Alliance for My Idol: Analyzing the K-pop Fandom Collaboration Network

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ABSTRACT

As the K-pop industry has been rapidly expanded, the strength of the K-pop fandoms is under the spotlight. In particular, the collaborations among fandoms for mutually supporting their artists have contributed to the success of the K-pop artists. This paper investigates the current practice of the fandom collaborations in K-pop. To this end, we first introduce the notion of the 'fandom collaboration network' that represents the collaborations among K-pop fandoms. By collecting and analyzing a large-scale fandom activity data from DCinside, we investigate (i) to what extent fandom collaboration is prevalent in K-pop, (ii) how fandoms collaborate with other fandoms, and (iii) what fandoms play
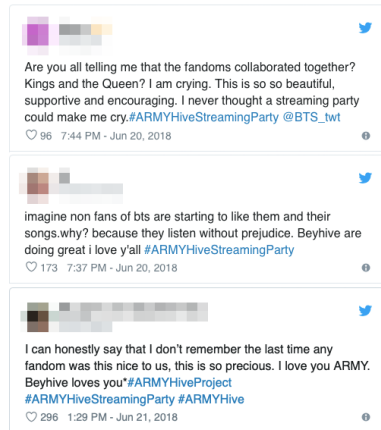
Figure 1: Examples of tweet for collaboration between two fandoms: ARMY (BTS's fandom) and HIVE (Beyonce's fandom).

Figure 2: An illustrative example of a fan gallery (the BTS fandom) in DCinside.

more roles in fandom collaboration than others. We find that K-pop fandoms actively collaborate with other fandoms for mutually supporting their artists. By analyzing the structural properties of the fandom collaboration network, we show the fandom collaboration is basically based on the reciprocity. However, we also show that the amount of collaborations between the two fandoms is often unfair. Among all the active fandoms in our data, we find that there a small number of fandoms who play significant roles in fandom collaborations in K-pop. We believe our work can provide important insight for K-pop stakeholders such as fans, agencies, artists, marketers, and broadcasting companies.

INTRODUCTION

The K-pop industry has been rapidly expanded. Bloomberg Businessweek reported that the K-pop international sales reached over $4.7 billion in 2016, by citing the Korea Creative Content Agency [7]. The 'BTS' (a K-pop boy group) can be one of the representative examples that reveals the success of the K-pop in the global music market, especially in the US mainstream music industry. They ranked at #1 in the Billboard 200 Charts twice in 2018, and received the Top Social Artist Award at the Billboard Music Awards in both 2017 and 2018, which recognizes the most influential artist in social media. According to the data reported by the Next Big Sound, the BTS had been mentioned over 36 M times in Twitter from February to March in 2018, which outperformed all the other artists [1].

The huge success of K-pop is significantly contributed by the fans of K-pop artists, or *fandoms*, each of which is a group (or a community) of fans who support an artist (e.g., BTS, Beyonce). In general, a 'fandom' is a group of fans who share a common interest such as supporting a sports team [11] or a K-pop idol [1], watching a television drama [4]. Such fandoms usually tend to (i) consist of passionate fans, (ii) reveal strong cohesion [1], and (iii) share its own culture [4]. In this way, K-pop fandoms can contribute to the success of their artists in various ways; e.g., making a voice that affects the decision of the agency by posting the tweets in Twitter; starting a campaign to raise a rank of the favorite idol in record charts; voting for their artists in the annual music award. For instance, the BTS's fandom, 'ARMY', has continuously contributed to the success of the BTS [1].

