

Creator-friendly Algorithms: Behaviors, Challenges, and Design Opportunities in Algorithmic Platforms

Yoonseo Choi

yoonseo.choi@kaist.ac.kr
School of Computing, KAIST
Republic of Korea

Min Kyung Lee

minkyung.lee@austin.utexas.edu
The University of Texas at Austin
Austin, TX, United States

Eun Jeong Kang

ek646@cornell.edu
Information Science, Cornell University
Ithaca, NY, United States

Juho Kim

juhokim@kaist.ac.kr
School of Computing, KAIST
Republic of Korea

ABSTRACT

In many creator economy platforms, algorithms significantly impact creators' practices and decisions about their creative expression and monetization. Emerging research suggests that the opacity of the algorithm and platform policies often distract creators from their creative endeavors. To study how algorithmic platforms can be more 'creator-friendly,' we conducted a mixed-methods study: interviews (N=14) and a participatory design workshop (N=12) with YouTube creators. Through the interviews, we found how creators' folk theories of the curation algorithm impact their work strategies — whether they choose to work with or against the algorithm — and the associated challenges in the process. In the workshop, creators explored solution ideas to overcome the aforementioned challenges, such as fostering diverse and creative expressions, achieving success as a creator, and motivating creators to continue their job. Based on these findings, we discuss design opportunities for how algorithmic platforms can support and motivate creators to sustain their creative work.

CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in collaborative and social computing**; **Empirical studies in HCI**.

KEYWORDS

Creator economy, Algorithmic platform, Algorithmic experience, Creative labor, Gig economy, Folk theories, Participatory design

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1 INTRODUCTION

The creator economy, in which creators independently produce and share their content, as well as gain popularity and revenues [6] on digital platforms, has become an integral part of our culture and economy. The market size of the creator economy is estimated at around \$100 billion, and more than 50 million people are working as content creators on various platforms (e.g., YouTube ¹, Instagram ², Twitch ³) around the world [73]. Van Dijck [69] stated that “YouTube [...] did not produce any content of their own; they merely accommodated the distribution and storage of content produced by their users” (p. 113). Creators, who are producing content in the platform, are an essential part of the creator economy platform in generating creative content and vitalizing online communities [56].

Yet, prior research explained that platforms like YouTube have not been ‘creator-friendly’ [42]. Achieving success as a professional creator is largely affected by the platform’s algorithmic features [25]: e.g., recommending content based on viewers’ preferences [67] and automatically demonetizing controversial content [51]. Despite its substantial role in the platform, the algorithm’s working mechanism is often neither transparent nor comprehensible to creators [16]. Creators try to understand algorithms by developing folk theories based on their experience [29, 34, 72], learning from community-shared knowledge or experts [9, 10] and devising strategies to survive on the platform [23, 51]. Yet, only a small portion of creators succeed — only 4% out of 50 million creators make a decent living income [73] — which potentially makes a vast majority of creators feel insecure [24] and stressed [65]. When their attempts at understanding or leveraging the algorithm fail, creators sometimes exhibit algorithmic resistance [40, 54] or take collective action against the platforms [4] such as platform migration [12, 33, 49].

Recently, HCI and CSCW researchers have investigated content creators’ algorithmic perceptions [72] and folk theories [54], yet the creator-centered design of algorithmic platforms has been underexplored. In our research, we explore how algorithmic platforms could be designed to be more ‘creator-friendly’ in the context of YouTube, a popular video-sharing platform. We took a mixed-methods approach to first understand what challenges creators

¹<https://www.youtube.com/>

²<https://www.instagram.com/>

³<https://www.twitch.tv/>

face in their effort to distribute their content, then co-design potential solutions to address the identified challenges in designing a creator-friendly platform. Through semi-structured interviews ($N = 14$), we first explored creators' work strategies with the recommendation algorithm and existing algorithm-driven challenges in the creative process. To delve into the perceptions and motivations behind creators' behaviors, we modeled a cyclical process (Fig. 1) behind the creator's decision-making. We observed three challenging situations creators encounter while navigating the cycle due to the algorithm: (1) when selecting their work strategies, (2) after experiencing the algorithmic impact, and (3) when experiencing the cycle of negative expectations and perceptions.

To explore design opportunities and considerations for creator-friendly algorithmic platforms, we conducted a participatory design workshop to derive solution ideas to address algorithm-driven challenges. In four workshop sessions ($N = 12$), participants suggested ideas for fostering diverse and creative expressions, achieving success as a creator, and motivating creators to continue their creator job. They devised specific design suggestions such as updating and controlling the algorithm, improving evaluation methods, mitigating mental stress, and getting creative inspiration and guidance.

