Marvel-ous Television:

An analysis of television adaptations of characters from Marvel Comics.

Group Members:

Brandon Bryant, Lucas Feng, John Kilfeather, Nguyen Ly, Andrew Messing

Introduction:

The Marvel Universe is a fictional universe based on Marvel Comics. Marvel has released many movies, TV shows and comics, but the main data focus of this report will be regarding viewer reviews and ratings of Marvel TV shows, both live-action and animated, since the first shows in 1966. We will also attempt to examine which other factors may have impacted these numbers.

Questions:

Below are the list of questions this report will attempt to answer, with the associated group member:

Brandon Bryant-- Does the number of IMDb reviews a Marvel TV show receives correlate with its numerical score?
Andrew Messing-- Can common cast's character predict classes?
John Kilfeather-- How do shows which appear on streaming services (Netflix, Disney+, etc.) compare to those which appear on broadcast television (Fox, CBS, etc.)?
Nguyen Ly-- How do Rotten Tomatoes audience scores compare to the critic scores in regards to Marvel TV shows?

Data Sources:

https://en.m.wikipedia.org/wiki/List_of_television_series_based_on_Marvel_Comics_publications
https://en.wikipedia.org/wiki/List_of_Marvel_Cinematic_Universe_television_series_actors
https://en.wikipedia.org/wiki/List_of_Marvel_Cinematic_Universe_film_actors
https://www.rottentomatoes.com/
https://www.imdb.com/?ref_=nv_home

Data Description:

For this project, there are four data sources. The main reference source would be the Wikipedia page of the television series based on Marvel Comics. This includes the running time of the series as well as the number of seasons and episodes. Review numbers and ratings are primarily obtained from IMDb and Rotten Tomatoes. The third source, Mergent, is used to compare Marvel and network companies finances and businesses when the television series were released and running. While TV viewership numbers would be an ideal study, the Nielson data is unfortunately only obtainable through financial means beyond the scope of this project.

The main study is comprised of 16 live-action and 32 animated TV shows for a total of 48 unique shows. The study variables are the IMDb and Rotten Tomatoes reviews (numerical, discrete). Other data including revenues of Marvel and network companies (numerical, continuous). To the right is a split list of the shows used in this dataset. Some shows will be omitted from IMDb or Rotten Tomatoes data based on lack of sufficient ratings data (ex: many shows had no Rotten Tomatoes reviews at all). For the purposes of this report, movies pertaining to the Marvel Cinematic Universe will be acronymed as "MCU." This pertains mainly to the live-action TV series' which appeared on Netflix.

Live-Action Tv Series	Animated TV Series
Agent Carter	Captain America
Daredevil	Hulk
Jessica Jones	Iron Man
Luke Cage	Mighty Thor
Legion	The Sub-Mariner
Iron Fist	Fantastic Four
The Defenders	Spider-Man
Inhumans	The Fantastic Four
The Gifted	Spider-Woman
The Punisher	Spider-Man
Cloak & Dagger	Spider-Man and His Amazing Friends
Agents of S.H.I.E.L.D.	The Incredible Hulk
Runaways	X-Men
Blade: The Series	Fantastic Four: The Animated Series
Mutant X	Iron Man
The Incredible Hulk	Spider-Man : The Animated Series
	The Incredible Hulk
	Silver Surfer
	Spider-Man Unlimited
	Avengers: United They Stand
	X-Men: Evolution
	Spider-Man: The New Animated Series
	Fantastic Four: World's Greatest Heroes
	The Spectacular Spider-Man
	Wolverine and the X-Men
	Iron Man: Armored Adventures
	The Super Hero Squad Show
	The Avengers: Earth's Mightiest Heroes
	Ultimate Spider-Man
	Hulk and the Agents of S.M.A.S.H.
	Guardians of the Galaxy
	Spider-Man

Figure 1: Marvel TV Series List

IMDb Rating Scores vs Number of Reviews:

When reading reviews of a television show, it stands to reason that the rating score a show receives is linked in some way to that show's popularity, in that a more popular show will be rated higher, thus having more reviews. Our data shows that this is mostly true, the highest rated shows had the most reviews, but there are a few outliers of which shows that were only moderately popular also had high scores, or would have lower scores than less popular shows. The show *Iron Fist* for example, boasted 104824 reviews, but a paltry 6.5 ratings score.

Although this score should be “above-average” on a 1-10 scale, modern ratings scales are more correctly rated 5-10, with some truly awful shows rating below 5, none of which appeared in our data.

With the rise of Netflix, television shows are more accessible than ever, and with that more people are likely to review said shows even if they are not well received. The majority of the live-action shows in our data are also on Netflix, while very few (if any) of the animated shows are. Our data shows that the shows which do have a higher number of reviews, are more likely to have a higher score as well. The graph in Figure 2 of animated shows, which has nearly twice the data points, better illustrates this phenomenon. In particular, the shows *X-Men (1992)*, *Spider-Man: The Animated Series(1994),* and *The Avengers: Earth’s Mightiest Heroes (2010)* had both the three highest ratings and the three highest number of reviews.

