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Impact of Algorithms on K-Pop Fans' Parasocial Interactions with Their Idols

Jingyu Wang

Business school, Sichuan University Jinjiang College, Meishan, China
wjingyu381@gmail.com

Abstract. In the digital media-dominated landscape of popular culture, K-pop, as a global musical phenomenon originating from South Korea, has experienced a meteoric rise inextricably linked to algorithmic recommendation technologies, collectively shaping a distinctive cultural ecosystem. Within this ecosystem, algorithms exert a dual and significant influence on parasocial relationships between fans and idols: On the one hand, they substantially enhance fans' "proximity experience" through precision content distribution, data-driven feedback mechanisms, and efficient community aggregation, meticulously crafting idol personas as "virtual intimate companions" to effectively satisfy fans' intrinsic need for emotional connection. On the other hand, algorithmic commercial logic may precipitate a "repetitive exposure trap," wherein excessive homogenized content triggers aesthetic fatigue, while simultaneously reinforcing "information cocoons" that constrain informational diversity. These adverse effects transform fans' emotional investment into a blind pursuit of data and traffic metrics, diminishing the depth of authentic social interactions and even exacerbating group polarization. This phenomenon profoundly reveals the technological reconstruction of emotional bonds in the digital era, serving as a critical warning against algorithmic over-manipulation of fan culture to safeguard cultural diversity and humanistic values.

Keywords: K-pop, parasocial relationships, algorithmic recommendation.

1. Introduction

As part of the most popular cultural ecology under the hegemony of digital mass media, K-pop (Korean pop music) is now being widely recognized on a global scale in a very short time. This is not accidental. It has a highly industrialized and mature content production mode, and is closely linked with high-level algorithm recommendation technology, and these two complement each other, which makes the unique and vibrant cultural ecology.

From customized clips to worldwide popularity Within 15 seconds, NewJeans' "Ditto" was a world hit in a pinch by the powerful TikTok algorithm. Every frame and music phrase is carefully arranged at the perfect moment according to the algorithm. And the retro style filter makes it an eye-catching visual contrast, forming a unique nostalgic atmosphere, so that the content attracts the audience in a forceful way. The iconic gesture, "clockwise rotation + foot sliding", easily can get the great memory in 0.7 seconds, because its meaning and signal are clear and abstract, and make the

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viewers' impression hard to forget in brain. The 8 seconds hook at BPM=128 presents a perfect rhythm that grabs users' hearing immediately and excites emotional resonance. These well-designed pieces have caused "Ditto" to stand out among all such informational flood, as a popular recommendation for algorithms and widespread sharing and heated discussion worldwide.

On the other hand, for fans' support to idol stars, the fans exhibit remarkably intense and creative efforts [1]. For example, to advocate their idols, the traffic accelerator tactic is adopted by setting up rankings operation systematically through the social platform and fan groups in the music chart. The fans engage in a fairly specialized workforce: with separate groups running the data analysis and statistics, raising fans support, managing the cooperation among fan groups, as well as another dedicated to coordinating the interaction with the other fan communities for the successful and consistent running of the ranking campaign [2].This case brilliantly illustrates the highly committed fan activities surrounding their stars and the explicit understanding of the algorithmic transmission concept. In addition, it highlights the invisibly infiltrating mechanism of K-pop transmission chain and algorithm systems.

The current paper extends this study in this direction to examine how Parasocial Interaction between the K-pop fandom and idols was influenced by the algorithmic mechanisms.

2. Literature review

The parasocial relationship built between fans and idols occupies a central place in K-pop fan culture. Parasocial relationships are defined as one-way interaction that fans perceive as intimate, like virtual bonds that resemble friendship or romantic relationships. It is a central psychology of K-pop fandom culture. Parasocial interaction was first suggested by the social psychologist Horton as a single-sided, imaginary but emotionally charged one-way interactive experience between fans and media figures [3]. In the context of K-pop, however, the focus of fan interaction is towards idols on media devices such as videos, live streams, and social networks. Even if such interactions are unidirectional since the idol generally cannot reply directly to a single fan, these followers still exert profound emotional investment in their idol. For example, TFBOYS fans would have enough initiative and imagination to celebrate their idols' birthday. By careful planning and multi-channel crowdfunding, it achieves the exceedingly creative birthday celebration plan to give moon rock, which shows not only the immense love of fans to idols, but psychological projection on idols as "virtual love companions". Another case is a hype war between the fans of two singers Jay Chou and Cai Xukun, on the Weibo charts, in which their followers used their precious time and energy to boost up their idols on this chart through the use of various means. The hype war here does not merely convey a numerical competition, but it is the expression of the fans' emotion, an important means to make their idols recognize widely.

