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Digital Fandom in Metrics:
How Does Capitalized Emotion in
Algorithmic Culture Raise Idol Trainees Up?

By

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Abstract

This paper looked at digital fandom under an algorithmic culture. We investigated the fan structure and their affective labor based on an idol selection contest that offers promising opportunities with our special focus on its underlying metric-competing mechanism. We also used computational simulation to verify if fans' effort on improving visible rankings on social media secures a position for their idols. By addressing these issues, we analyzed why fans are willing to trade their labor and how the capitalism logic empowers and exploits the fan community for their emotion and labor.

Keywords

Fan economy, Digital fandom, Metric Society

Introduction

Jenkins (2012) put forward the concept of 'Affective Economics' to describe the consumption behaviors driven by affection. With such development, fans are receiving more attention for their purchase power and social media influence. Digitalization on the other hand, restructures people's perception of numbers and builds hierarchical classification system based on rankings (Mau, 2019). The participation of fans on social networking sites is more visible and transparent, which provides a ground for comparison or even competition. This paper studies digital fandom under the algorithmic culture based on an idol selection contest in which the rankings are said to be determined by fan votes.

In the first section, we explained the structure of the fan community as well as their digital labor corresponding to their roles within the hierarchy. Then we applied machine learning method to look at the feature importance for interpretability. We also simulated a counterfactual contest result based on sub-boards rankings and compare it to the actual result, with the purpose of understanding and evaluating how fans involve themselves in the metric competition. Finally, with the previous result from computational method and the observations from digital ethnography, we discuss the reasons why fans participate in digital labor in an organized order and how the metric society empowers fans whilst exploiting them on the logic of affective economics.

Literature Review: Affective Economics in Metric Society

Digital technologies enable a higher-level of participation of audience (Hindman, 2008). Jenkins (2006) in particular looks at how such technologies develop new forms of participatory and collaboration culture within the fan group. Andrejevic (2008) discussed the unpaid labor and

rewards that fans gain from their fan fiction authorship. But in the more digitalized environment, fans extend their operation to other forms of labor. Stein (2015) further examined the 'feelings' that are brought up and enhanced by the increasing fanatic participation across social media, and such strong collective affections that being represented in texts, pictures, sounds, voices, videos and interactive games reciprocally construct more 'enthusiasms, emotional investments and attachments within the sphere of culture' (Kuhn, 2013). Those cultural capitals and emotional capitals derived from fandom drive the fans to leverage their loyalty towards particular brands when they make their purchasing decisions as consumers, which is defined as 'affective economics' (Jenkins, 2006, p.319). Smith (2007) also examined the capitalized emotion and demonstrated that desires are under the capitalist infrastructure. Similar to Yin (2020) argued, fans have become increasingly crucial to practice material and immaterial labor to be the most affectively and loyal consumers, in a digitalized way.

On the other hand, as many have observed, the digitalization process also gives birth to all forms of data, which provides raw materials 'for actually or seemingly objective comparison' (Mau, 2019). The language of numbers changes our perception of value and social status and as Habermas (2007) put, our everyday life is colonized by concepts of 'predictability, measurability and efficiency'. Mau further illustrates that the 'society of scores, rankings, likes, stars and grades' encourages a wider monitoring or evaluation on various social aspects based on data, which reciprocally reconstructs or even recreates a social world (Sauder, 2007) with new social orders. Mau describes this as a metric society.

The metric society permeates in all spheres of social life, including the capitalized fandom. Alaimo and Kallinikos (2017) also observed the 'computed sociality' where technology serves as foundation to bring socio-cultural subjectivity. Kuhn (2013) stated that digitalization not only

changes the forms of participation of fans, but also affects how fans 'make sense of their affective attachment to the fan objects'. The algorithmic culture then reshapes the perception, experience and performance of the individuals and community (Striphas, 2015). As data on social media is more visible and transparent than ever, it offers accountability for decision-making with evaluations and comparisons on rating, scores, rankings and other quantitative forms (Mau, 2019). Fans are encouraged to participate in 'a culture of exchange' with the rankings they manufactured on social media platforms, to negotiate with capitalists and exchange for media exposure or endorsement opportunities for their fan objects. Hills (2002) argued that affective economics calls upon capitalists to enact fan discourses of decommodification but the social media has made the fans become more willing to commodify their love, in exchange of the promised opportunities. The exchange, in the context of China, is achieved through wining the ranking competition among a number of homogeneous fan groups. Yin (2020) discovered that Weibo, the microblog in China, developed multiple sections and functions that aim to algorithmically encourage and cultivate the quantification practice of fandom. This fosters the norm for fans to perform 'giant traffic data' by making the related numbers on Weibo look bigger. In the quantitative digital environment, fans are mobilized to follow the data-based manner, yet it surprisingly lacks examination on how the metric-centered digital labor derived from their affection is organized. Tiziana (2000) also demonstrated that the net labor as a trait of cultural economy, embodies a complex relation to emotion and is an undervalued force in modern capitalist societies. This paper will explore how affection of fans turns into digital labor, how such digital labor is organized in the fan community to achieve higher quantitative measurements, how affection is in turn enhanced in a digital community, and finally how do the rankings made by fans are actually making the call.

The ‘Produce 101’ Idol Contest Series in China

• The idol industry

The traditional way of forming an idol group requires years of training and practice behind the scenes, and yet those trainees still face strict and constant elimination after years of training as sometimes the agencies would evaluate on how much they fit the market and decide whether to provide subsequent resources to these idols. The training not only includes how they sing, dance or rap but also how they look, talk and act when they face the media and the public. They are manufactured to satisfy the expectation of the K-pop fans based on the insightful market understanding from the media agencies. Unlike pure singers, dancers or actors who attract the audience by their talents or skills in their fields, idols often receive affection from fans for their appearance and personality at the very start of their career.

• The Produce 101 series

Driven by the booming fan economy, Produce 101 series is a reality survival show for idol trainees from different entertainment agencies to compete, and selecting the top 9 trainees with the highest popularity to form an idol group among over 100 trainees from different entertainment agencies in a closed environment till the final day. The trainees would be isolated from all forms of digital communication for months and would not know their popularity level until each round of ranking release.