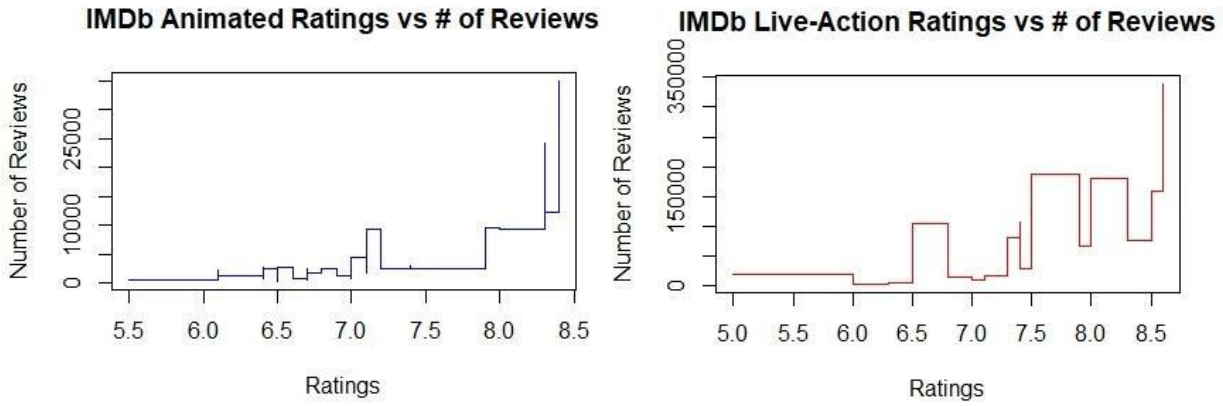

Figure 2: IMDb Ratings vs Review

Indeed as well, the correlation graphs (Figure 3 below) of this data confirm that the number of reviews has a strong correlation with the ratings of which a show receives. In our data, the live-action series has a correlation of approximately 0.662, while the animated series is 0.738. This stands up to intuition in that a more enjoyable show would also be more popular, which would lead to both more ratings and higher scores. There are some outliers, but those may be attributed to the advent of streaming services such as Netflix, which will be examined later in this report.

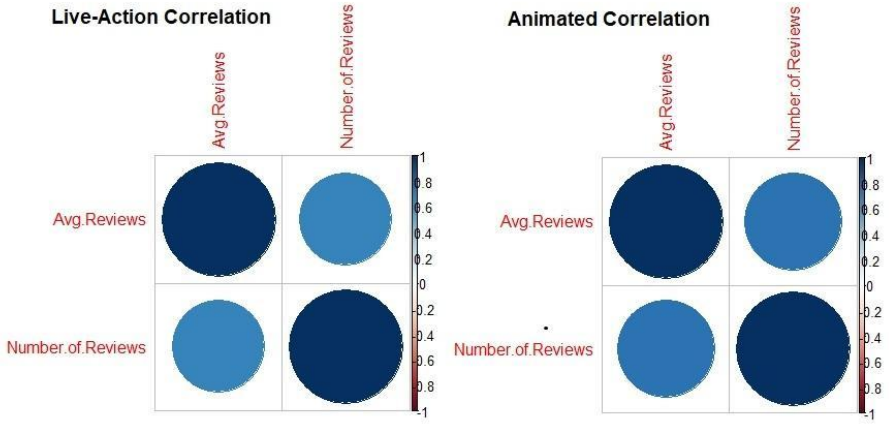

Figure 3: IMDb Ratings vs Review correlation

Grouping the Data 1: Series or Characters

One of the key changes to the modern television adaptations of Marvel comic books and their characters has been, following the more general Marvel Cinematic Universe (MCU) model, the tendency towards independent narratives and away from the more individuated model of mainstream television series. Many modern Marvel television series have, like popular *Avengers* franchise and similar cinematic universes, adopted a model that characterize many mainstream film adaptations of Marvel (and DC) comics today: relatively independent development of individual series surrounding one central character in a common world. Thus in a show such as *Jessica Jones* or *Agents of S.H.I.E.L.D.*, there are references in these series to events and persons found in other shows or films set in the same universe. Indeed, many of the cast members common to one series can be found elsewhere in the modern MCU or its television equivalent. In some ways this may seem no different from spin-offs, sequels, and so forth common to television shows for many years now. The television series *Agent Carter* is, in some ways, just such a spin-off: if looked at only in the context of its "parent" show *Agents of S.H.I.E.L.D.*, it is a fairly traditional extension of one television universe from one series to another. Within the Netflix Marvel television universe, similar things might be said of the series *The Punisher*, which features a character found in *Daredevil*, now within a series centered around him.

Yet such a characterization misses key components that differentiate the modern transmedia model used in many Marvel television adaptations from previous versions over the past several decades (Flanagan, Livingstone, & McKenny; 2016). Previous attempts to unify even successful iconic television series, such as *The Incredible Hulk* (178-82) and *The Amazing Spider-Man* (1977-79) were never realized, while in shows such as *Agents of S.H.I.E.L.D.* such

unification existed from the start: the central character (Clark Gregg's "Phil Coulson") of the show first appeared in Marvel's *Iron Man* as a member of the organization *S.H.I.E.L.D.* (whence the series' name), both of which have been featured since in multiple Marvel films such as *The Avengers*. Despite being a single actor portraying a single character, Gregg's role as Agent Phil Coulson provides an integral link between MCU and *Agents of S.H.I.E.L.D.* (as well as the later *Agent Carter*), forming a bridge between the worlds of film and Marvel television series (Scott, 2017). Likewise, while its true that *The Punisher*, at least in relationship to *Daredevil*, is quite like spin-offs such as *Angel* in which the central character first appeared as a recurring one in another series (*Buffy the Vampire Slayer*). But this misses the overall context of both series. Jon Bernthal's Frank Castle is hardly the only character to appear on both shows, and the list of characters common to both series includes cast members that can be found elsewhere within Netflix Marvel universe. In fact, while the character Phil Coulson provides a direct link between the MCU and *Agents of S.H.I.E.L.D.* as well as *Agent Carter*, Netflix's Marvel universe begat its own parallel by constructing a television version of *The Avengers* franchise: *The Defenders*. Here, storylines from multiple Marvel series line-up (along with their characters) and, as in the films, the stories of the individual characters continue after the series finale.

There are many ways to quantify and analyze the interconnectivity of the Marvel television series and to what extent they can best be characterized as individual adaptations along the lines of traditional television series or into more complex groupings that transcend traditional boundaries. Network analysis, for example, is a common set of tools widely used to model and visualize the kinds of connections that exist between Marvel television series, their respective characters and storylines, etc. Latent variable analysis is another approach to uncovering hidden structures and relationships in data. But these models can quickly become too complex and computationally demanding. Fortunately, the above review of changes to the cinematic and televised marvel universe above provides a possible solution.

If, as argued in Scott (2017), Phil Coulson (played by Clark Gregg) can provide a bridge between the film franchise and the television series *Agents of S.H.I.E.L.D.*, could such cast member portrayals of characters in television series do the same? It is certainly true that many links between a Marvel television series and a broader universe exist beyond that of a particular actor's portrayal of a character (if for no other reason than that in both film and television over the decades different the same characters have been portrayed by different actors in different adaptations). For example, "[a]lmost every episode of Marvel's *Agents of S.H.I.E.L.D.* features references to the events and characters within the film franchise" (McSweeney, 2018; §9.1), and such references to other series or films within the Marvel universe are found frequently elsewhere in the sampled live action series (albeit not as frequent as "almost every episode"). Other connections among different series and between a series and recent Marvel films may also exist. Here, however, we will extend only what interrelationships can be captured by shared

appearances across series and/or between a series and the films. It will be assumed that, as in *Agents of S.H.I.E.L.D.*, shared or common cast members' characters can serve as proxies for interrelating factors more generally.