Finally, we discuss creators' motivation behind work strategies and the folk theorization process in the creator context, the creator-unfriendliness of current algorithmic platforms, lessons from conducting participatory design with creators, and potential opportunities and considerations for designing a creative-friendly algorithmic platform. This research contributes to fast-growing areas in the field of HCI and CSCW such as investigating folk theories, supporting platform workers, and democratizing the algorithmic platform designs. We offer three contributions in the context of the creator economy platform:

- Identification of creators' work strategies to work with or against the algorithm and their motivation behind choosing specific strategies.
- Understanding of creators' algorithm-driven challenges during the content creation process on YouTube.
- Design opportunities for creator-friendly algorithmic platforms to improve creators' algorithmic experiences during the creative process.

2 RELATED WORK

To situate our research, we review prior work about users' perceptions and folk theories on platform algorithms, and user-centered design approaches for the platforms.

2.1 Algorithms and Platforms

Algorithms have become an essential element on various online platforms. In the flood of information, the algorithm recommends dating partners [53], moderates inappropriate comments [20], and is even responsible for connecting workers on gig economy platforms [39, 58, 70] or content creators [43] with potential consumers. Therefore, a substantial body of research has been performed to investigate how users perceive the algorithm and what effects the algorithm might have on society from a socio-technical perspective [31, 39, 46].

Nevertheless, the algorithm's inner working is still often a black box in the real world. Workers under algorithm-based platforms, such as gig workers, service providers, and content creators, consider the problem more seriously. This is because such black box problems make it difficult for them to guarantee a stable career. For example, Uber drivers have struggled with algorithmically-determined surge pricing when choosing driving routes because it is highly associated with their income [58]. Jhaver et al. [39] investigated users' algorithmic perceptions of Airbnb Hosts and found that hosts felt a lack of control and uncertainty over algorithmic decisions, and had to negotiate between attracting consumers and appealing to the algorithm. Despite the fact that these platforms provided occupational opportunities, workers believed that they were not prioritized and sometimes even ignored by the algorithm [18].

2.2 Folk Theory and Behaviors around Platform Algorithm

Due to the black box nature of platform algorithms, users develop their own belief systems, also known as 'folk theories [29]', to understand invisible systems. Previous work on social media has shown that users perceive algorithms as the rational assistant, the unwanted observer, the transparent platform, and the corporate black box [36]. Through surveys with general users, researchers found that users perceived that algorithms are intangible, reductive, and exploitative beings that make people feel like they are under control [75]. In TikTok, users sometimes think that algorithms are shaping their identities about how they appear to others, attempting to change the identities to align with their understanding [40].

Such folk theories affect how users behave within the algorithmic platforms, and their effects are visible across various platforms. Lee et al. found that algorithmic behaviors trigger drivers to take actions such as creating workaround strategies and communities with other drivers in ride-sharing platforms [48]. Similarly, users tried to boost attractiveness ratings in dating apps by devising algorithmic strategies based on their folk theories [53]. In social media, users adjust their beliefs based on information they receive through various user actions [27].

In the same vein, creators have also created algorithmic folk theories in creator economy platforms (e.g., YouTube, TikTok, Instagram). Wu et al. introduced three personas that the YouTube creators perceived algorithms as a gatekeeper, a drug dealer, and an agent [45]. Focusing on algorithmic demonetization, Ma et al. also pointed out that creators use uncertain knowledge to avoid having their channels moderated by algorithmic punishments [51]. This leads creators to feel that their work dependency is precarious. Wu et al. implied that creators worked with or against the algorithm in similar situations and called for further investigation into the motivations behind their behaviors. This could be related to the creators' folk theorization process, such as in Devito et al., where the authors described how social media users make decisions based on algorithmic results [27]. However, to our knowledge, there is little research on how folk theorization takes place in the creator context. Our research seeks to fill this gap by exploring how content creators make decisions in the creative process based on their understanding of the algorithms and what challenges they face in the process.

2.3 User-centered Approach to Improve Experiences around Platform Algorithms

HCI researchers have suggested user-centered approaches to improve experiences around platform algorithms. One line of work has investigated ways to make the platform algorithms more transparent and comprehensible. Shen and Devos et al. suggested a user-centered algorithmic auditing concept where users can scrutinize how algorithms work through day-to-day interactions [63]. Devos et al. also suggested a user-driven algorithm auditing paradigm driven by user studies, by which users also comprehend unfavorable algorithmic behaviors [30].

Furthermore, the participatory design and co-design method [78] has been widely used to understand users' perspectives. Design workshops can be used to invite users to review design scenarios, provide feedback, and even design algorithmic features [2, 47, 76]. Researchers are able to broaden their understanding of domain expertise and incorporate their perspectives with technology in the design process [78]. A large body of research has been done to explore how the participatory design method can be applied to improve user experiences in algorithmic systems of various context [2, 19, 47, 68]. Vega et al. suggested design opportunities for freelancing platforms based on empirical studies with freelance workers [2]. WeBuildAI proposed a framework that allows stakeholders to design algorithmic policies and build computational models [47]. Zhang et al. conducted participatory design sessions with drivers to re-design algorithmic management features such as collective driver data sharing [76]. These are performed by inviting stakeholders who have been working on the platforms and examining their specific needs and suggestions on the platform's design.

