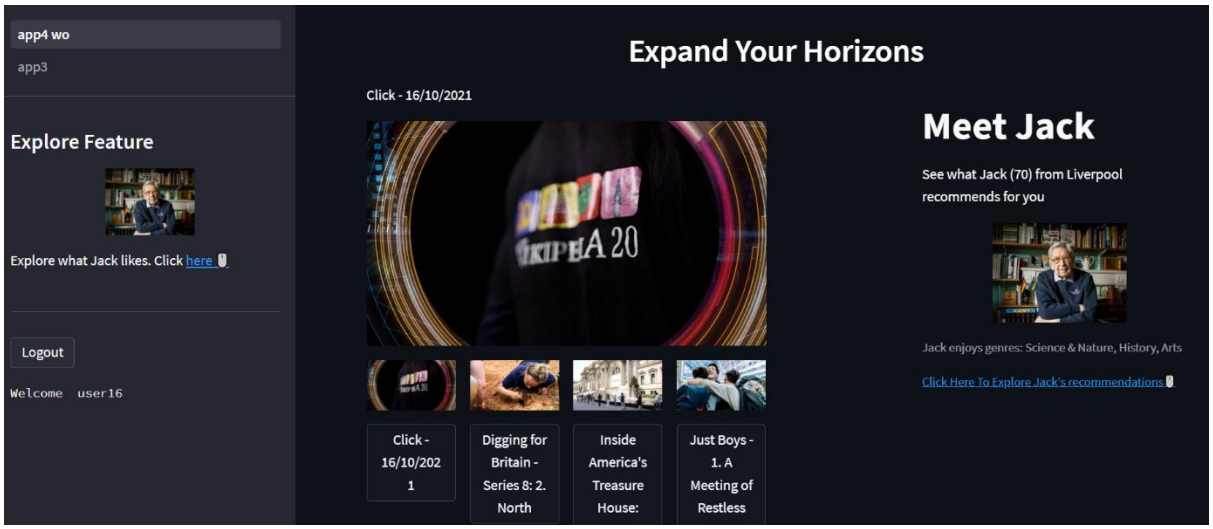
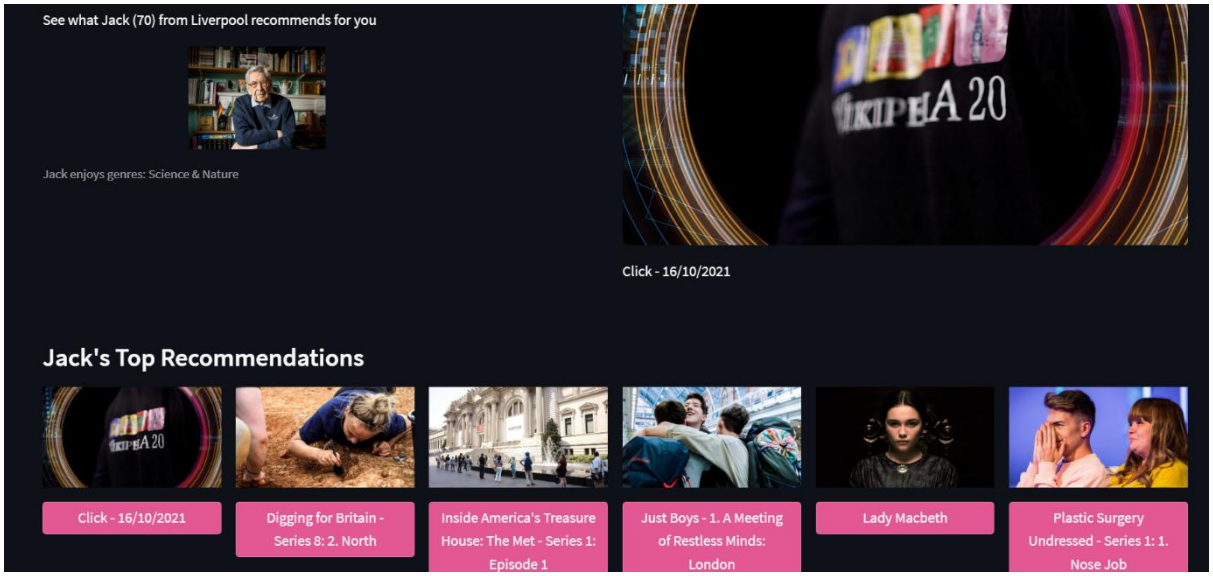


Figure 5:

Jack's homepage



3.7. Metrics

To evaluate the implementation of the four core values, both quantitative and qualitative methods would be needed, but could not be implemented yet due to time constraints. To measure diversity, an A/B test could be conducted, with some users having the usual BBC iPlayer interface and others also having the Explore feature. One could then compare the number of items users watch that were not part of their list of recommendations, whether recommended by "Jack" or searched for by the users themselves.

Inclusion could be measured through the number of active elderly users on the platform over time, assuming that a more inclusive interface encourages users to use the BBC iPlayer rather than watching the channels directly on TV. Inclusion could also be measured more directly by asking elderly users to rate the usability of the platform on a scale and comparing the rating either over time or again using an A/B test.

Autonomy and trust are more difficult to quantify and could instead be evaluated using interviews or focus groups with the target group.