To assess the possibility that 1) interesting classifications of series into larger, Marvel sub-universes can be found by examining shared cast members' characters and 2) whether such groupings may shed light on the data gathered from IMDB and Rotten Tomatoes, it was first necessary to identify the main and recurring cast members in the relevant live action shows. This was done first by finding those cast members listed under the "Starring" section of the Wikipedia infobox for each series as well as the Marvel Cinematic Universe television actors Wikipedia page. The result yielded the names of 188 actors listed by Television series in which they appeared. Names common to more than one list were identified and counted. The names were then checked against the Wikipedia page for MCU film actors. Because this study is concerned with Marvel television, neither the number nor the names of the Marvel film(s) an actor appeared in were recorded. Instead, a single list was created and peopled by the names of those cast members of Marvel television series characters who made an appearance in at least one film. Accounting for duplicate appearances yielded a list of 153 cast members, out of which 66 portrayed characters common to at least one Marvel television series or appeared in the films:

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Min. 1st Qu.  Median    Mean 3rd Qu.    Max.

  1.000   1.000   1.000   1.303   1.000   6.000
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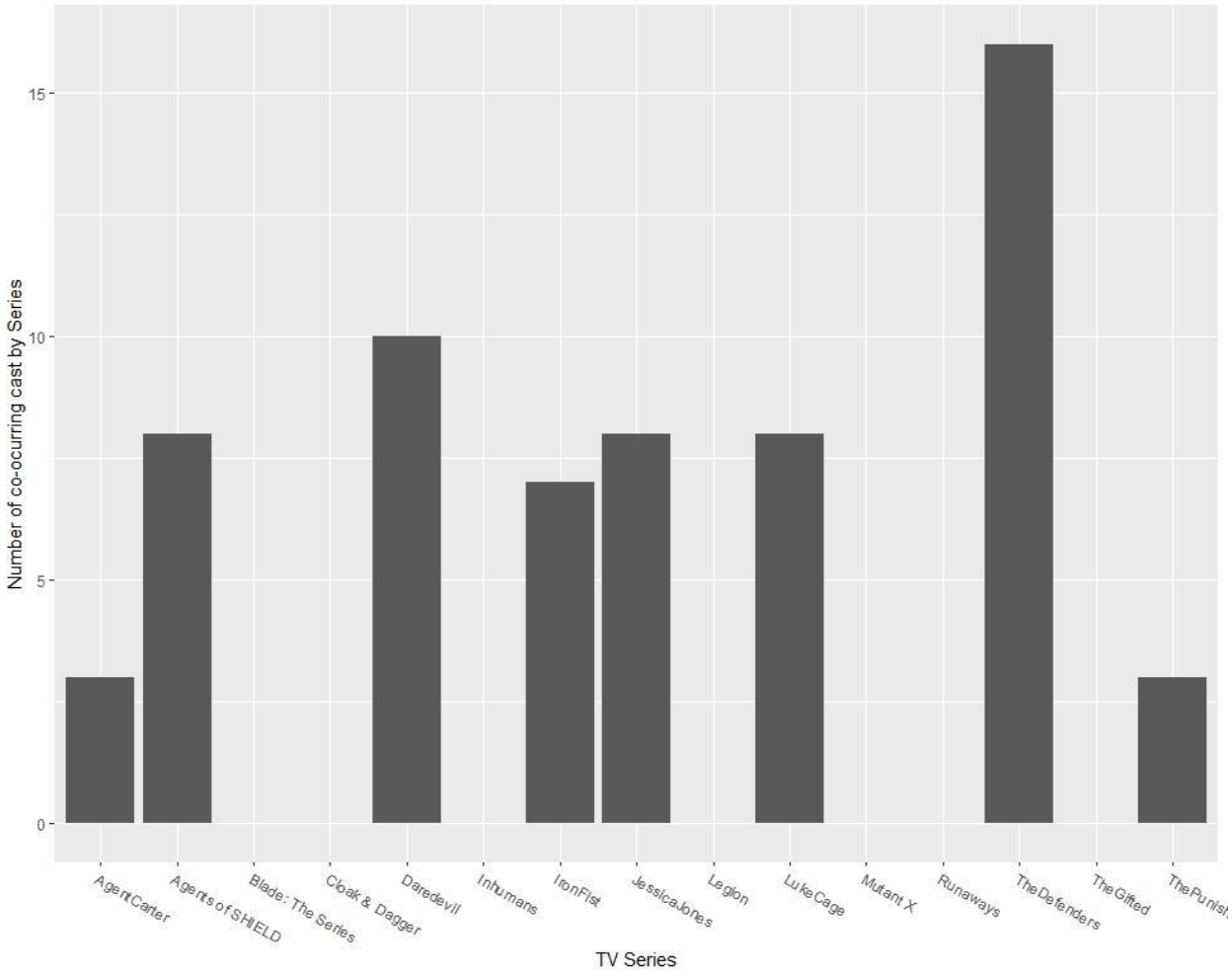
As expected, the raw counts of cast members whose characters appear more than once is not high relative even to the main cast of any given series (let alone the entire cast!). However, we recall that a motivation for this analysis was the single character/cast member link between the entire MCU and *Agents of S.H.I.E.L.D.* (and also the power law distribution characteristic of social networks and similar small world graph models). What is more relevant is the breakdown of reoccurring cast member characters by series:



It is clear that several of the series (seven) share no cast members while many others (eight) share more than a few and one series, *The Defenders*, has 16 out of 17 cast members shared among other Marvel series. Of those with common cast members, only two series appear outside the Netflix Marvel Universe: *Agents of S.H.I.E.L.D.* and *Agent Carter*. These two series also contain all the characters found in the Marvel films.