Unlike traditional selection with a long period of training process behind the scenes, the time period of Produce 101 series is quite short, with one individual show-up performance and three rounds of group stage performances in 12 weeks, the survived trainees can directly form into an idol group that have excellent opportunities to show up in the public. During the twelve-week show, the online TV platforms will release two episodes per week. In each episode, there will not

only be scenes of their practice and performance for the three key performance stages, the reality show also plays a key part, and this might be an even more important part than the stage performances because instead of seeing the idols as end products, it offers a different scope to witness the growth of idols and understand them. Often, when a new idol group comes out, they are expected to be in an 'idol mode' and get ready for performance stages. But the contestants in the show would receive much more tolerance on their dancing, singing and rap abilities. This is because that although some audiences may still prefer trainees who have singing or dancing talents, many audiences who become a fan of these trainees do enjoy witnessing, encouraging and supporting the trainees to develop skills and become qualified idols.

The final idol group will be run by a giant entertainment agency that is invested by the host platform and will be given top resources and opportunities in nearly all fields in the entertainment industry: music, dance performance stages, movies, business advertising endorsements, luxury fashion shows, and many other reality shows. Resources for survived group of course will not be distributed equally but will be allocated according to the final rankings inside the idol group, namely the total votes on the last day of the contest. This means that top opportunities and resources will first be leveraged to the trainee with the highest votes, he or she is very likely to have individual opportunities apart from attending activities as a member of the idol group. In comparison, the trainee with the least votes might not receive many extra chances in the fierce idol industry because his or her ranking in the contest proves he or she is not so 'valuable' in terms of business return.

• The rules and the sub-boards.

As announced by the host, votes are constituted of two parts: the major part comes from four round voting from fans, the other comes from votes rewarding for top stage performance of the

three-round public debut which invites 400 audiences to the front casting scene and asking them to make votes according to their preference. The rewarding votes might be crucial for those who have fewer fans in order to survive, but its scale is not comparable to the fan votes of the top-ranked trainees. Votes will be cleared and recounted from zero for every trainee on every round of ranking release. In the three rounds of elimination, there would be 60 trainees out of 108 to survive, 35 out of 60 to survive, 20 out of 35 to survive and finally a live streaming performance casting to announce the final top 9 out of the 20 candidates.

Therefore, fans are deciding the destiny of idols as they contribute popularity and key votes. They decide the survival of idols and decide which idol receives the best opportunities. An audience can vote for 9 trainees per day in the first round of voting, and can only vote for 2 trainees per day in the second round, and finally can only vote for 1 trainee per day in the third round to develop from a generalized affection to 'pure' affection and solidify their identity as one's fans. Votes are limited to one vote per ordinary account for each trainee and two votes per vip account per day for each trainee. Each mobile number can only register for one account, but there are several ways to break that limit. A major way is to buy the products from the sponsor of the show, which are usually beverages. In each box of the beverages, there are two accompanying voting cards with QR code that provide additional votes and can be voted for four times. The official price of one box of the beverage is 54 RMB, but as fans do not need those beverages, they can instead only buy the voting cards from scaplers who sell these cards to fans and sell the beverages to others separately. The price of the voting cards can fluctuate quite strongly from 6 RMB to 18 RMB because it is determined by the fast-changing demand in the market. Also, buying the cards in groups would be cheaper than buying a card individually at a retail price. Therefore, fans need to raise money, negotiate with scaplers for cheaper cards price,

make proper amounts of purchase as a group and organize the code-scanning and voting in different stages.

Apart from the three-round rankings that are based on the votes, there are a number of other metric-based activities as additional exposure opportunities for their idols during the show aside from the original video platform iQiyi. For example, the e-commerce platform Jingdong has an interactive game page for fans to cumulative support score and provides the title of 'Jingdong ambassador' for the top three trainees and their posters will be displayed on the homepage of the Jingdong app. Or on an English-learning app, there is a virtual classroom in the name of each idol and their fans would participate to memorize the flashcards of English vocabularies in that classroom. The total number of vocabulary flashcards reviewed by the fans is made to be another ranking board. The metrics can also be simply the views, likes, and comments under individual performance videos as a measurement of to what extent the stage performances of individual trainees attract fans. These metrics can help the host platform monitor and chase real-time clout and help marketers to decide which trainees to choose to cast inserted advertisement played in each episode or collaborate for product endorsement and promotion. Although the result of this contest is only determined by the voting boards, fans still put giant effort in securing the rankings on these sub-boards that are not directly related to the contest. This is because the voting boards can only be seen and released by the host platform, so fans lack ways to monitor and supervise whether the votes ranking is modified by the platform or not. However, the sub-boards can serve as a reference for contestants' relative rankings, and it is reasonable to consider that the rankings should stay consistent across all boards. The transparent and visible sub-boards to some extent supervise the official rankings of the untransparent and invisible mainboard as a popularity reference. From the business perspective, instead of looking at the numbers of votes that are in a

way deceptive and manufactured, capitalists hope to know how many fans of each idol are actually participating in the system and how much they can afford to devote both in time and money so that they can make evaluatios on how many business profits or online traffic they can gain.

So to fans, these additional metrics, on the one hand, are like extra exams that ask for their effort in the digital environment to fight for exposure, attention and resources for their idols whilst on the other hand, with these sub-boards rankings, fans would form a consensus idea of ranking and supervise the main voting board result.

Research Questions

Following the rules of the contest, in this paper we hope to answer questions as follows:

1. What are the structures of fans? What labor do fan communities contribute on social media to engage in the contest with an algorithmic mindset? How are fans organized?
2. Do the ranking metrics of fandom guarantee the career path of idols?
3. What does digital labor mean to fans? Why they are willing to participate in such work surrounding on metrics?

Data

Our focus is two-fold in this research, one is to understand why fans are willing to devote themselves to different digital labors for a higher ranking for idols and how they achieve it, the other is to use machine learning methods to verify whether such data-based competing mechanism indeed secures a bright star path for their idols. Therefore, we have two types of data to collect. One comes from digital ethnography. The other data are collected manually from a

mobile application called Funji who monitors and records the daily metric of idols on various boards across different social media platforms. As the numbers of votes are only recorded and announced by the platform without supervision and are direct determinants of the result, we use these metrics from various platforms to measure and approximate the popularity of trainees instead.