However, these participatory, co-design approaches have not been applied to the creator context. While both the content creator and gig-work platforms allow users to earn money, they also differ in significant ways: Creators do not "work for" the creator economy platform itself to earn money but rather utilize the platform to express their own creativity and earn benefits. As opposed to standardized gig labor (e.g., Uber, Airbnb) where the type of services is predetermined, creative labor could be provided in a wide range of content, services, and quality, which is mostly decided by creators' own creativity and passions [5]. For this reason, creator economy platforms would benefit from design solutions that are unique from the gig-work platforms. In our work, we use a participatory design method to center content creators in the creator economy platforms by highlighting challenges and co-designing solutions with content creators. Exploring what kind of creator support is required in the creator economy platform would help HCI and CSCW community understand how the platform should be designed to support and encourage creators to sustain their work.

3 RESEARCH OVERVIEW

We chose YouTube to examine our research questions. Here, we review the attributes of YouTube which contribute to the creator economy and related literature in HCI and CSCW communities. Also, we manifest how our study design is developed.

3.1 Context of Research

YouTube is the biggest global video-sharing platform [17] where anyone can create their independent channels and share videos as a creator. The length of the videos could be varied from long to short; there is a new short-form video similar to the other platforms' format (e.g., TikTok or Instagram Reels). Like other creator economy platforms, the platform enables creators to monetize their content by adding advertisement clips [6]. Over the past three years (2019 – 2022), over two million creators have joined YouTube Partner Program (YPP) to earn ad revenue [56]. At the same time, they show off their influential power based on their fan base [35]. They are no more just 'video editors' but often function as small entrepreneurs, dealing with brands and managing teams [65].

YouTube has encouraged creators' activities in multiple ways, such as creator funds [52], trying to help creators understand individual performance [7]. Yet, creators are inevitably influenced by algorithms and acute to the direction of their updates. While its high invisibility [8], creators could not easily ignore the content curation algorithm for their work life and the platform ecosystem. Algorithmic moderation led them to feel precarity to work on YouTube [51]. Also, in 2017, some creators revolted against YouTube's policy on their algorithm [45]. Though the YouTube algorithms try to help creators monetize, YouTube has been perceived as dominating and tempting creators rather than giving benefits to them [72]. Such perceptions may be inevitable for YouTube due to the nature of the platform ecosystem [3], but finding reasons behind the gaps between the platform's commitments and their needs would build positive mutual concessions in terms of how creator economy platforms should be operated. To do this, understanding how creators decide to work with or work against the algorithm is important, which is less explored in prior work.

Considering the vast volume and maturity of the platform, we proceeded with this work based on the YouTube platform, with the high expectation of investigating a wide range of challenges that the content creators could have, and design implications that could be applied to other creator economy platforms.

3.2 Methods Overview

We took a mixed-methods approach combining semi-structured interviews and participatory design workshops. From the literature review, we found that current recommendation algorithms and platforms are perceived not to be creator-friendly. To devise a creator-friendly algorithmic platform, we needed to investigate how creators interact with the algorithm and what kind of difficulties are situated in their interactions. Furthermore, we wanted to investigate how and in what aspect the current algorithmic platform is supportive of creators. Through the semi-structured interviews, we explored the needs of creators when interacting with algorithms in the platform by extracting the algorithm-related strategies and challenges of creators. Then, we explored design opportunities for a creator-friendly algorithmic platform by leveraging the challenges we investigated using a participatory design method. Participatory design [59] has been widely used for imagining and designing algorithmic experiences in HCI and CSCW communities [19, 68, 76]. We aimed to closely connect the two approaches by utilizing the output of interviews (Section 4) — creators'

algorithm-driven challenges — as the primary material of the design workshop (Section 6). In the process, we let creators empathize with existing creator-unfriendliness in current practices and potentially transform them into creator-friendly platform designs.

4 STUDY 1: CREATOR INTERVIEWS

To understand the formation of creators' perceptions, expectations, and behaviors and the algorithm-driven challenges, we conducted a semi-structured interview study with creators who reported that they perceived experiencing algorithmic effects on their creative process, either positive or negative on YouTube. In what follows, we introduce the recruitment process, participant dynamics, interview protocol, and results of the data analysis.