This, in turn, has spurred research into the activities of K-pop fans [5, 6, 10]. Min *et. al* [10] showed that K-pop fans in Chile actively developed an affinity with K-pop culture through social media. Kim *et. al* [5] founded that K-pop fan networks are internationally abundant in Twitter, and they communicate with each other by sharing URLs about K-pop. The prior studies have revealed valuable insights into understanding individual fan behavior. However, relatively little attention has been paid to *how a fandom interacts with other fandoms*, rendering the following research questions: How do K-pop fandoms interact with each other? Are those interactions reciprocal or parasocial? Are there fandoms that play more roles in fandom interactions than others?
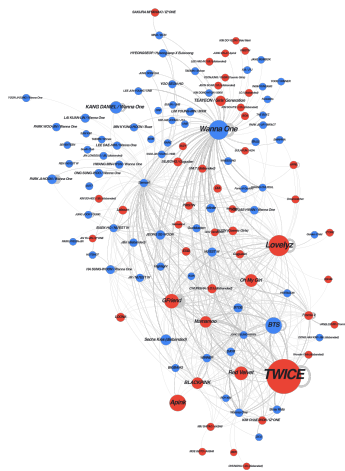
To answer these questions, this study investigates interactions among K-pop fandoms in the first place. In particular, we focus on 'collaboration' between two fandoms for mutually assisting their
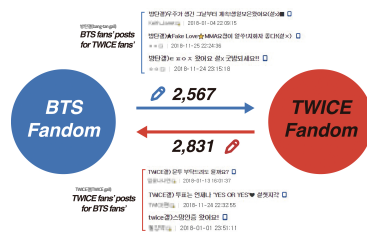
Figure 3: The links between the 'BTS' and 'TWICE' fandoms in the fandom collaboration network.

Figure 4: The fandom collaboration network among the K-pop fandoms. For a visualization purpose, we only display the edges with the top 1% weights. A larger circle indicates the large number of posts (activities). The red and blue colors indicate girl and boy idol groups, respectively.

artists, one of the notable interactions among K-pop fandoms. For example, Billboard [3] reported that 'ARMY' (the fandom of the BTS) and 'HIVE' (the fandom of Beyonce) mutually support their new songs by posting tweets with the '#ARMYHiveStreamingParty' hashtag for boosting their ranks up in the music streaming charts (See Figure 1). To represent the cooperations among K-pop fandoms, we introduce the notion of *'fandom collaboration network'* where there exists a link between two nodes (fandoms) if one of them supports the other fandom (Figure 3). We collect and analyze the fandom activity data from popular 321 K-pop fan communities on *'DCinside'*, a popular interest-based online platform that includes active and representative fandom communities, which contains 18,817,412 posts updated from January 1st to November 25th, 2018. Using the collected data, this paper investigates: (i) to what extent fandom collaboration is prevalent in K-pop, (ii) how fandoms collaborate with other fandoms, and (iii) what fandoms play more roles in fandom collaboration than others.

FANDOM ACTIVITY DATA

To analyze how K-pop fandoms interact/cooperate with each other, we collected fandom activity data from *DCinside (https://www.dcinside.com)*, a popular interest-based online platform that includes active and representative K-pop fan communities. A 'gallery' in DCinside is a topic-based community, and users who are interested in the topic of the gallery can write and read posts, and write comments to uploaded posts as well as others' comments. As anyone can create a new gallery under the permission of the manager in DCincide, multiple fan galleries for the same idol group can exist, and those fan communities may support whole members of the idol group or a particular member of them. That is, there can exist galleries for the BTS and RM (a rapper of the BTS), respectively. In our work, a fan gallery is regarded as a 'fandom'. Figure 2 shows an example of a fan gallery for the BTS in DCinside.

To identify target K-pop fandom galleries in DCinside, we first explored the weekly Top 100 music charts reported by *Melon (https://www.melon.com)*, a popular music streaming service site in Korea, from January 1st to November 25th in 2018, and identified 30 K-pop idols whose songs had been listed in the charts. We first collected 6,761,817 posts from all the galleries that are associated with the 30 idol groups. By analyzing the post information of the collected galleries, we then identified additional K-pop fandom galleries that support the collected galleries or are supported by the collected galleries at least 100 times, and then collected all the post information of them. Each post information includes its title, uploaded date, view, comment and likes count, username, userid for a registered user or (partial) IP address for an unregistered user, and the name of the associated fan gallery. Finally, the collected data contains 18,817,412 posts uploaded in the 321 distinct fan galleries, from January 1st to November 25th in 2018, in DCinside.