This is not surprising that the mechanisms of parasocial relationships are created by deep-seated psychological processes, and their roots lie in the basic need of people for affectional links. In the real world, if social ties between people do not meet people's innate need for affiliation, fans then carry emotion to idols as "idealized people at a psychologically safer distance," and thus substitute this need [4]. In real-life, some fans may feel lonely and lacking of self-esteem, however, idols often demonstrate and offer the appearance of success, and wear a facade of nice and positive social emotions publicly. These traits have become vicarious psychological rewards for fans. Fans establish special emotional relations with their idols by monitoring news and enjoying their work, thus getting psychological satisfaction. Specifically, fans share their fan emotions with each other such as sympathies about their favourite idols and thus they may feel close to one another. They exchange their fan emotions with each other fan experiences in different types of fan clubs and fan groups,

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thus creating an even more expansive circle of fans. These fans from the same group can offer and share empathy for each other, and thus they create a warm and vibrant vibe. The resonance adds richness in fans' feelings towards the idol and inspires diversity in fan cultures [5,6].

3. The algorithm's effects on parasocial interaction between Korean Pop fans and Korean Pop idols

3.1. Algorithmic enhancement pathways for Parasocial Interaction (PSI)

Thanks to the industrial characteristics of the K-pop industry, its distribution pattern is also easy to be "algorithimized," TikTok's "collaborative filter recommendation"10, Douyin's "two-tower model with real-time feedback"11, and WeChat Channels' "social tag matching" technologies together are a fine-grained distribution system. Takiing NewJeans' "Ditto", for instance, the viral fame of a song is clearly not accidental — the effect of retro filter color contrast, signature hand gesture choreography and perfect synchronization (within 0.7 seconds) of moves, such as "handclock spin and foot slides", and the algorithmically critical 128BPM 8-second chorus hook, as the subsequent slides section this study describes in further detail below [7]. It is especially interesting that the entertainment corporations like HYBE are introducing so called "TikTok Strategy Teams," where releasing new tracks necessitates the song to contain at least two "modular viral factors," a calculation of choreography difficulty (e.g. rather than using many "high kicks", use waist turns for easier replays as a dancer cover).Such "algorithmic reverse engineering" guarantees that the entire chain of K-pop contents creation and distribution is mapped algorithmically to achieve maximized interactions with target fan bases.

Recommendation algorithms present reinforcing (alienating) forces on the parasocial relationships of Kpop fans and idols: positive and negative force on the one hand. The fan's interest is strengthened through highly accurate matching and seamless consumption. The memory effect of TikTok's 15 seconds economics guarantees isolated idol content (e.g. idol singing parts from one song) for the TikTok users. Additionally, TikTok facilitates the viral spread of the cut by importing features from popular platforms like Weibo (a popular Chinese Twitter), where idols offer new audio or music videos and fans dance and create memes based on those cut videos, driving the loop of parasocial interactions among K-pop idols and fans. Moreover, as K-pop fandom's "meme economy" extends to merchandise, K-pop fans will often partake in supporting these cute interactions through purchased K-pop products on Tmall (China's e-commerce platform) and KPOP TOWER (an online K-pop merchandise e-shop) that incorporate idol videos or characters [2,3,7]. For example, after Kim Namjoon from BTS went viral online singing a "Go Go Rainbow" in a tea shop, KPOP TOWER released an umbrella with the same singing background. Here, fans show tremendous support towards idols to sustain their social interactions (the K-pop idol in this case is transformed into a useful object); while their labor power towards idols is given up in return. In the "task-driven task" (dancing tasks, fanams), high-frequency dissemination of fans' feeds; There is a psychological effect of "repetition of exposure - emotional arousal"; There is an "social relationship chain recommendation" function in Video Channels, which adopts an idol content implantation mode that connects with fans' off-line social scenarios through a friend chain, improving the virtual interactive immersion. In contrast, the algorithms' data logic could even remake the very essence of PSI. Given that the fans just receive the homogenized contents being calibrated by the algorithms (for instance, stereotypical gestures like "waist-level framing with hands close-ups"), the personal emotional relationship they create with the idols might be analyzed into the "quest for " data correctness"." ; While it is true that the K-Means clustering method can effectively classify