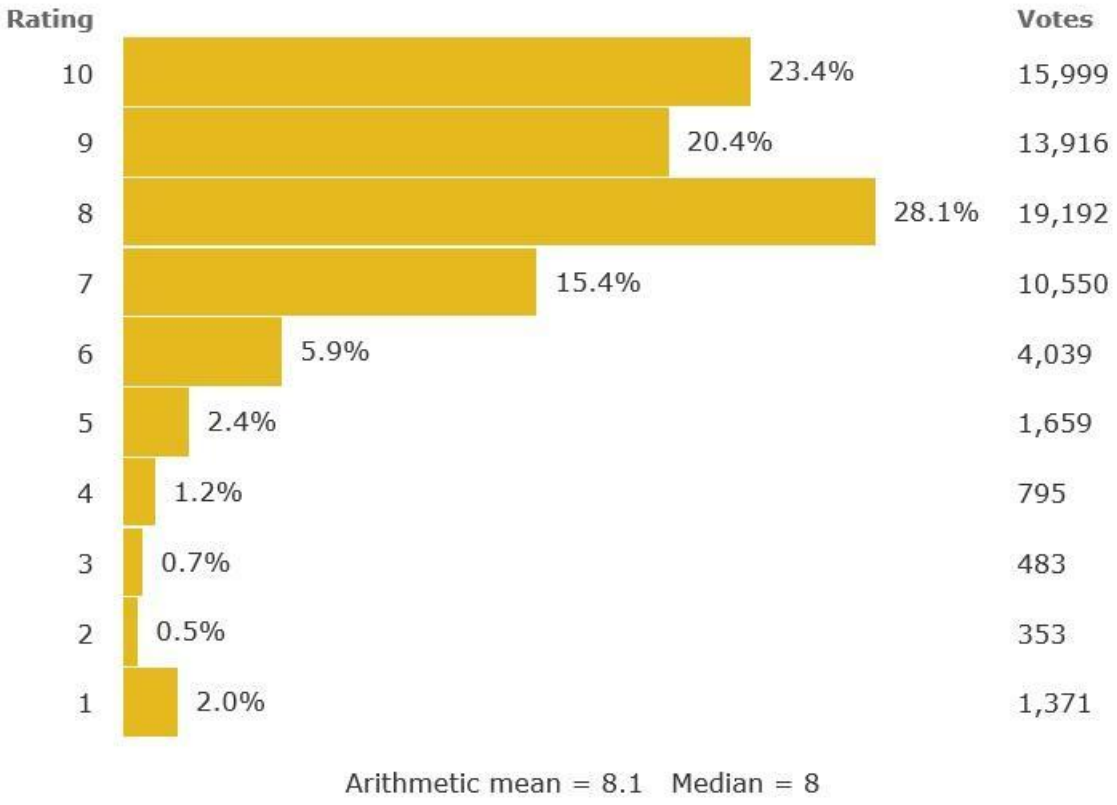
We now have an empirical, quantitative basis for grouping the IMDB ratings and review data by shows sharing a "character" universe rather than simply by series: The Netflix Marvel Universe, the *Agents* universe, and the more isolated series can all be investigated as groups. If the increasing tendency towards shared plots, characters, references, events, and so forth that characterizes the modern Marvel film and television adaptions also drive audience ratings, we might expect that variances among "shared" universe is smaller than those which are relatively isolated. Additionally, we will investigate whether it appears that the ratings and review data support these classifications by how the data are clustered when examined by these groups.

Unfortunately, Rotten Tomatoes has an extremely misleading way of displaying both their audience and critic scores. Looking at Rotten Tomatoes page for *Agent Carter*, for example, we find that the "Average Tomatometer" is 86% while "Average Audience Score" is 85%. The "Tomatometer" is supposed be a measure of critics' ratings. In fact, "[a] Rotten Tomatoes score represents the percentage of critics who felt mildly to wildly positively about a given film" (Wilkinson, 2017). In other words, rather than aggregating actual scores from critics, Rotten Tomatoes determines whether or not (and by criteria unknown) a review is positive or not. All positive reviews are counted equally, as are "negative" (or non-positive). The actual "score" is really a count of how many critic reviews were counted as positive or not.

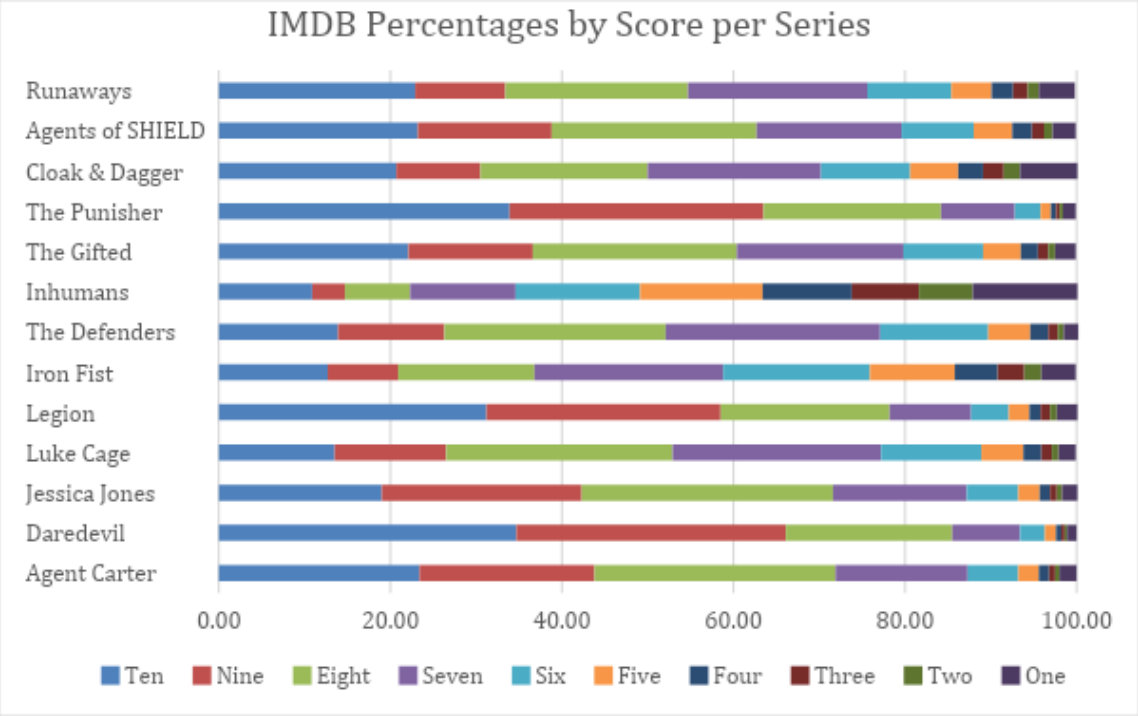
The "Average Audience Score" is, if anything, much worse. Like IMDB, Rotten Tomatoes allows users to award scores to the shows or movies they wish to review. Unlike IMDB, however, the average audience scores are NOT actually averages! Rather, they are the "percentage of users who rated this 3.5 stars or higher" (as can be seen e.g., by clicking on "more info" on the "Agent Carter" page where the scores are displayed). Thus when Rotten Tomatoes claims that the "Avg Audience Score" for *Agent Carter* is 85%, what they in fact mean by this is that out of all the audience scores received (the numbers are rarely given), the "score" is the percent of scores that were at least 3.5 stars.