FANDOM COLLABORATION NETWORK

To model the collaborations among K-pop fandoms, we introduce the notion of *'fandom collaboration network'* as a weighted directed graph, $G = (N, E, W)$, where N is the set of fandoms and E is the set
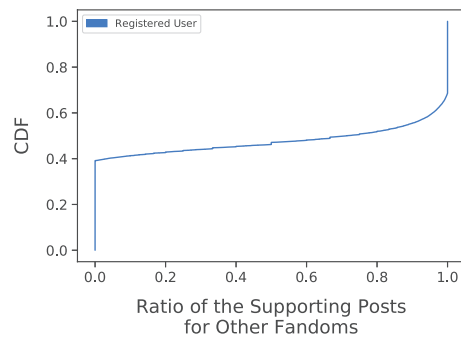
Figure 5: Ratio of the number of posts for supporting other fandoms to the number of all the posts uploaded in other fandoms for each registered user.
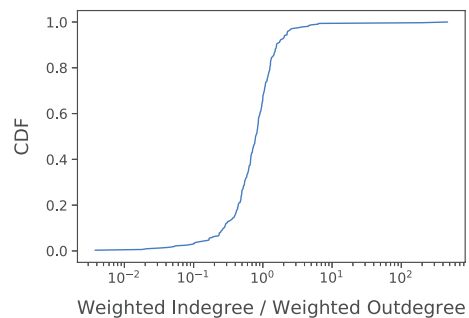
**Figure 6: Ratio between the weighted indegree and outdegree for each fandom in the fandom collaboration network.**

of edges between two fandoms. That is, if a fandom *A* supports a fandom *B*, there exists a directed edge from *A* to *B*. We notice interesting fandom collaborative activities in K-pop, i.e., fans in the fandom *A* supports the fandom *B* even though they are not the fans of the *B*; more specifically, fans in the fandom *A* visit the online community page of the fandom *B*, and upload a post with a screenshot displaying the streaming proof of the song of the fandom *B*'s idol. After that, the fans in the fandom *A* can expect to get back from the fans in the fandom *B*. For effectively managing the collaboration with other fandoms, some fandoms have a moderator who manages a list of the fandoms that are planned to visit or are expected to get back. Note that the weight of each edge indicates the total number of collaborations, i.e., in our work, the number of supporting posts.

Since most of the fans write the title of collaborative posts with a consistent pattern including abbreviations of the fandom names, we can easily classify the posts whether they are collaborative fan activities, and what is the name of their associated fandom. Figure 3 is an example of the collaborations between two fandoms: BTS and TWICE fandoms. While the 'BTS' fandom writes the supporting posts to the 'TWICE' fandom 2,567 times, the 'TWICE' fandom uploads supporting posts to the 'BTS' fandom 2,831 times. Finally, our fandom collaboration network consists of 321 nodes and 57,985 edges. Figure 4 depicts the K-pop fandom collaboration network based on our collected data. The average degree and weight of the fandom collaboration network are 180.64 and 14199.11, respectively.
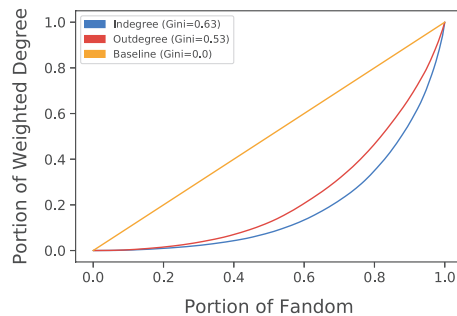
ANALYSIS ON K-POP FANDOM COLLABORATIONS

In this section, we analyze the collaborations among K-pop fandoms in the given fandom collaboration network. In particular, we seek answers to the following research questions.

Q1. How prevalent is fandom collaboration in K-pop? By analyzing all the collected posts in our data, we find that the portion of posts for the collaborative fan activities is 24.2% (4,557,914) out of all the posts, revealing that K-pop fandoms actively cooperate each other. Among the posts for participating in the collaborative fan activity, 83.6% of them are written by registered (i.e., non-anonymous) users in DCinside, who are usually regarded as passionate fans. Note that there are 56,352 registered users in our collected data. We also investigate how the registered users participate in fandom collaborations. To this end, we calculate the ratio of the number of posts for the collaborative fan activities to the number of posts uploaded in other fandom communities for each registered user in Figure 5. That is, if a user, who wrote the most in BTS fan gallery, writes 5 posts in other fandom galleries, and 2 of them are about collaborative activities, the ratio for the user is 0.4. Note that we only focus on the 48.4% of the registered users in Figure 5 since 51.6% of the registered users have not written any post in other fandom galleries in our data. As shown in Figure 5, the ratios of the over 52.9% of the users are over 0.5, meaning that a substantial portion of the registered users actively participates in fandom collaborations. Note that the ratios of the 44.5% of the registered users are close to 1, implying that those users write posts in other fandoms only for fandom collaborations.
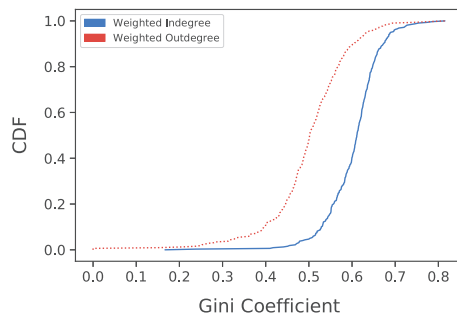
Figure 7: Gini coefficients of each node in weighted edges from/to other fandoms.