• Data sources

We collected data from the show *Youth With You 2* with 108 contestants, hosted by the video platform iQiyi. We collected the everyday metrics of each idol during their contest period. The metrics come from a number of widely-recognized boards that can reveal the popularity of idols: (1) Super topic active board including daily sign-up, number of posts, the number of views in the individual super topic; (2) The hashtag trending hours on Weibo with hashtag mentioned the idol; (3) The number of discussions that mentioned the idol on Douban (a hobby and interest-based social media platform); (4) Weibo fan numbers including increased and cumulative statistics; (5) Average Weibo interactions of idol's daily posts, including the number of replies, reposts and likes; (6) Media reports on idols (duplicates removed) on Tencent Entertainment and Toutiao.

• Features

Input Features	Details
Super topic daily sign-up on Weibo	Super topic daily sign-up on the selected days of the contest (Day1 of the broadcasting, Round1 Elimination, Round2 Elimination, Round3 Elimination, Final day of the contest). Super topic is a section on Weibo to gather users with the same interest. Each idol has a super topic virtual plaza for fans to gather. A sign-up means that fans go to a specific super topic page and recognize their identity as fans. This feature indicates the level of identity awareness and the general community size.
Super topic daily views on Weibo	Super topic daily views on the selected days of the contest (Day1 of the broadcasting, Round1

	Elimination, Round2 Elimination, Round3 Elimination, Final day of the contest). This feature indicates the level of basic interest on the idol from the general public. A view on an idol's super topic means a click on the specific super topic discussion page for an idol.
Super topic daily posts on Weibo	Super topic daily posts on the selected days of the contest (Day1 of the broadcasting, Round1 Elimination, Round2 Elimination, Round3 Elimination, Final day of the contest). This feature indicates the level of engagement of fans in the specific idol page. Posts are normally the newest information about the idol, advocations for more engagement, explanations why the idol deserves more love, etc.
Hours on Weibo top trending board	Hours stayed on top trending board on Weibo on the selected days of the contest (Day1 of the broadcasting, Round1 Elimination, Round2 Elimination, Round3 Elimination, Final day of the contest). This feature indicates the likelihood to attract the general public. The longer an idol-related hashtag stays on trending board, the higher possibility that the idol is seen by more Weibo users.
Douban (Chinese version of Reddit) discussion	Douban discussion on the selected days of the contest (Day1 of the broadcasting, Round1 Elimination, Round2 Elimination, Round3 Elimination, Final day of the contest). This feature indicates the level of discussion on the contest in a wider public sphere.
Weibo cumulated fans	The cumulated number of fans on the selected days of the contest (Day1 of the broadcasting, Round1 Elimination, Round2 Elimination, Round3 Elimination, Final day of the contest). This feature indicates the cumulative popularity of the idol.
Weibo increased fans	Increased number of fans on the selected days of the contest (Day1 of the broadcasting, Round1 Elimination, Round2 Elimination, Round3 Elimination, Final day of the contest). This feature indicates the increased popularity of the idol.
Weibo average interactions on idols' posts	Weibo average interactions on idols' posts on the selected days of the contest (Day1 of the broadcasting, Round1 Elimination, Round2 Elimination, Round3 Elimination, Final day of the contest). During the contest, idols would publish the same posts required by the host platform to promote the show and test their popularity. Fans would try to maximize the number of reposts, likes and comments of these posts. This feature indicates the level of visible and comparable engagement of fans.

Media reports on Tencent Entertainment & Toutiao	The number of media reports and interviews on Tencent Entertainment and Toutiao account on the selected days (Day1 of the broadcasting, Round1 Elimination, Round2 Elimination, Round3 Elimination, Final day of the contest). This feature indicates the mainstream media recognition on the idol.

We did not take personal features of trainees as input variables for several reasons: (1) our focus is on how the labor of fans determine the final rankings of their idols thus we keep the features produced by fans; (2) personal features such as appearance are difficult to capture across different platforms for different audiences and those features can have strong multicollinearity with how much labor fans put.

• Data pre-processing

Data pre-processing work before performing the machine learning pipeline is crucial in our case for two reasons: (1) The dataset is pretty small and imbalanced; (2) The scales of predictors are quite different. To solve these two problems, we use *Synthetic Minority Over-sampling Technique* to increase the proportion of the minority class, namely the survived group in the contest, as well as using the normalization technique to make the predictors comparable to train machine learning models.

- SMOTE method

As the dataset is composed of only 9 samples with response variable Y = 1, it can be difficult for the algorithms to capture characteristics of corresponding predictors when making classifications. Therefore, to balance the imbalanced data, we apply SMOTE method to do up-sampling and increase the proportion of Y = 1 before splitting training and test data. SMOTE is proposed and developed by Nitesh Chawla and it is useful in learning the minority. The method works by selecting samples that are close to the feature space and drawing a line between the

samples in the feature space and drawing a new sample at a point along that line, in this way, it creates synthetic examples for the minority class (Chawla, 2002).

- Normalization method

The range of our data varies significantly from one predictor to another, so normalization is necessary to standardize the features. Therefore, we use normalization to scale the data to [0:1].

Research Methods

To answer the questions, we used both ethnographical and computational methods. Firstly, we applied the digital ethnography method by participating in different forms of fan labor in the digital fan community during the contest. Secondly, we compared the metric growth between the survived and the eliminated groups during the different rounds of the contest. Thirdly, we trained a machine learning model with the pre-processed data and examined the feature importance of our machine learning model to interpret what features are crucial in determining the final result. Fourthly, we simulated the ranking with weighted metrics of the fourth round with the assumption that the final round metrics are the most relevant ones to the final result. And we compare the simulated Y with the observed Y to verify if the actual rankings of the contest are consistent with the amount of labor fan contributed to their idols.

1. Digital Ethnography

Digital ethnography is the study of people in the digital world. To study online fandom and understand how fans act, react and involve themselves in a digital community, we participated in the daily activities of fans with a special notice on how fans engage in these activities and advocate for metrics-related labor to improve their idol's rankings on different boards during the contest period of *Youth With You Season 2*. We first engaged in the general discussion on idols

such as posting Weibo and comments as ordinary fans with complimentary words to attract more audience, later we produced posters and fan fictions of different forms for deeper interactions and engagement with others. We also enrolled in crowdfunding battles that are set for buying contest votes by fan clubs. Finally, we worked as one of the fan organizers and participated in strategic decision-making process to help allocate our financial resources as well as the labor resources of fans in different contest stages.