It is still possible, as seen above and below in other sections, to compare these scores as scores both to IMDB averaged scores and as critic vs. audience scores. We will begin here, though, with a more robust (albeit cruder) approach in part so as to validate the heuristic use of these percentages as averaged scores elsewhere.

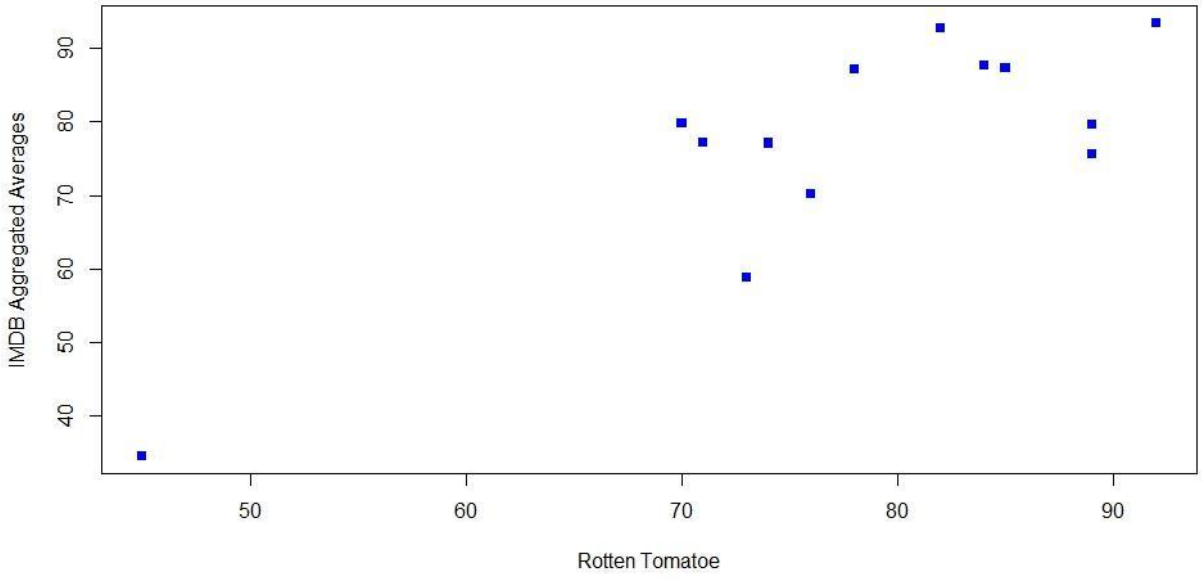
IMDB scores are based on a 10-point scale, as pointed out in the section above. Unlike Rotten Tomatoes, however, IMDB not only includes the number of reviewers that the score is averaged from, but includes a breakdown by number and percentage of each individual rating behind an average. Thus, for example, we find the following scores for *Agent Carter*:



In order to assess the validity of comparisons across IMDB and Rotten Tomatoes, the rounded percentages from each live action show which had a Rotten Tomato audience score were recorded:



Scores were then calculated for each series in a manner consistent with Rotten Tomatoes methods: for each series, the percentages of those ratings deemed "positive" (see below) were summed to form a single "audience score" that reflects the percentage of ratings which were equivalent to a 3.5 score or higher on rotten tomatoes (i.e., a score of 7 out of 10). The resulting single aggregated "scores" from IMDB for each series were compared against those from Rotten Tomatoes. The results supported the heuristic use of Rotten Tomatoes as a comparable metric:



While the results supported the comparable rating scales across sites, they made difficult a more nuanced analysis of the ratings data when grouped as above. There are indeed differences among groups, but the IMDB and Rotten tomatoes data do not in general provide accurate and reliable enough data to ensure that within and between group variances reflect the underlying universe structures identified by shared characters via common cast members as opposed to the more isolated universes of other series rather than by e.g., digital vs. streaming. Therefore it is to this second approach to grouping we now turn.

Flanagan, M., Livingstone, A., & McKenny, M. (2016). The Marvel Studios phenomenon: inside a transmedia universe. Bloomsbury Publishing USA.

McSweeney, T. (2018). *Avengers Assemble!: Critical Perspectives on the Marvel Cinematic Universe*. Columbia University Press.

Scott, S. (2017). Modeling the Marvel everyfan: Agent Coulson and/as transmedia fan culture. *Palabra Clave*, *20*(4), 1042-1072.

Wilkinson, A. "Rotten Tomatoes, explained: Does a movie's Rotten Tomatoes score affect its box office returns? And six other questions, answered". https://www.vox.com/culture/2017/8/31/16107948/rotten-tomatoes-score-get-their-ratings-top-critics-certified-fresh-aggregate-mean

Grouping the Data 2: Streaming vs Broadcast:

One question that we came across in the data was the impact of streaming vs broadcast viewership and ratings. How well do the shows on Netflix compare to ones on broadcast television?