Figure 8: Lorenz Curve for the weighted degrees of the fandoms. Note that the baseline represents the case where all fandoms have the same weighted degrees.

Q2. Do more active fandoms participate in more fandom collaborations? We next analyze whether more active fandoms tend to participate in more fandom collaborations in K-pop. To this end, we measure the Spearman's rank correlation [8] between the number of all the posts uploaded in a fandom gallery and the number of posts for collaborative fandom activities. More specifically, we calculate the rank correlation between the number of posts of a node and its weights of incoming/outgoing edges in the fandom collaboration network. Note that the Spearman rank correlation indicates the correlation between the two distributions of ranks, ranging from -1 to 1. The Spearman coefficients for the incoming and outgoing edges are 0.72 and 0.77 ($p-value$ < 0.0001), respectively, implying that the active fandoms are likely to actively participate in the fandom collaborations.

Q3. Are fandom collaborations reciprocal or parasocial? We investigate whether two nodes are mutually connected in the fandom collaboration network. We find that 89.1% of the edges are bidirectional, which indicates that fandom collaborations are reciprocal. To measure how fandom collaborations are *quantitatively* reciprocal, we next measure the ratio between the weighted indegree and outdegree for each fandom in Figure 6. The ratios of 50% of the fandoms are less than 0.79, meaning that many fandoms tend to more support other fandoms but less get back from others. On the other hand, the ratios of 25% of the fandoms are higher than 1.15, implying that only a small portion of fandoms tends to mutually and fairly collaborate with others.

We next investigate whether and how the collaborations *by a fandom* are evenly distributed across the fandoms or skewed to particular fandom(s). To end this, we measure the Gini coefficient of each node (in the fandom collaboration network) in terms of weighted edges from/to other fandoms. The Gini coefficient [2] is a widely used metric for quantifying the inequality of a given distribution, ranging from 0 to 1. If a distribution has a high coefficient value, the given distribution can be regarded as skewed. For example, if a fandom supports the fandoms A for 5 times, B for 2 times, and C for 3 times, the Gini coefficient of the fandom is 0.2. Figure 7 plots the distribution of the Gini coefficients of each fandom. As shown in Figure 7, the Gini coefficients are mostly high, meaning that a fandom tends to focus on collaborating with a small number of fandoms.

Q4. Are there fandoms that play more roles in fandom collaborations than others? To display the distribution of the fandom collaborations, we first plot the Lorenz curve [9] for the weighted degrees of fandoms in Figure 8. As shown in Figure 8, the distribution of the fandom collaborations (i.e., weighted degrees) is highly skewed, where the corresponding Gini coefficients in weighted indegree and outdegree are 0.63 and 0.53, respectively. For example, the top 10% fandoms (in terms of the number of collaborations, i.e., weighted degree) are responsible for 42.4% and 31.5% of total collaborations, in terms of weighted indegree and outdegree, respectively, as shown in Figure 8. This implies that a small number of fandoms play significant roles in fandom collaborations in K-pop.

CONCLUDING REMARKS

This paper investigated the current practice of the K-pop fandom collaborations. We showed that K-pop fandoms actively collaborate with other fandoms for mutually supporting their artists. By analyzing the structural properties of the fandom collaboration network, we found the fandom collaboration is basically based on the reciprocity. However, we also found that the amount of collaborations between the two fandoms is often unfair. Our analysis further revealed that a fandom usually tends to prefer to focus on collaborations with a few fandoms. Among all the active fandoms in our data, we showed that there a small number of fandoms who play significant roles in fandom collaborations in K-pop. We believe our work can provide important insight for K-pop stakeholders such as fans, agencies, artists, marketers, and broadcasting companies.

ACKNOWLEDGEMENTS

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