4. Conclusion

A recommender system was built on top of the current BBC iPlayer to accommodate elderly users and nudge them to see content beyond their filter bubbles. As we defined the core stakeholders and their values, we concentrated on the public values of diversity, inclusion of the elderly, autonomy of the users and user trust. These values were operationalised following the value sensitive design methodology. Semi-structured interviews with the elderly were employed to further understand their values and user behaviour as well as to inform the creation of representative user personas. These personas were later used to simulate realistic user data as a basis for the recommender system, which was collaborative-based and used clustering as the main method to recommend both more personalised, but also diverse content for the users. The diverse content recommendations were then presented in the Explore feature by a fictional character in the interface. We also proposed several metrics to measure the implementation of these values.

4.1. Limitations

One limitation of this project is that due to time constraints we could not test our interface and recommender system on the target group. Therefore, we were not able to collect data on the metrics discussed above. The assumption that the new interface would improve the implementation of our four core values is therefore largely based on our literature research and our interviews, which were, however, consistent and had clear implications.

Insights from these interviews also led to the adoption of "Jack" as the fictional character who introduces the users to content outside of their bubble. While Jack was introduced to increase the diversity and inclusion of the platform by simulating recommendations from a friend, there is a potential value tension with trust. When elderly users, who are less familiar with algorithms on the Internet, learn that Jack is a fictional character, they may feel deceived by the platform and therefore lose trust.

Another limitation is the clustering algorithm used. Choosing the number of clusters was based on a visual inspection of the dendrogram and the cluster sizes that would result from different numbers of clusters. As the algorithm is scaled up to more users, the number of clusters would need to be chosen automatically. This could be implemented using more complex hierarchical clustering methods such as DBSCAN or HDBSCAN[3]. However, the effect of a more complex algorithm on efficiency would need to be considered, as the computing time of the current script is already relatively long.

4.2. Future research

Future research should focus on the factors that increase elderly users' willingness to explore different and more diverse content. Based on the interviews, the recommendation system described here suggests new content from the nearest cluster, which is therefore still quite similar to the user's preferences. To investigate how elderly users can be exposed to even more diverse content without losing their interest, future research could investigate the effect of slowly moving towards more distant clusters of recommendations.

Another avenue that we started to explore here is the introduction of a fictional character to increase users' acceptance of more diverse content. Future research should explore the usefulness of such a character, especially for elderly users, more systematically through experiments or interviews. This could include further adapting the fictional character to the user, for example by aligning the gender and age.

[3] Density-Based Spatial Clustering of Applications with Noise or Hierarchical Density-Based Spatial Clustering of Applications with Noise. These are density-based clustering algorithms that could ensure a minimum cluster size and generally work better on data that is not easily captured in circles.

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Appendix A:

Interview Questions

1. Note down interviewee age, gender, nationality, educational background
2. How do you access media content: e.g., do you just switch on the tv? Do you go to Netflix? Public broadcaster? Do you select what you want to watch? Or are you happy to just watch whatever is on tv?
3. What do you usually watch? (genre, content, older/newer content, country of origin, which language, subtitles/original language, etc.)

a. Do you think you consume different type of content? Or mostly stick to one thing?

4. Would you enjoy watching something else/different? (e.g., different genre)

a. Why or why not?

5. Would you prefer watching something that is a little bit different (still related to your taste) or just randomly being exposed to some kind of different content? (not necessarily only a bit different)

a. Why or why not?

6. If you do? Are there any barriers that don't allow you to watch something different? Is it difficult to find new content?
7. What would help you to find/watch new content? (Enabler to diverse content)
8. Have you heard about filter bubbles?
9. Do you think you are in a filter bubble when using media platform?
10. Show visualization of filter bubble. What do you think about this? (https://www.figma.com/file/8Z8ahpwFKuTaWAXqEZpsIZ/Untitled?node-id=0-1&t=qv68Cceh6p8LY0wR-0)

Appendix B: Description of Personas

Persona A: Jane

Jane is an 81-year-old woman who prefers TV to streaming services, but enjoys the benefits of IPlayer, such as getting an idea what the content is about, when she knows how to navigate it. She is quite loyal to her favourite genres, which are drama films, seasonal sports, historical films, cooking shows and crime films. However, she dislikes gore and violence and thus stays away from many crime series. She likes to see the psychology of a character in a film and also likes international content, although she is not a big fan of travel documentaries. Jane also does not like sci-fi and newly produced comedies. She chooses the content she watches based mostly on her favourite genre and description, and she is willing to experiment with new content within her favourite genre, especially when it is recommended by an editor or friends and family, as she likes to discuss what she watched wither friends, especially when it is a new release. She is quite open to new content as she is already bored by the classics as she has seen most of them. However, she does not spend much time browsing and selecting the content, she often tries random content that grabs her eye for being in her favourite genre or having an interesting description, but if she does not like it, she abandons watching quickly without trying something else. Moreover, she prefers films over series.

Persona B: Robert

Robert is a 65-year-old man who already uses IPlayer quite often and values content that is either entertaining to him or adds value to the society. He is quite tech-savvy and he likes to try out different technology features and options just to see what they do. He watches British news and

talkshows as well as documentaries about nature and art. He also enjoys shows that are related to art, music (such as concerts) or travel. He is an avid crime shows watcher and he enjoys especially Scandinavian production. On the other hand, he dislikes reality shows and content that is mostly designed for youth, he finds them too modern and progressive. He prefers series over films and he has a very long attention span while watching since he has all the time in the world. Moreover, Robert is interested in new content on IPlayer, but is a bit reserved, so he watches mostly the new content recommended to him by his close friends. He selects what he will watch in advance most of the time and selects one of the first recommendations only when he does not already have his pick in mind. Unlike Jane, he does not quit series of a film easily, rather he invests some time into watching and forming his opinion on whether to continue or not.