4.1 Recruitment

We invited participants who meet two conditions: a creator who (1) owns a YouTube channel and has actively maintained it for over a year and (2) is earning financial income from YouTube, either inside (e.g., ad revenues, YouTube Partners Program) or outside the platform (e.g., product placement). We defined an active channel as where the creator uploaded a video at least once a month, in the last year or more. Recruitment flyers are posted at (1) the online YouTube creator community in South Korea (KTUBE⁴), (2) social media platforms (Twitter, Facebook), and (3) several university online boards. Adding to this, we sent cold emails to creators who specified business emails on their YouTube channels. To populate the invitation list, we listed creators by searching YouTube with diverse keywords from public lists of common video categories [66] on the internet. We narrowed down to creators (1) whose 'Joined date' in the channel description exceeds more than a year with active video uploading and (2) who have more than 1,000 subscribers—which is the Minimum eligibility requirement to join YouTube Partners Program.

In the pre-survey, we asked about creators' working period on YouTube, channel category, experience in paid plan advertising, level of commitment, and the goal and purpose of running their channel. Additionally, we used the pre-survey to secure diversity in channel categories.

4.2 Participants

In total, we recruited 14 YouTube creators (5 female, 9 male). All participants were running their channels in Korean, aged between their 20s and 30s. The channels dealt with diverse topics such as computer science, beauty, Vlog, and music. Half of them were full-time, and the other half were part-time. The active period of the channels varied from 2 years to more than 8 years (See Table 1).

4.3 Interview Protocol

We designed the interview questions in three main parts. In the first part, we asked about their overall experience as a creator, such as how they perceived algorithmic impact and felt about those experiences. In the second part, we focused on asking how they took action to work with or against the algorithm. By asking about their behavior strategies, we also asked what kind of challenges they had

experienced during the creative process in the current platform. During this part, we asked participants to show channel analytics in their YouTube Studio which is the official administration tool provided by YouTube, and reflect on their past experiences based on the performance metrics (e.g., view counts, video watching data analytics, etc.) in the tool. Other than YouTube Studio, we asked how their decision-making process during the creator activities is influenced by the algorithm and their knowledge. Finally, we asked about their ultimate goals as a creator and how the YouTube algorithm should be improved to support them. The authors reviewed the participants' channels before the interviews to gain their background contexts and ask personalized questions. All interview sessions lasted up to 2 hours remotely over Zoom. All interviews were conducted in Korean and audio-recorded upon their permission. Participants were compensated with 160,000 KRW (Approx. 135 USD).

4.4 Data Analysis

Two researchers conducted thematic analysis [11] by first reading the transcripts and clustered notable responses of interviewees based on the following information: creators' general experience and work life, their perceptions and expectations toward the algorithm, how they work with or against the algorithm, reasons behind their work strategies, challenges they encountered due to the algorithm, their overall conceptualization of the YouTube algorithm, etc. For each cluster of information, we classified codes into themes and iterated over the codes within each theme, while re-classifying a subset of codes. Finally, we labeled the themes and went through the codes of themes and subthemes together for coherence. The quoted statements in this paper were translated into English. Before the analysis, we transcribed the audio recordings of interviews with Clova Note⁵ and used a qualitative analysis tool, Dovetail⁶ to proceed with the overall work.

We clarify that participants' experiences reported in the upcoming section were explicitly recognized by them as a result of the algorithmic impact and not attributed to virality or popularity unrelated to the algorithm. During the interview, participants sometimes did not distinctly mention the specific type of the algorithms, e.g., between search ranking and recommendation but mentioned them in the concept 'algorithm.' Rather, participants focused on stating where the result of the algorithm appeared or which traffic source presumably produced the result.

5 CREATORS' ALGORITHMIC WORK STRATEGIES AND CHALLENGES

Creators showed two opposite behaviors of either working with or against the algorithm. The behaviors a creator exhibit is not fixed throughout the whole creative process — they change based on the constantly updated expectations and perceptions toward the algorithm. We aimed to unpack the motivations behind each behavior and discovered a cyclic relationship between expectation, perception, and behavior. We describe this iterative decision-making process as the *creative decision-making cycle* (Figure 1). For creators, their expectations of the algorithm's impact and its helpfulness

⁴<http://ktube.kr/>

⁵<https://clovanote.naver.com/>

⁶<https://dovetailapp.com/>

Participant ID (Gender, Age)	Channel category	Active duration of channel	Total number of subscribers	Level of commitment
P1 (M, 30s)	Computer science	4 years & 8 months	156K	Full-time
P2 (F, 20s)	Vlog	4 years & 8 months	31.5K	Part-time
P3 (M, 20s)	Music playlist	3 years & 1 month	107K	Part-time
P4 (F, 30s)	Beauty & Fashion	7 years & 5 months	124K	Full-time
P5 (F, 30s)	Beauty	7 years & 6 months	352K	Full-time
P6 (M, 30s)	Single-person households	3 years & 1 month	377K	Full-time
P7 (M, 20s)	Pop music review	3 years & 10 months	5.39K	Part-time
P8 (M, 30s)	Journalism & News	4 years	191K	Part-time
P9 (M, 30s)	Marketing & Ads	3 years & 4 months	371K	Part-time
P10 (M, 20s)	IT & Travel	3 years & 7 months	6.93K	Full-time
	Car review	4 months	Not open to public	
P11 (F, 20s)	Animation	3 years & 1 month	42.9K	Part-time
P12 (F, 20s)	Vlog	1 year & 5 months	36.9K	Part-time
P13 (M, 20s)	Cover music video	1 year & 8 months	75.5K	Full-time
P14 (M, 20s)	Game	6 years & 1 month	100K	Full-time