2. Metric Growth Comparison

By calculating the ratio of the average number of each predictor of the two groups, we compare the metric growth between the two groups in different stages with the goal of examining how large is the discrepancy and when does the discrepancy start.

$$r = \frac{total\ amount\ of\ predictor\ of\ survived\ group/survived\ candidate\ number}{total\ amount\ of\ predictor\ of\ eliminated\ group/eliminated\ candidate\ number}$$

So the ratio is the average number of each predictor of the survived group divided by the average number of corresponding predictor of the eliminated group.

3. Machine Learning

We built a logistic regression model to understand what features are more important in predicting the results and verify whether the metric-centered effort of fans can guarantee the survival of idols. The predictors are listed in the data section which are different metric categories across Weibo and Douban in different time periods. The response variable is the survival (Y=1) or elimination (Y=0) of the final round. We used the feature importance given by the regression coefficients as a measurement of the contribution of the corresponding metric in determining the outcome, and feature standardization was performed to ensure that the feature importance is comparable.

4. Synthetic Counterfactual Rankings

To verify if the metric-centered mechanism determines the ranking, we tried to simulate a counterfactual ranking and compare it with the official ranking released by the platform. We assumed that the last round sub-board metrics across social media platforms are the closest to measure the amount of labor that fans contributed on the final stage of the contest and therefore are the closest dataset we have to approximate the final rankings. Thus we used the last round sub-board metrics to simulate a counterfactual ranking and compare the result with the actual ranking to examine the difference. If there is a difference, it can origin from two aspects: 1) The sub-boards metrics are not close enough to approximate the main board voting; 2) The sub-boards metrics are close enough to achieve the approximation but the mainboard ranking is modified by the platform. In our case, we assume the latter.

The synthetic metric-based rankings are calculated by the weighted average of the final-round metrics. To ensure the selection of the weights for calculating the synthetic rankings is robust for this counterfactual analysis, we tested for the sensitivity of the results with 1000 times random weights drawn from an Irwin-Hall distribution. In each simulation, the algorithm would assign a weight ranging from zero to one to each feature, and all the weights sum up to 1 to restrict the ranking score. With these weights, we calculate the ranking score for the top contestants.

$$score = \beta 1 \times X1 + \beta 2 \times X2 + \cdots + \beta 12 \times X12$$

$$\beta 1 + \beta 2 + \cdots + \beta 12 = 1$$

In this way, we calculated the synthetic metric-based rankings and compare those with the actual outcome. If the outcome is straightforwardly determined by the metrics, it should be observed that the synthetic metric-based rankings are consistent with the actual outcome. In this way, we could verify whether the rule of metrics believed by fans is indeed the underlying mechanism that works for this public-selected idol competition.

The Structure of Fans and Their Labor

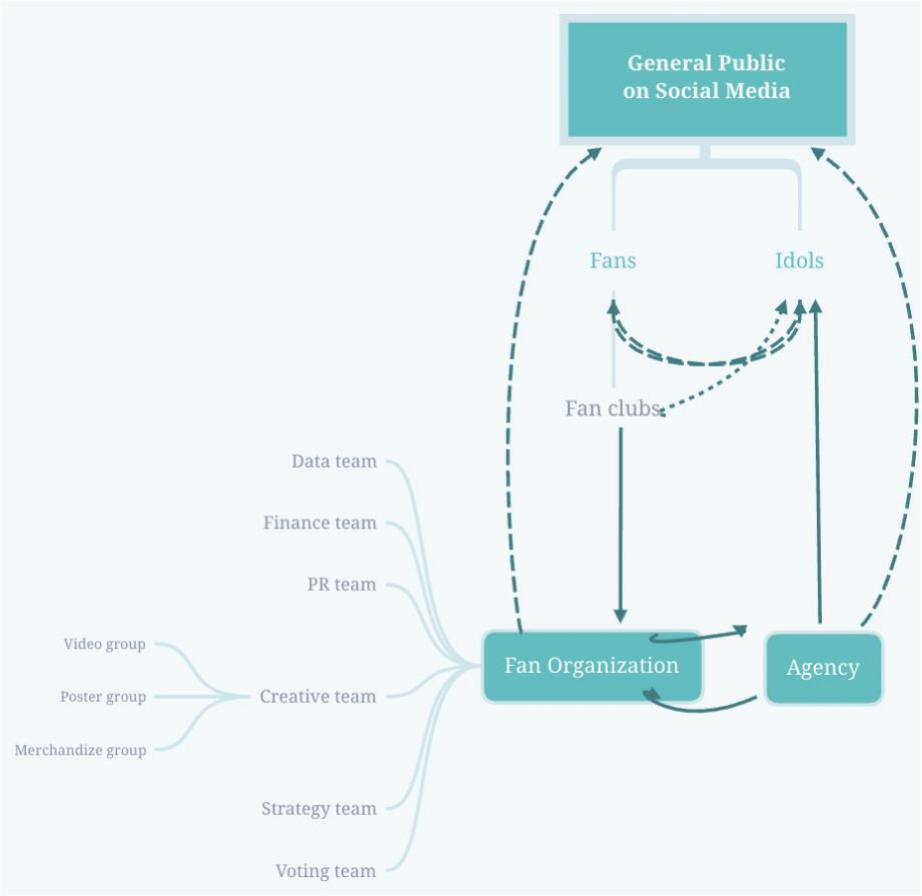

Figure 1: Structure of Fan Community

The labor can be divided into several categories: (1) Repeated labor for social media metric growth, to manifest the scale and participation of active fans to the external; (2) Creative labor including video recreation, fan fictions, drawing or short behavior interpretation to cultivate the affection of fans to the internal and stimulate the repeated labor; (3) Strategic labor to plan, organize and implement tasks. Fan contribute their labor corresponding to their role.

• Fan organization: strategy planning as an official administration

Fans are highly organized and are developed into different hierarchies. Each idol will have an official fan organization, which takes the administrative position that manages different teams to

provide corresponding assistance to distribute tasks and organize fans. The leaders in the fan organization are elected based on their resumes, in which they will demonstrate their abilities and experience as fan organizers, and provide evidence on how much they have devoted to 'love' the idol, usually measured in how much money they have spent on the idol.