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groupings of users, it can also reinforce fan circles in an "information cocoon" ,which intensifies the fanboys irrationally star-chasing behaviors (like borrowing money for ranking, attacking different-opinioning people) [8]. Moreover, the personalized information algorithm recommends may help the fans to build an “idealized” image of the idols in a virtual space, which can largely differ from the actual idols, hence triggering fans’ cognitive dissonance. Therefore, although algorithmic recommendation technology enables parasocial relationships between the K-pop fans and idols, the potential mental and social implications caused by algorithmic recommendation technology still deserve careful attention [9].

As in the current era characterized by digital media, algorithm technology has become the most significant mediating factor between K-pop fans and idols, having significantly altered the formation logic and theoretical reality of Parasocial Interaction. The “two-faced blade” feature of parasocial interaction in an algorithmic environment is equally significant: technology empowerment promotes psychological closeness, and commercial logic capital imposes distance. The fundamental principle of algorithm-enhanced PSI is that its technical mechanism of emotional amplification. First, the algorithm recreates the fans' “imperative experience” through the technical mechanisms of making contents more available. In the old-fashioned idol market, personal practice videos or vlogs in practice rooms that were posted on the platform were released intentionally on the official accounts (by agency or superstar’s fans) only as “content for insiders.” to Recommend-Model for Fan Interest. It is also feasible to recommend heavily engaging fan groups and push selective content for this audience. This, of course, creates the impression "Peeping at their bedroom" (giving a heightened perception of "Intimate Friend". For example, South Korean entertainment firms are using YoutuTube's auto-generated recommendation of “member fancam” to create emotional appeal for their fans and thus the belief that “I am the only viewer of this performance.” In addition, numerical data feeds the fandom emotion with objectified power. As votes on songs and plays are translated in real-time into the “Popularity Ranking” and “Contribution Value Leaderboard,” and those are synced to a fan group, the role of the seemingly meaningless act of each fan does not go unnoticed as helping “grow the idols’ careers. In a sense, this assurance that “my attendance counts” is actually technological authorization by algorithms that treat abstraction in terms of observables. And, at last, community aggregation is the boost of sentiment in aggregated form by algorithmic protocols. The mechanism of hashtags automatically collects like-minded fan-groups with algorithms of preferential allocation of cumulative block-pleaching idol’s tutorial chart-top and preferential amplification of trending hashtag. In that group-story line of people, all of them are protecting the idol, the individual PSI (Parasocial Interaction) is further summarized to another collective emotional projecting point.

3.2. Pathways of algorithmic weakening or alienation of PSI

At the same time, the algorithm's logic to commercialize reduces and distorts PSI from multiple aspects. Traffic-driven recommendation algorithm creates a “repeat-exposure trap” in content dimension. “To increase user engagement time”, algorithms continue to suggest entirely different edited edits of performances and retouched photos with various different styles, which put the fans into “aesthetic fatigue”—when the multifaceted idol persona is condensed and reduced into a few “viral clips”, as the emotional newness and exploratory curiosity wane. At the level of interactivity, the instantiation of paywalls shifts emotional labor into a contest for consumption. Accordingly, this algorithm foregrounds and recommends only channels of virtual gift and content-exclusive subscription purchases, so the original support action of affection based on giving is transformed into a consumption logic of “the greater the contribution value, the closer the relationship”, blurring

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PSI with material investment comparisons. From cognition, information cocoon creates false self. User-based CF recommender systems that recommend contents based on a user's historic clicks might provide one-dimension contents like 'an idol's perfect show' or 'an idol's touching monologue' but will exclude and conceal 'an idol's controversial speech' or 'an idol's authentic personal clip', and fans might regard their idols 'an algorithmic decoration doll'. If the actual contents conflict with the constructed idol image, PSI is very likely to be shattered by loss of belief. What is more worrisome is algorithmic ranking-facilitated intracommunity conflict. With the establishment of quantifiable scores, e.g., fanscore and social conversion ranking lists, fanship affection becomes fetishism with competitiveness. Fans want to become the so-called No. 1 fan, and some will hate each other regardless of whether they support the same idol. PSI in this context becomes "hate your rival fan rather than love the idol" (PSA)." [10].