Table 1: Participants’ demographics, channel information, and their level of commitment at the time of interviews.

influence what actions the creators might take (e.g., deciding which topic to cover in their next video). Creators then receive feedback on their behavior through the results of their creative work, on which they believe the algorithm exerts its influence [25]. With the new results, creators perceive the algorithm, adjust their expectations toward it, and repeat the decision-making cycle.

In the following sections, we explain the two groups of expectations toward the algorithm—whether it is creator-supportive or not—with example contexts. For each group, we present the creators’ corresponding behaviors: (1) working with and (2) working against the algorithm.

5.1 What are Creators’ Perceptions and Expectations Toward the Algorithm?

We categorize expectations into two categories based on whether the creator perceives the algorithm as helpful and supportive, or not. We focus on two concepts that frequently emerged in our interviews, as well as previous work: being ‘blessed’ or ‘doomed’ by the algorithm [62, 64]. These refer to the creators’ perceptions of the positive and negative impact that the algorithm had on their content. All participants stated that they had experienced small or big algorithmic blessings, such as a sudden increase in the number of views or subscribers or high comment traffic. In comparison, participants experienced frustration or disappointment when the results were poor despite the effort put into creating the content, and blamed the algorithm for it. Participants explicitly used terms such as “dead,” “abandoned,” and “no more opportunities to be blessed” expressing their dismay.

5.1.1 Believing in algorithmic support.

There was a widespread perception that the algorithm is an all-powerful being that determines one’s fate. P4 mentioned, “To be successful as a creator, it is much more important to be chosen by the algorithm than to put in the effort, such as taking optimization strategies to appear in the top search results.” P11 reported that she felt grateful after experiencing an algorithmic blessing. However, she felt as though it was akin to a “miracle”, as it was uncontrollable from her side. P9 also mentioned that the algorithm was an incentive that motivated him to continue his career.

Most participants wanted to reproduce the effects of algorithmic blessing to gain popularity or profit. For example, P2 became more conscious of the algorithmic impact after one of their videos reached 600K views, seemingly due to the help of the algorithm. Similarly, participants became more aware of the algorithm after experiencing its effects (blessings), but they were uncertain about how to replicate the effect again. On the other hand, participants hoped that the algorithm would “save their life” when their channels were struggling from low performance. For example, P12 thought that the most effective way of overcoming a slump would be getting an algorithmic blessing.

5.1.2 Lacking trust in the helpfulness of the algorithm.

Unwanted results after getting algorithmic effect. Despite its potential, the algorithm did not always function as the participants expected. One example was by suggesting the video to the wrong audience. P7 pointed out that while some videos got lucky by being exposed as the top search result, other videos were not as fortunate. They thought the reason was that the “algorithm did not expose

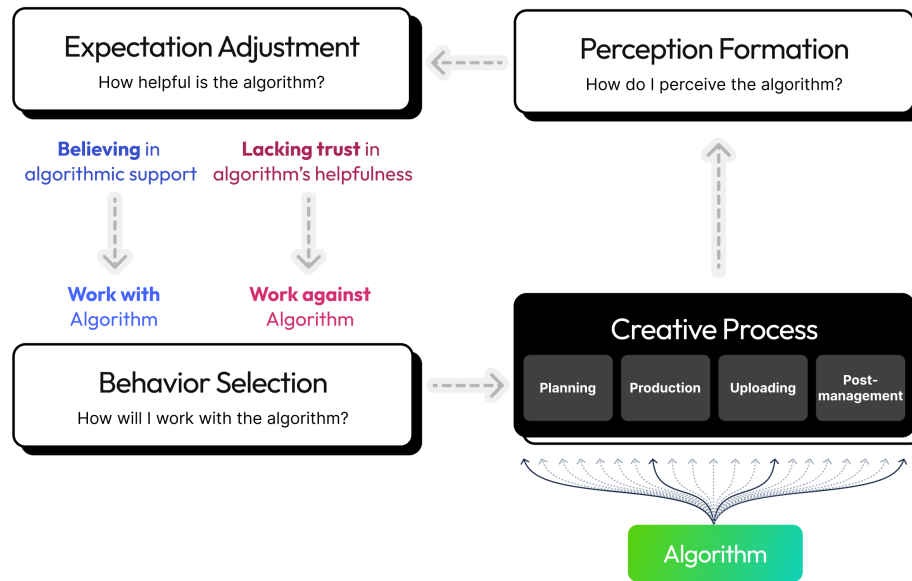


Figure 1: Creative decision-making cycle. Based on the cycle, we explain the creator’s expectations and perceptions behind the decision-making process on their behaviors. Within the cycle, the creative production process locates between behavior selection and perception formation. We explain the perceptions and expectations in Section 5.1 and behaviors (work strategies) in Section 5.2.