The subset of data chosen for this comparison were the following:
Netflix- The 6 live action shows that aired on Netflix exclusively: *Daredevil, Jessica Jones, Luke Cage, Iron Fist, Defenders, Punisher.*

Broadcast- The 6 live action shows that primarily aired on broadcast television after the debut of the MCU that bound both sets in continuity: *Agents of S.H.I.E.L.D., Agent Carter, Legion, The Gifted, Inhumans, Cloak and Dagger.*

Doing a direct comparison on the datasets yielded the following averaged results:
(Netflix vs Broadcast for format)
IMDb ratings: 7.7 vs. 7.2
IMDb viewership numbers: 162k vs 66k
Rotten Tomatoes Critic score: 74 vs 75
Rotten Tomatoes Viewer score: 78 vs 75

This data on its face shows a clear competition in ratings with both getting decent enough reviews, but viewership data shows a massive preference towards Netflix. But the data needs a bit of refining. As I calculated the standard deviations, I noticed some rather high ones. This implies that either the data was very spread out or there existed outliers that were messing with averages. Looking through the data I saw that each subset had a single show either at or close to 2 standard deviations away from the average for ratings. In the case of Netflix we had *Iron Fist*, and for broadcast we had *Inhumans*. Both significantly weighted down the averages. So I decided to omit these two data points since each side had one.

By doing so the standard deviations became markedly lower (save for one) as the following comparison shows:

Netflix
IMDb standard deviation: from .8 to .6
Rotten Tomatoes critic standard deviation: from 19.81 to 11.26
Rotten Tomatoes viewer standard deviation: from 7.76 to 8.17

Broadcast
IMDb standard deviation: from 1.2 to .5
Rotten Tomatoes critic standard deviation: from 31.60 to 5.68
Rotten Tomatoes viewer standard deviation: from 16.14 to 7.66

With the data now having the outliers removed I was able to re-average the data and found that the closeness hadn't changed much but had shifted the ratings balance slightly in favor of broadcast, but the viewership still *overwhelmingly* favored Netflix as shown in the data below:

(Netflix vs Broadcast for format)
IMDb ratings: 8.0 vs. 7.6
IMDb viewership numbers: 174k vs 75k
Rotten Tomatoes Critic score: 81 vs 87
Rotten Tomatoes Viewer score: 79 vs 81

So the answer to the question of Streaming versus Broadcast superiority seems to be that Netflix is the superior option, given that ratings are very close on both platforms, but viewership is vastly higher on streaming sites. It also shows that almost all serialized live action content put out by Marvel in the MCU era is of high quality as a side note.

Critic vs Audience score (Rotten Tomatoes):

Rotten Tomatoes Live Action Critic Score Summary:

Minimum	1st Quartile	Median	Mean	3rd Quartile	Max
11.00	66.75	84.50	73.36	87.75	94

** n = 14

Rotten Tomatoes Live Action Audience Score Summary:

Minimum	1st Quartile	Median	Mean	3rd Quartile	Max

41.00	71.50	77.00	74.93	84.75	92.00

** n = 14

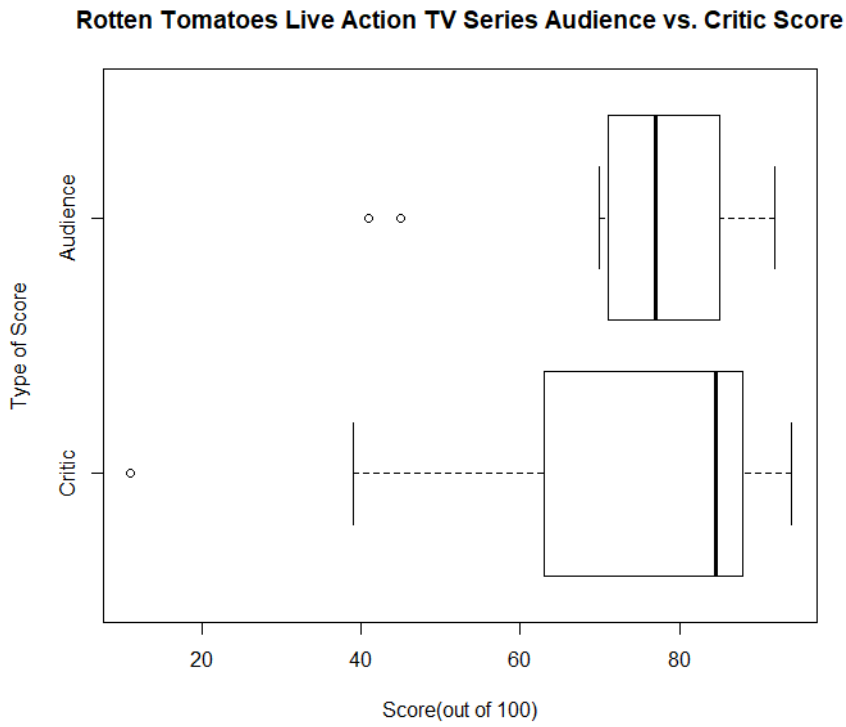


Figure 4. Comparison between Rotten Tomatoes Audience Score and Critic Score for Marvel's Live Action TV Series.

Based on the data for Marvel's live action TV Series, there is a 11.14 points difference between the median and the mean scores. This is due to the minimum value, the Inhuman series, being an outlier with a score of 11. In comparison, for the Rotten Tomatoes audience score, there is a difference of 2.07 points between the median and the mean. However, this difference is less than the one for the critic score. There are two outliers for this set of data, at a score of 41 and 45, which is the series The Incredible Hulk and Inhumans respectively. For both critics' score and audiences' score, Inhuman had a low score and was an outlier. There is also a 7.5 points difference between the median of the critic and audience scores. The critics rated the live action TV series higher than the audience.

In Figure 4, the spread of the critics score is wider than the spread of the audience score. For critics score, this is an IQR of 21 points, whereas the audience score has an IQR of 13.25. Based on the IQR and Figure 4, there is a higher variability of scores in the critics score than the audience score.