Fan organization plays a central role in strategic planning for winning the contest. The strategy involves planning, organizing and implementing their operations according to the competition agenda, which almost works the same way as an entrepreneur team. The organization is divided into different groups: (1) PR team manages the public relations and is responsible for maintaining a good reputation for the idol; (2) Data team decides the priority of official posts and social media boards to compete for rankings, monitors the metric performance, report daily summary on the data account and advocate for more participation; (3) Finance team has control over the money raised by fans, hold activities to raise more funds, as well as monitoring the price of votes and participating in the bidding of voting card; (4) Creative team takes a role in media management. When other departments need to hold certain events, this team would assist to make advertising punchlines, videos, posters or sometimes design merchandize products as a gift for fans with good fan performance, often measured by how much money a fan raise; (5) Voting team organizes fans to register voting accounts and make additional votes repeatedly with the voting cards bought by the finance team. The team sets up voting labor shift from day to night to achieve all-day long voting, which means that some fans are arranged at late night to vote for hours till the next morning. This shift is to show that their voting is increasing gradually not suddenly in the statistics, to avoid suspicion of cheating and avoid votes-cleaning by the platform; (6) Strategy team works as the board of directors to manage and coordinate all teams to work together.

Despite the management of all teams, fan organization also manages the fans in an indirect but strict way by establishing the rule of conduct to regulate fans. The way the fan organization runs is essential to determine the destiny of idols in the contest. This is because how fans promote, discuss, act and react on social media has a wider influence and this in a way sets a primary impression of the idol to the general public, which will significantly influence the expansion of the fan base. Sometimes the organization can declare to 'fire' certain fans for not following the behavior conduct, to get rid the possible negative influence caused by such deviance.

Fan organizations also take the ambassador role to collaborate and negotiate with the agency. This is because an agency often manages multiple idols at the same time, and fan organizations need to follow how the agency allocates its resources to each idol in a reasonable way. Therefore, although the agency is more sensitive and resourceful in the entertainment market and industry, the agency should respect the fan organization and discuss important issues together to share information and make the best decisions for the idol.

• Fan club: enriching the narrative behind the scene

Unlike the fan organization, fan clubs run more freely and creatively and the number of clubs is not limited. A popular idol can have tens or hundreds of fan clubs, but the size and scale of each fan club are much smaller compared to fan organization, usually run by two to four people. The main purpose of fan clubs is to stand on the front line, take additional photos or videos and give instant feedbacks of idols every time there is a show-up opportunity of the idol. This is because each episode of the contest show is limited to around 180 minutes, and it is very likely that the program would not distribute the length equally on everyone and cut off many scenarios and bury growing and friendship storylines. Without enough information from the show, it is hard for fans to discover new angles to depict and expand their interpretation of their idol. This is crucial

because the journey of character and personality exploration on the trainee is essential for fans to raise their curiosity and sense of belonging so that they maintain emotional devotion on the idol. Therefore, the fan clubs provide materials in different media forms, either pictures, videos, or even pure textual descriptions for fans to dig out multiple perspectives on the idol and their idol's personal connection with other idols through stationing outside the spot place of the show day and night and wait for their favorite trainees to show up when they start or finish a day of training and casting. This is their daily output known as 'photo of starting work' and 'photo of finishing work' as a daily reporting of the trainee's everyday news. Sometimes they use microphone loud-speakers and shout to encourage the trainee to tell their affection and love.

• Fans: Storytellers and metrics contributors

Individual fans are free to participate in fan activities, but hierarchy exists within these fans as well. Individual fans can attract other fans by their vivid interpretation on the idol and in this way, they become a key opinion leader and are expected to take more responsibility in content production. Ordinary fans take the most repeated work by clicking on the videos, reposting, commenting or liking the posts of their idols for tens or hundreds of times to add to the metrics growth. Such interaction can be stimulated by pure affection when fans are not familiar with the ecosystem of the fan community, but it could also become deliberate when fans are disciplined with the 'metric rule'. If one is disciplined, it is likely that he or she would have a higher level of engagement and follow the rules designed by the fan organization when participating in the group activities. This often means that they will start to care about the ranking on boards, the number of interactions related to their idol, the increase of fan base, the number of votes and many other metric-based indexes. Therefore, they would enroll themselves in the metric growth as well as enlarging the fan base and advocating for more involvement of other fans. So they

would repeatedly repost, send comments, and even register for multiple and accounts and switch to click the ‘like’ of the idol’s posts and make the numbers look larger. They would collectively quote and use the same hashtag related to the idol to share photos and interesting anecdotes of their idol during a short period of time so that the hashtag would appear on the Weibo trending board and attract the general public to click on, build positive impression, cultivate curiosity and interest, and hopefully transform part of the public to fans. To make the idol memorizable, fans would make use of simple character labels that explain the personality of the idol to distinguish the idol from others. This can be effective when the fans are excellent storytellers, and unlike traditional long fan fictions, Weibo limits the post to 140 characters, which reduces the cost of content production while saves time for bystanding consumers to view and decide if they are interested and attracted by the idol, or by the image of the idol depicted by the fans.

Does the labor of fans count as it is promised?

Following the effort fans make on the rankings, numbers, speed, scores, we examined what are the trends in different contest stages and whether such efforts in metrics are decisive in helping their idols survive.

- **Metric Comparison between Survived and Eliminated Groups**

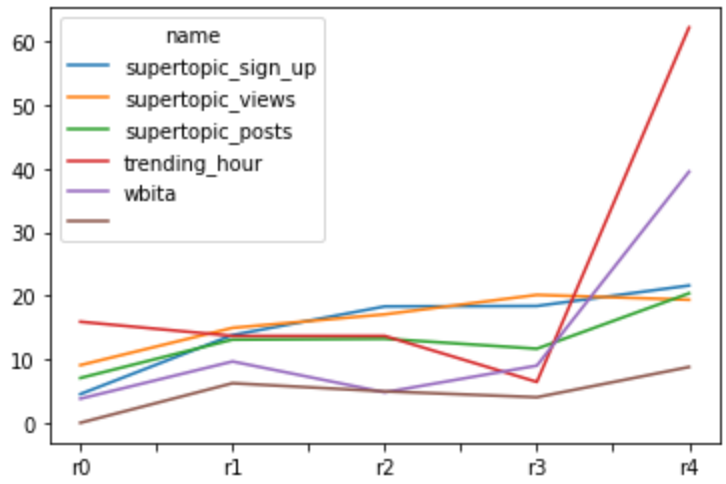

Figure 2 Averaged Feature Ratio of Two Groups

The metrics of the survived and the eliminated groups in different contest stages also reveal the trend of growth between the two groups. The graph above presents the ratios of sign-up, views, posts, hashtag trending hours, Weibo interaction and increased fan numbers between the two groups on each round of elimination.