the video to the right viewers.” P10 pointed out the one-time effect of the algorithm, which is not helpful for creators due to the lack of sustainability. Furthermore, he once got the algorithmic blessing on the video, which he made without much effort nor attachment—which made him not feel rewarded. After getting the algorithmic blessing, P2 felt regretful about receiving it too early, within the life-cycle as a creator, because she could not stop thinking about the algorithm. She mentioned that “I would prefer not to be blessed.”

Doomed by the algorithm. ‘Doomed by the algorithm’ was how the participants described the feeling of being abandoned or betrayed by the platform due to the algorithm’s lack of support. Although participants initially tried hard to leverage the algorithm, expecting an algorithmic blessing, their attempts kept failing. Such failures to replicate the algorithmic benefits made participants lose trust in the algorithm’s helpfulness. P7 compared this to the fluctuating stock market: something they cannot take their eyes off of and something that makes people feel exhausted. P4 raised a similar opinion that the algorithm was inconsistent, based on 8 years of her creator experience. Despite their time spent working as creators, their understanding of algorithms couldn’t get any better, making them feel insecure about their future. They thought platforms should explain how their algorithm operates and provide guidelines to increase transparency.

Not supporting creative values. P10 mentioned that the algorithm is ‘uncooperative’ toward the creators’ artistic expressions. “I’m not sure whether YouTube is an appropriate platform to continue my creative pursuits. I sometimes want to send a serious message through my content or want to grow as an artist, but the algorithm

does not seem to respect me in that sense.” P1 was frustrated as he learned that the algorithm seemed to mostly prefer contents that are addictive and entertaining, not favoring the educational content on his channel. He complained that compared to other channels, he had less opportunity to be blessed by the algorithm.

5.2 How Do Creators Work With or Against the Algorithm?

Interviews revealed that most creators follow a similar process of production: planning, recording, editing, uploading, and analyzing the results. Creators also employed high-level strategies to manage their channels in a long-term manner. In this process, their perception and expectation of the algorithm influenced their decisions.

Overall, they showed two contradictory behaviors toward the algorithm: working with and working against it. Participants initially expected and tried to take advantage of the algorithm by intentionally working with it. However, if they kept failing to meet their goals, they started to work against the algorithm, showing indifference toward the algorithm and looking for alternative strategies to increase the performance of their channel. Figure 2 shows the creators’ behavior strategies working with or against the algorithm across the creative process.

5.2.1 Working with the algorithm.

Many participants chose trendy and timely topics when making videos, thinking that algorithms would favor them. With the high expectation of re-gaining the blessing effect, creators sometimes even negotiate between what they want to create for their channel

	Work with	Creative Process	Work against
CHANNEL	<ul style="list-style-type: none"> Understanding channel performance from the perspective of viewers Analyzing the reasons for receiving the algorithmic effect or the lack thereof Running real-world experiments 	MANAGEMENT	<ul style="list-style-type: none"> Creating or moving out to a new channel Collective action with other creators (e.g., leaving the platform) Gaining profit outside of YouTube
	<ul style="list-style-type: none"> Choosing a topic that might be favored by the algorithm Creating stimulating/timely/trendy content 	PLANNING	<ul style="list-style-type: none"> Creating videos that creators want to express their creativity Intentionally avoiding algorithmic impact (e.g., avoid making popular videos)
VIDEO	<ul style="list-style-type: none"> Changing the way of structuring and editing videos Changing the way of recording videos Producing high-quality content Creating videos based on the same material (Halo effect) 	PRODUCTION	<ul style="list-style-type: none"> Consolidating channel identity while ignoring algorithmic factors Producing high-quality content for other opportunities outside the platform Planning content not adhering to current trends
	<ul style="list-style-type: none"> Revising upload settings by editing content (e.g., thumbnail, hashtags) or scheduling the publish time Uploading another video right after the algorithm-favored video (Halo effect) Uploading videos when other creators upload similar videos (e.g., a new product launch) 	UPLOADING	<ul style="list-style-type: none"> Using upload settings that aim to avoid algorithmic impact
	<ul style="list-style-type: none"> Frequently changing the title or thumbnail when the content seems to be blessed (Halo effect) 	POST MANAGEMENT	<ul style="list-style-type: none"> Forming a dedicated fandom community for reliable support

Figure 2: Creator's working with and against behaviors across the overall creative process.

versus what is trending at the moment. We also found three major strategies for doing so, which are explained in detail below.