Difference in Rotten Tomatoes Live Action Scores Summary:

Minimum	1st Quartile	Median	Mean	3rd Quartile	Maximum
-34.000	-3.000	4.000	-2.385	7.000	17.000

** n = 13

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The decimal point is 1 digit(s) to the right of the |

-3 | 44
-2 |
-1 | 9
-0 | 3
 0 | 0145579
 1 | 17
```

Figure 5. The stem and leaf plot compares the distribution of differences between critic and audience scores of Live Action Marvel TV series

Based on the stem and leaf plot in Figure 5, the distribution is unimodal and skewed to the right. This is reflected in the median where the difference in scores is 4.00. The mean is more impacted by extreme numbers, which is why the mean is at -2.385. In general, most of the differences in scores does not extend beyond 10 points. When taking out the outliers, which is Iron Fist (-34), Inhumans(-34), and Cloak & Dagger (-19), on average the critic rate the live action TV series 5.6 points higher than the audience. Without removing the outliers, critics rate the live action TV series 4 points higher than the audience.

Rotten Tomatoes Animated Series Critic Score Summary:

Minimum	1st Quartile	Median	Mean	3rd Quartile	Maximum
50	65	80	77.86	92.50	100

** n = 6

Rotten Tomatoes Animated Series Audience Score Summary:

Minimum	1st Quartile	Median	Mean	3rd Quartile	Maximum
67	73	84	84.23	96	100

** n = 19

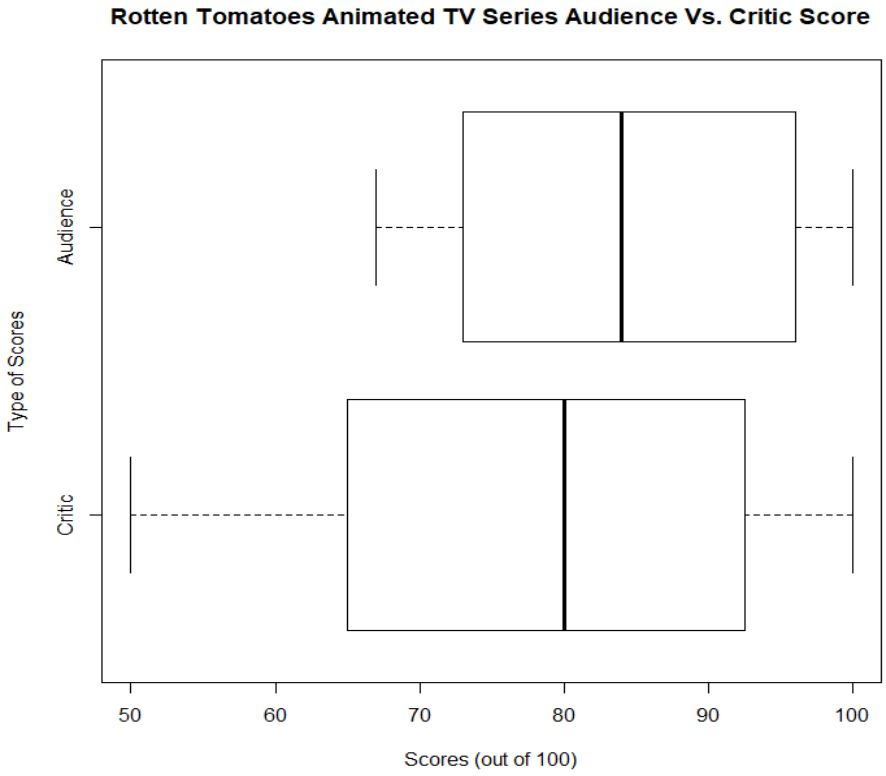

Figure 6. Comparison between Rotten Tomatoes Critic and Audience scores for Marvel's Animated TV Series.

It is important to note that the amount of data points for Rotten Tomatoes critic scores for Marvel's animated series is low, with n = 6. Based on the data, there is a 6.37 points of difference between the mean of the critic score and the audience scores, whereas there is only a 4.0 points difference between the median. There is no particular outliers. However, this can be due to the low numbers of data points. Based on Figure 6, the distribution for the audience score and critic score seems normal and without skewness. The distribution of data for the critics score is more spread out than the audience scores. For critics, the scores spread from 50 points to 100 points, whereas for the audience, the scores spread from 67 points to 100 points.

Difference in Rotten Tomatoes Animated TV Series Scores Summary:

Minimum	1st Quartile	Median	Mean	3rd Quartile	Maximum
-17.00	-11.00	-3.0	-5.6	0.0	3.0

** n = 5

Since n = 5, there is not enough data to see the distribution for the difference between the critic and audience scores for the animated series. However, it seems that the critics rate the animated series lower than the audience. On average, the critic rate the animated series 5.6 points lower than the audience.

Animated vs Live-Action ratings on average:

IMDb and Rotten Tomatoes Live Action Score Summary (out of 100):

Minimum	1st Quartile	Median	Mean	3rd Quartile	Maximum
35.33	74.83	79	76	86	90.50

IMDb and Rotten Tomatoes Animated Scores Summary (out of 100):

Minimum	1st Quartile	Median	Mean	3rd Quartile	Maximum
55.5	72	76.50	77.51	85.75	94.33

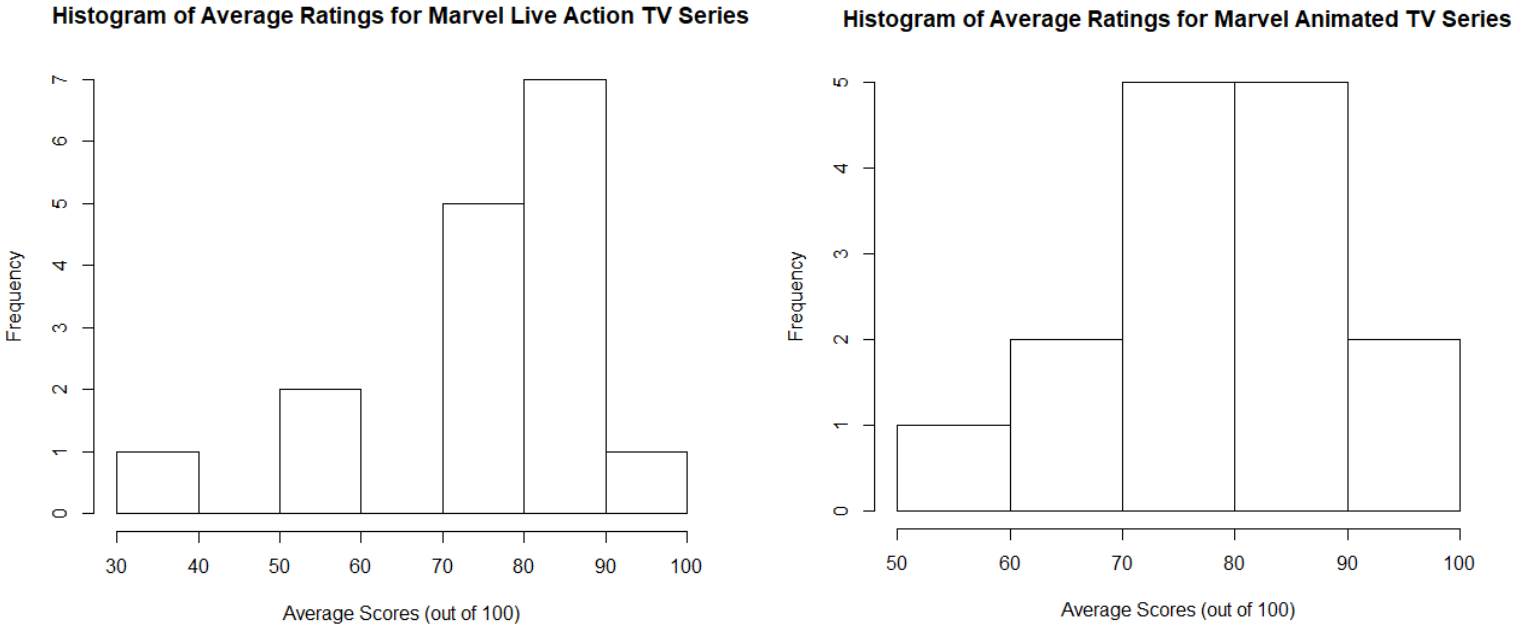

Figure 7. The two histograms shows the distribution of average scores of IMDb ratings, Rotten Tomatoes Critics Scores, and Rotten Tomatoes Audience Scores for both Marvel's Live Action and Animated TV series. The IMDb scores were changed to out of 100 instead of out of 10.

Based on the histograms in Figure 7, the distribution of the average rating for Marvel live action TV series is skewed to the right while the ratings for Marvel animated TV Series is symmetric. Due to its skewness, the live action series has some series with low ratings. The outlier of scores would be the series with the average score of 35.33, which is the Inhumans series.Otherwise, the scores for all the series is between the range of 50 to 100 points. The distribution for the ratings for both the live action series and animated series are very close. The median, Q1, and Q3 for both distribution is within 1 or 2 points away from each other. The mode

of average ratings for live action TV series is between 80 and 90 points out of 100. And the mode of average ratings for animated TV series is between 70 and 90 points out of 100.

Since Rotten Tomatoes review for live action and animated series for both audience and critic scores does not pass the Shapiro Wilks Test for normalcy, we look at IMDb scores for analysis.

Shapiro Wilks Test for IMDb Scores:
Null Hypothesis: The distribution of IMDb animated TV series scores is normal.
Alternative Hypothesis: The distribution of IMDb animated TV series scores is not normal.