It can be observed that the two groups differentiate pretty much from the first day of release and the disparity expand quickly on round one and such gap maintains from round one to round three. On final round elimination day, another huge disparity appears in nearly all variables. Such a trend tells that the fans are putting more effort and expanding the gap between the two groups in decisive stages.

• Feature Importance of Logistic Regression

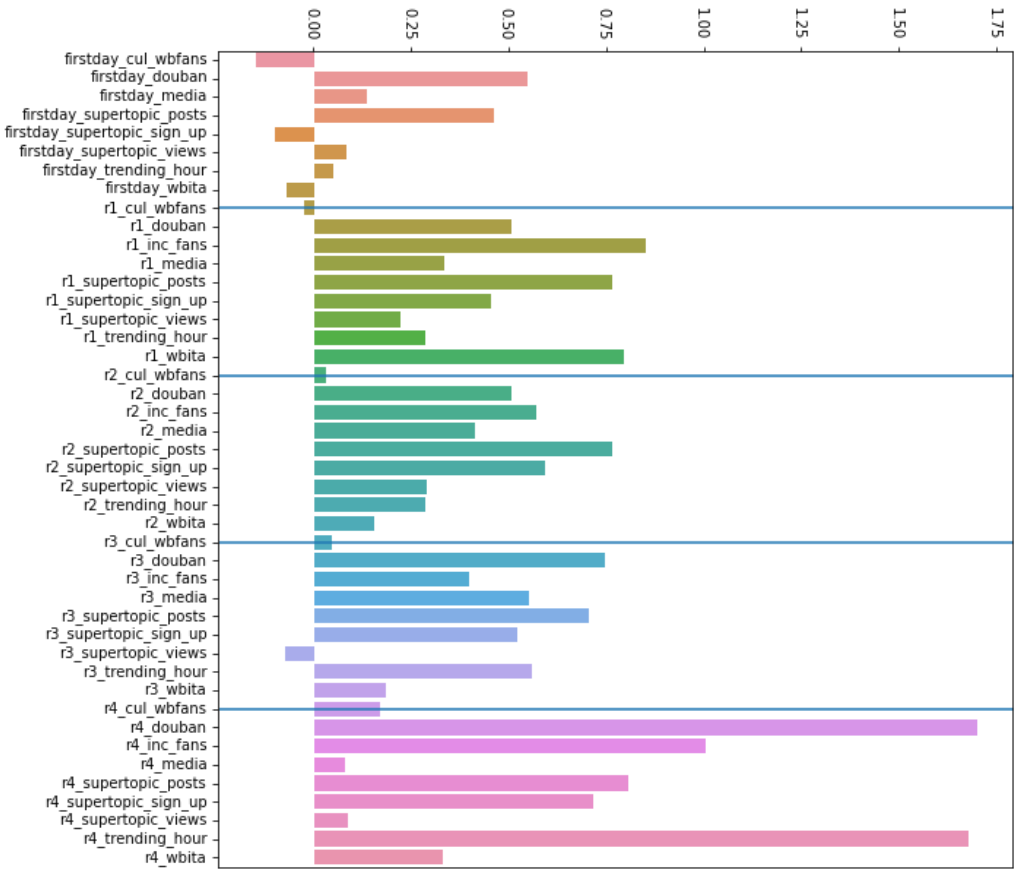

Figure3 Feature Importance of LR Model

We used the logistic regression to analyze the feature importance among the 44 features. We observed that the predictors of the first round to the third round explain an equivalent degree of the response while the predictors of the final round explain a significant part of the response. This is because the voting result at each round determines the survival for the next round, the number of votes would be cleared to zero and the count would restart again for the next round. Therefore, as the final ranking is just determined by the last round, fans should put the majority of their effort into the final round if they could ensure the trainee's survival of the first few rounds. Such distribution indicates that the strategy fans took follows the pace of the contest, while it also suggests that fans have a good command of the contest rule and are making insightful labor and resources allocation.

The graph also reveals the fact that the importance of particular metric changes over time, which indicates that in different stages of the contest, fans may shift their focus to different platforms for different metrics, so some metrics become less important in later stages while some become more important in explaining the result. For example, on the first day of the show, the cumulative number of fans negatively influences the response variable. One possible reason could be that, although some contestants have already built their fan base before the show, these past fans may not engage themselves in this contest. Instead, the number of increased fans is more positively related to the result and its importance keeps growing along the process of the competition, compared to the cumulative number of fans.

If we take a closer look at the importance of different boards, Douban metric has the highest importance in every stage. As a hobby-and-interest-based platform that encourages free discussion, Douban provides a virtual space for fans to freely discuss their attitudes and feelings on the contest without being monitored as the platform does not offer transparent manifestation on data on how many times a trainee is being mentioned. Therefore, Douban might be the most independent platform from any competition-driven metrics. Instead of displaying deceptive popularity on visible platforms like Weibo that counts every fan participation, Douban may reflect the true size of fan base, which has a direct and strong correlation with the labor fans can put, and therefore determines the final votes. On the contrary, the feature importance of Weibo-based predictors is less stable, which might result from the fact that they are manufactured by bots-like fans, and cannot reflect the true fan base.