Halo effect: leveraging the benefits of an algorithmic effect that has already occurred. Participants said they would create new content with the assumption that algorithmic effects would reoccur, a phenomenon that P9 referred to as the 'Halo effect.' Participants tried to detect and replicate elements that were seen as critical in their earlier algorithmic blessings when producing new content. To take advantage of the halo effect, participants would update the title and thumbnail of the blessed video, upload another video on top of it, or make a series of videos similar to it.

Learning from real-world experiments. Participants tried to understand the mechanisms of the algorithm by running real-world experiments with their channels. Some participants actively tested hypotheses, expecting to control the algorithmic impact on their channels. For example, P12 prepared a video based on her hypothesis that the algorithm would bless a video with the following factors:

a lightweight topic like an eating show (Mukbang), an entertaining title, and a thumbnail with her face. She expected higher view counts and reactions from the viewers, but she did not see the desired results.

Meeting the advertisers' preferences. Earning financial benefits on the YouTube platform is mainly supported via YouTube Partners Program— which is enabled by advertisements. Some participants chose topics of their content with advertisers in mind. P6 and P9 thought that the YouTube algorithm would prefer content regarding uncontroversial issues so that more types of advertisements could be added to their videos. P9 said he stopped posting unpopular but diversity-related content (e.g., LGBTQ) that advertisers might not prefer.

5.2.2 Work against the algorithm.

When participants thought that the algorithm would not be helpful for them anymore, they sometimes made decisions to 'ignore'

the algorithm. Previous literature discussed similar behaviors toward the algorithm and its changes in the context of co-working with an algorithmic persona [72] and collective action in social media [29, 54]. We found two remarkable working-against behaviors from the creators. Participants mentioned creativity, channel identity, and quality of content are important factors in explaining how they work against the algorithm. Since they believed that the algorithm was not supporting their primary values, they chose to prioritize them and work against and avoid the algorithm.

Prioritizing creativity and channel identity. Pursuing creativity as a creator is a natural urge. However, some participants stated that the more they care about the algorithm, the less they can focus on creativity. P3 intentionally tried to avoid the influence of the algorithm when deciding the topic of new content because he was confident about his content's power without getting support from the algorithm. He mentioned that "Whenever I create music playlists, I can choose trendy music in the YouTube community, but I don't. It may attract the algorithm, but I just want to focus on expressing my creativity." P10 made a similar point stating that he did not want to adjust or change his content for an algorithmic impact. Some participants also intentionally disregarded the algorithm to maintain their channels' identity. P5 mentioned that she had thought about whether she should focus on her main content of cosmetics reviews or try popular topics to be chosen by the algorithm. However, she noted, "I consciously try not to care about the algorithm because then I might lose my channel identity and color."

Producing high-quality content for other opportunities outside the platform. Previously, when P10 had just started as a YouTube creator, he admitted that he kept looking for the algorithm a lot because their only source of income was the YouTube Partners Program. However, P10 confidently said that if the content is well-made and high quality, it is possible to gain on-demand production opportunities for companies and paid promotion opportunities (e.g., posting a video with sponsors). He told us, "For now, even though my channel does not get the algorithmic blessing and has low view counts, I'm okay with it. The quality of the channel has been recognized by companies; thus, they ask us to create advertising content. Now my main income comes from there, not from YouTube."

5.3 Challenges within the Creator's Creative Decision-Making Cycle

Participants faced many challenges as they navigated through the creative process (planning - production - uploading - post-management). As these challenges appear, they contribute to the growing negative perception of creative activities within YouTube in general. Moreover, additional challenges arose after multiple iterations of the creative decision-making cycle, making it hard for them to sustain their career as a creator. In this section, we introduce challenges that creators have experienced during the creative decision-making cycle. As shown in Figure 3, we mapped the identified challenges to each stage in the cycle.

5.3.1 Selecting work strategies. Creators experienced several challenges related to the algorithm hindering them in deciding the ways of creative expressions and identities. Due to the perception of being favored or discriminated against by the algorithm, creators

had self-imposed constraints on their creative work. Here, challenges are directly related to (1) creative expressions, (2) quality maintenance, and (3) content strategies.

There are many different assumptions and guesses behind what kind of content the algorithm favors, but the fact that what content the algorithm really prefers is actually unknown. By observing how YouTube videos get popular, they believed that the algorithm preferred stimulating and entertaining content over informative and instructive topics, which sometimes made it difficult to create the content they really wanted. P9 mentioned that "It seems like the algorithm less favors informative videos (e.g., eco-friendly topic), which I value quite a lot. If I make the same effort but don't get enough performance on specific types of video, then what should I create?"