```
> shapiro.test(IMDb_AN$`Avg Reviews out of 10`)

        Shapiro-Wilk normality test

data:  IMDb_AN$`Avg Reviews out of 10`
W = 0.94699, p-value = 0.1183
```

Null Hypothesis: The distribution of IMDb live action TV series scores is normal.
Alternative Hypothesis: The distribution of IMDb live action TV series scores is not normal.

```
> shapiro.test(IMDb_LA$`Avg Reviews out of 10`)

        Shapiro-Wilk normality test

data:  IMDb_LA$`Avg Reviews out of 10`
W = 0.96388, p-value = 0.7324
```

In both tests, we cannot reject the null hypothesis at the 5% level of significance. The p-value for the Shapiro Wilks Test for IMDb animated TV series is 0.1183. The p-value for IMDb live action TV series is 0.7324. The data suggests that the IMDb scores for the animated and live action TV series is normal.

Two Sample T-Test:
Null Hypothesis: The mean reviews of the two groups are the same. (H_0: $\mu_{LA} - \mu_{AN} = 0$)

Alternative Hypothesis: The mean reviews of the two groups are not the same.
(H_A: $\mu_{LA} - \mu_{AN} \neq 0$)

```
> t.test(IMDB_LiveAction, IMDB_Animated)

        Welch Two Sample t-test

data:  IMDB_LiveAction and IMDB_Animated
t = 1.1983, df = 24.737, p-value = 0.2421
alternative hypothesis: true difference in means is not equ
al to 0
95 percent confidence interval:
 -0.2383618  0.9008618
sample estimates:
mean of x mean of y
  7.22500   6.89375
```

Based on the two sample t-test, we cannot reject the null hypothesis at the 5% level of significance. The data suggests that the difference in means review IMDb scores for both Marvel's live action and animated TV series are the same. Based on the confidence interval, we are 95% confident that the differences in means is between -0.2383618 and 0.9008618. If we were to repeat this data and compute a 95% confidence interval for the differences in means of the two types of series, 95% of the resulting confidence interval will contain $\mu_{LA} - \mu_{AN}$. We hope that our confidence interval (-0.2383618, 0.9008618) is one of the 95% that does contain $\mu_{LA} - \mu_{AN}$.

Conclusions:

Our findings suggest a strong correlation between ratings scores and number of reviews. We've also discovered that both ratings scores and reviewer numbers were higher on average on streaming services such as Netflix than their broadcast counterparts. An algorithm was designed to predict the likelihood of a given actor appearing in a given Marvel TV show, and compared critic versus audience scores of the shows. The latter of which suggests that critics rate shows on average much lower than audience members.

When comparing Rotten Tomatoes reviews, on average, critics rate live action series 4.00 points higher than the audience. For animated series, on average, critics rate 5.60 points lower than audience. However, for the animated series, the data is largely incomplete and resulted in a low number of scores from critics. For the animated series critics' score, n = 6. Therefore, we look into comparison between all the combined scores between Rotten Tomatoes critics, Rotten Tomatoes audience, and IMDb. In this case, both live action and animated series have roughly the same distribution, range, IQR, and median. However, the live action series have 1 series which rated significantly low, which is the Inhuman series. When looking at the differences in means between the two types of series, we look at the IMDb data. The data suggests that the mean reviews of the two groups are the same.