- **Simulated Ranking with Examined Robustness**

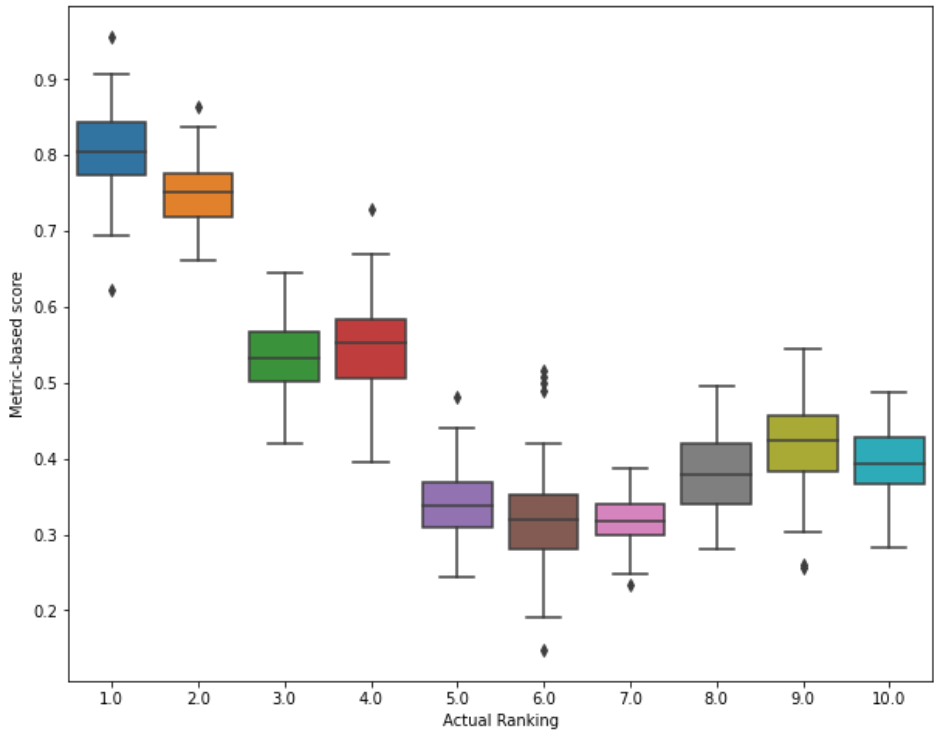

Figure4 Simulated Ranking Score VS Actual Ranking

In Figure4, x-axis is the actual ranking while the y-axis is our simulated score distribution. From the graph, the average ranking scores of the top two contestants both exceeded 0.75. The average ranking scores of the contestants ranked at the third and fourth place both exceeded 0.5. And the average ranking scores of the contestants ranked at the fifth to tenth place are all below 0.4, except for the average score of the ninth contestant slightly exceeds 0.4.

The result from our simulation shows some degree of inconsistency between the simulated ranking score and the actual ranking. Firstly, the scores of the 3rd and the 4th contestants are close, but the contestant ranked at 4th place has a higher average score than the 3rd contestant. Secondly, the average scores of the 5th to 7th are lower than the 8th to 10th, yet they occupy higher positions. As this idol group is set to be a nine-girl team called ‘The9’, the 10th contestant was even eliminated out and had no chance to access all the wonderful opportunities as promised. In comparison, the top two contestants stay consistent with their scores.

Such discrepancy indicates that a relative metric advantage does not necessarily secure the corresponding positions for trainees, but an absolute advantage does. Although the rule of the game seems to be transparent as popularity measured in data is visible on many channels, intervening factors like the capital power from big agencies or the preference of the host platform can still modify the result behind the scene. If the metric gap is not so perceivable and overwhelming, these factors can easily disrupt the rankings of trainees without being questioned because these social media metrics are additional verification of one's popularity but only votes on the platform are decisive. This is why the absolute gap is important. Such metric gap should be visible across various ranking boards, which would form a general ranking consensus for all fan participants in the game. If one constantly stays at the first place across all boards, it is impossible for intervening factors to drag her position down because it obviously violates with the rule of the contest, and the platform would lose credibility and suffer from legal risks as fans has put huge amount of money to make their votes. This means that absolute position is under the monitor of all fans and such ranking consensus on absolute position in a way verifies the credibility of this game and is necessary if the platform wishes to hold the next game.

The Return of Digital Labor

• Individual's Emotional Attachment to Idols

For fans who participate in the idol-raising contest, the labor in most cases is not for acquiring actual profit or any financial interest. Rather, such labor is an effort to project their emotional attachment to the idols. Unlike voluntary fan labor such as fan productions or fan fiction that are driven by affection with no clear ends, metric labor in this scenario is requested by the capitalists, thus it is also needed for the idol in order to survive the game. Therefore, fans

actively shoulder the responsibility of metric competition to achieve the dream of the person they like. The non-sense metric labor, such as repeatedly repost the same Weibo posts in order to increase the visible count of repost numbers, becomes a medium and a way of achieving, to connect themselves to the final goal.

Hochschild (1979) argued that emotional work in essence is an act under certain imagined social roles although sometimes the act is operated in a way that seems spontaneous and real. Goffman agreed that people are immersed in their acts and maintain appropriate roles that fit the current social circumstances. As the contestants are quite young, fans often assume themselves to be a boyfriend, a girlfriend or a family member of the idol with the mindset of 'accompany the idol to grow'. Some fans who are older than these idols may assume themselves to have parental responsibility. For example, as parents, they should provide opportunities and let idols try out their hobbies and figure out their strengths. This could be achieved through the repeated digital fan labor because the metric-centered labor can exchange opportunities in the entertainment industry as promised by the contest rules. The imagined roles of fans strengthen their emotional attachment to their idols. They act through the voting process and spare no effort to conduct repeated tedious labor day and night and imagine themselves to be the decisive power of the destiny of their idols. Then what stir up their emotions are not only the far-away idols on the screen, but also their identified selves with presumed roles, which significantly enriches their complex emotional experience during their labor.

• Hierarchical Recognition as Rewards

Fans follow fans so that they form into a community and through the formation of the fan cycle, they would be kept updated for the latest news of their idols. Each fan in the fan community develops their identity and hierarchy with the capitals they put. They invested different amounts

of social, economic and cultural capitals, which classifies the fans into divergent hierarchical categories. Inside the community, social capitals such as social network resources, economic capitals such as frequent participation in crowdfunding, cultural capitals such as popular recreation and interpretation on texts or videos, work together to determine the position of fans. Quantitatively, such position is manifested through the number of followers of one fan. From core, center, ordinary to marginal, they acquire and receive different levels of exposure and interaction both with other fans and with the idol they like. This reciprocally returns different levels of feedbacks and rewards of their affective labor, which is often embodied as a more welcomed narrative of their interpretations on the idol, accompanied by a more influential status. Their welcomeness and popularity are also exhibited on social networking platforms through the ranked listing of their posts, comments or likes by the algorithm of the platform, which makes these 'big fans' more visible than others.

As not all fans can reach high positions in the community and only those who devote sufficient capitals are offered with the opportunity to occupy a dominant position, most of the fans would actively engage in the affective labor and hopefully become the top-welcomed minority group in the fan community, which will allow them to cumulate more community capitals that have more discourse power. Such power develops their identities within the community, builds up their recognition for the self and leads other fans to run the system according to their expectation. In other words, the fans in the higher hierarchy will have more agency to exert power under the fan community structure. They would be more capable of poaching texts or videos in ways they like and their depictions of idols would become dominant and therefore reshape the way for fans to interpret their favored person. They are more likely to advocate other fans to participate in all forms of labor following the voting agenda.