In this industry ecosystem of digital technologies-based idol industry system, the algorithm subtly redesigns the affection relations among fans and idols. This data-driven new type relational pattern forms miracle of highly efficiency mass dissemination at the cost of three deeper crisis—algorithmic illusion in cognitive layer, dependence crisis in psychological layer and authentic crisis in ontological level—collectively the vulnerable point of current idol industry.

Social Media Sites' collaborative filtering algorithms are at work to build elaborate information bubbles, which are efficiently isolating users within highly constructed echo chambers. Each like or comment get weighted with machine learning models in a split second to congeal into a virtual media of "universal applause." Weibo hot posts with a Top 1 VIP users generated a very high number of hundreds of thousands of reporters and commenters, who are algorithmically maintained active user communities. Such data-infused interactive system would create a fan's 'universal acclaim' cognitive bias (i.e., a bias allowing them to fall for the algorithmically modulated partial resonance of likes and dislikes of the posts) and to think that the 'overwhelming majority' or consensus is reached among fans.

As fans' daily behavior transforms from casual actions, after multiple days, to automatic actions of "checking numbers—doing task—receiving comments," they invest their feelings in this numb chasing of data. The Korea Entertainment Research Institute reported that 43% of the highly involved fans who attend the Korean music chart competitions show signs of real-world social depression and 37% of them show hyper-refreshing screen behavior sign of anxiety [11,12]. This addiction to virtual and carefully controlled and organized socialization, just like digital dopamine's endless endorphins, turns love, real emotional bonds into an organized data prison.

Occasionally, in order to build attractive idols, entertainment companies use the deep learning model to analyze and re-design idol personalities and even amplify the most distinctive parts in modeling. According to the artificial intelligence personality test report issued before a trainee's debut, the natural and introverted and delicate personality of a trainee has been determined by the Artificial Intelligence (AI) technology as "market risk factors", so eventually the personality reconstruction project the trainee will have a carefree, warm image. Such kind of personality adjustment tailored by commercial logic may be in balance during the traffic dividend, but when the genuine snapshots of idols smoking or binge drinking in private are captured by the lenses of the paparazzi, the bubble made by algorithm-constructed perfection cracks at once [11]. During a celebrity personal identity collapse case of popular online celebrity, the fan Psychological Identification Strength Index collapsed from 82% to 10% within 2 days, even causing a large-scale network abuse [12].

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4. Conclusion

According to the method of literature and case combination, in this paper, the interaction between the Algorithmic Recommendation technology and PSI of K-pop fans is examined by reviewing the status quo and previous research on algorithmic recommendation technology and K-pop fan industry. For example, from the perspective of parasocial interaction theory and K-pop fan industry, this paper discusses the psychological mechanism of PSI as the essence of fan culture—derived from the basic emotion requirements of human beings. Under the absence of real-life social relationships, fans will build up "the virtual intimate companion" psychological projection relying on one-way idol media content exchange (e.g., MV, livestreams) for compensating the belongingness need and serving as positive energy substitution (e.g., satisfying loneliness).Second, by building on NewJeans' viral case study "Ditto" (worldwide explosion in 15 seconds), and HYBE's "TikTok Strategy Team" algorithmic back-engineering (e.g. In keeping with "at least 2 modular dissemination units" design, dance difficulty choreography to increase cover-dance (perpetual cover and mashup) adoption and "collaborative filtering recommendations" and "social tag matching,"), this paper presents in this paper that "algorithms"—both "performatively," through technologies such as "collaborative filtering recommendations" and "social tag matching", and in the "algorithmic business processes"—structure the modular adaptability of K-pop content, all the way from production (visual hook optimization and rhythmic segmentation), to dissemination (precision audience targeting), along the complete chain of production. Last, this paper brings up the ambivalence of the effect of algorithms and parasocial contact, again, from two sides. First, algorithms amplify fan connection across content availability (the delivery of finite contents in the optimal combination), the numbers (quantifying engagements, like likes and shares in trending social graphs into influence), and affiliations (increasing sentiment contagion within communities via tagging).In contrast, such commercial rationality can also create a "repetition show trap" (aesthetics tiredness), "shopping competition" (numerating connections via virtual redenomination), and "information silo" (indulging personas that replace authenticity), diminishing PSI from information chase to trust degeneration and destroying the authenticity and longevity of the fan culture. This research explains how digital tools are making emotional connection and their peril.

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