• ‘Us’ in an Imagined Community

Apart from the construction of the self, because of their shared value and similar action mode on social media, fans form a sense of belonging and recognition to the community, which reciprocally stimulates the organized digital labor. Fans act in particular ways so that they easily resonate with others for their affection. Through such a process, fans construct their own symbolic system to distinguish ‘us’ from ‘others’. They make up stories and fictions with their invented gags or memes based on their observations on the idols. They also use particular color as an identifier to represent the community and distinguish from others. Nash (2000, pp.468) extended Anderson’s notion on ‘imagined community’ to fan identifications. He argued that an imagined community is formed through a popular allegiance to shared norms. Fans adopt the data competition rules and conduct repetitive and tedious work to chase for a better ranking. Under such rules, fans are more mobilized as a group rather than individuals because disparate effort on data from an individual is very likely to be neglected in the giant flow of information on social media, but an aggregated fan labor targeting on particular boards significantly improve their visibility and manifest their community power. In other words, fans are offered with opportunities to experience the power of influence when they participate in community activities which may never be achieved when they work as an individual. Through the positive feedbacks from the collaborative data contribution activities arranged by the fan organization, fans improve their belonging to the imagined community. Such a community satisfies ‘a desire for connection’ that is hard to achieve ‘in the context of capitalist social relations’ (Kalman-Lamb, 2020).

The Alienated Affective Labor: Exploitation and Empowerment

Although fans actively contribute their emotional labor for their idols and to some extent establish recognition on their community identity and acquire emotional intimacy from such experience, it cannot be denied that their labor is essentially being deployed by the capitalists through a plausible mechanism to legitimate the exploitation. On the other hand, fans are receiving more power because of their visible presence and wide influence on social media. If fans are not receiving fair treatment from the capitalists, they might organize social media activism against the capitalists, therefore reciprocally restrict the exploitation. In other words, such ceaseless metric competition rules enrich the ways of empowerment and exploitation on fans.

• Empowerment

Scholars like Sullivan (2013) argued that digital media empowers fans and exploits their labor by blurring the boundary between producer and consumer, and in this way liberates fans from 'hegemonic control of the context'. This means fans are given the opportunity to poach the content according to their will and share in their community (Henkins, 2006). But the ubiquitous rankings on social media now reshape conceptions of power from a quantitative perspective. Fans are empowered with decision-making rights that are once not there. As long as they manifest their social influence in the digital space to satisfy the marketing ends of the capitalists, they can determine the results. With the goal, the community structure is developed to organize corresponding labor. So even if the emotions of fans are often fanatic and strong, their actions are strategic.

• Exploitation

Similar to what Hochschild (1979) has demonstrated for emotional work, here instead of saying that such metric mechanism completely manipulates fans, we argue that it evokes the

participation of fans both in emotion and working in the digital space. It looks like fans are situated to the framed capitalist structure, but it is hard to define who takes the dominant position in this game because the game is more like a trade that should satisfy both ends. Although fans are not the rule-makers, they are not slaved or suppressed, even though sometimes they do conduct digital labor for an excessive amount of time, it derives from their affection. Their emotional labor is exploited under a capitalist logic - those who want to have more should work more. However, the question is that such work never comes to an end. Winning certain position is never enough, the battle never ends. Fans spare no effort to get rid of any ambiguity that could possibly rewrite the ranking. The status insecurity and the imagined consequence imposes an ongoing war between fan community even if they have already occupied a top position. The imagined fear of not reaching the survived ranking position and consequently ruining the dream and career of one's favored trainee alienates the fans to spend more time and more money, make more emotional investment and devote themselves to this cult competition on meaningless numbers.

Conclusion

This paper examined the digital fandom ecosystem within an algorithmic fan culture. Under the pressure of algorithm, the numbers no longer grow naturally but increase with purposeful, organized plans. The visible rankings on social media on the one hand increases the transparency on popularity, whilst it also adds a number of tasks on fans to maintain and boom such popularity. The data-targeted tasks are carefully considered, publicized, organized, and implemented by different hierarchies of fans with the goal to engage more general audience and advocate for more votes, either from natural affection or organized labor. Their identities as fans

are established and further enhanced as they entrench themselves in the community. Under the competition rules of data, their imagined connections with idols and their complex emotions towards the idols are amplified through collaborative participation and engagement of repetitive or creative fan labors. Their shared symbolic systems further distinguish one from another and construct an imagined exclusive community in which they share their victory and failure on every metric war, strengthening their emotional ties.

It may seem that the metric-centered competition offers more initiatives for fans, but such a rule in fact does not empower them. Instead, the disciplined, communized and capitalized mechanism is exploiting their labor with no ends and traps them in the community by pushing and monitoring each other inside the group while ceaselessly making comparisons with external opponents. We verified that relative advantages in data might not guarantee a corresponding ranking position and fans seem to be aware of this. So their status insecurity drives them to conduct more and more repetitive labor for an absolute gap to resist the invisible power from capitalists. But no one knows when to stop, even for the fans of the candidates who ranked at the top position. Digital fandom with affective labor under the metric-competition structure is thus alienated.

Future Work

This paper seems to be the first quantitative research to study how fans participated in digital fandom with an algorithmic mindset and how fans contribute their labor following the metric-based trend. Although the topic can attract scholars from multiple areaa, for example anthropology, economics and communications, it is hardly studied from a computational social science perspective. One reason might be that the data is extremely hard to collect as the

rankings are set on different boards across different social media platforms with different goals, and the forms of data across different seasons of the Produce 101 series are not quite consistent, so data is either limited in size or inconsistent in forms. Therefore, the integration for a larger dataset is definitely a barrier. To eliminate such deficiency, works can be done in extending the scope of social media metric data to natural language data. Another reason could be that the data rules are only efficient in a short period of time. The rules of data competition are constantly changing within a short period of time based on the level of popularity of the show. Thus, if scholars do not engage in the fan community and participate in each stage during the contest but study this topic afterwards, there might be some obstacles in tracking, understanding and interpreting the fast attention switch and labor shifts of fans.

Therefore, to conduct computational research on digital fandom, the primary task would be to acquire adequate and sufficient data following the pace of fan events. Then topics on how the affection-driven and metrics-measured labor is organized, amplified, disciplined, internalized, communized and capitalized can be further studied from different perspectives.

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