The algorithmic uncertainty leads to hesitation when trying to make videos with new topics or opening a new channel. P14 mentioned that he wanted to open a new channel for his next phase, but he was concerned about the algorithmic black box. "My current channel is luckily exposed to the algorithm and became famous at that time. As Minecraft is not as popular as before, I want to open a new channel with a different topic. Yet I'm still unsure which category and plan I should prepare for a new channel to be chosen by the algorithm."

Even though creators put in significant effort to generate high-quality content, the algorithm often did not work as they expected, giving relatively low returns. Due to such economic instability, participants sometimes gave up on caring about the quality of content.

Furthermore, being unable to understand the algorithm hindered creators from building concrete strategies for content creation. Some creators thought the algorithm was biased, making it hard for them to establish strategies. P10 mentioned that "We don't know which side to focus on between whether we should change the way we produce content or change the way we consider algorithms."

5.3.2 Reviewing performance after video creation. After deciding on behavior, creators take actions based on their work strategies and complete the creative process until the video uploading and post-management. The distributed video would get evaluated by the platform with quantifiable measures; the performance achieved from video distribution is not only affected by the algorithm but also by audiences, which nobody knows, in fact. Based on the achieved performance, creators perceive the algorithmic effect and adjust their expectations. Through this long process, creators encounter challenges related to (1) the high impact of the algorithm, (2) low returns, and (3) lacking feedback, explanations, and interpretations.

Participants were often frustrated that their effort and time were not the only factors that affected the performance of their channel and content. As they thought that the algorithm largely influences such results, they recognized it as an absolute and powerful being. P12 mentioned, "I want to get 100,000 subscribers by utilizing the algorithm. [...] However, it is a number that's almost impossible without the support of the algorithm."

In contrast to the significant power the algorithm seems to have, participants sometimes reported feeling helpless when their strategies and efforts did not produce the expected results. P11 mentioned

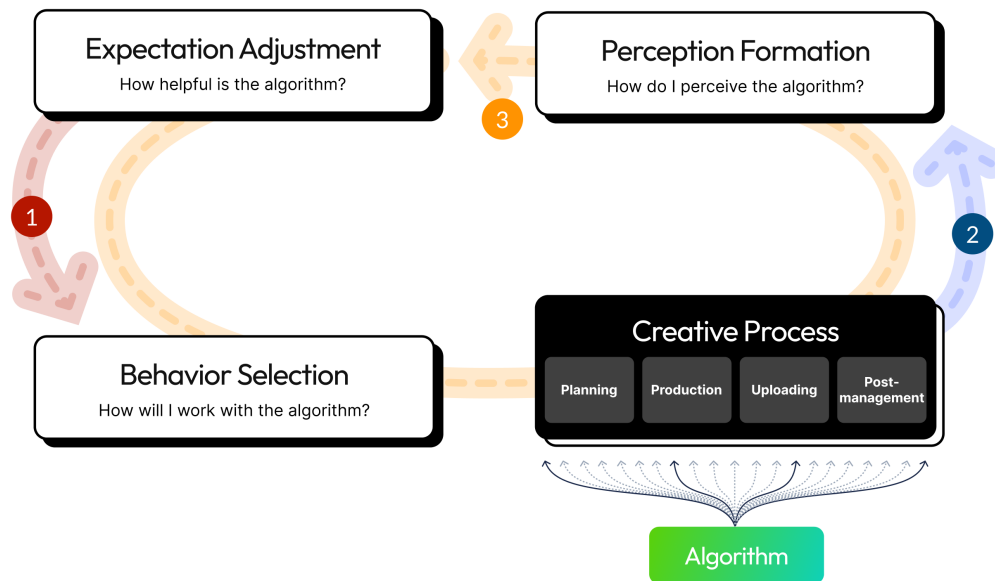


Figure 3: Three main challenges that occur within the creative decision-making cycle — (1) when deciding on work strategies (Section 5.3.1), (2) after getting performance results on their content (Section 5.3.2), (3) repeatedly experiencing negative aspects of the algorithm (Section 5.3.3).

that even though she made similar videos, one video can exceed 1 million views, but another can show insignificant results. She believed the reason for that difference could only be from the algorithm, as there was no difference between contents. P1 also said he spent a lot of time planning for and creating videos, but not receiving sufficient compensation made him feel discouraged.

Even if they achieved high performance compared to their expectation, it is not transparent whether the return is due to their effort or due to the algorithmic impact. Participants were barely able to interpret YouTube Studio, more than just with provided results. As there is no explanation, participants lose their trust in the algorithm.

5.3.3 Repeatedly experiencing negative aspects of the algorithm. Most creators produce a series of content on their channel, which means their creative process is iterative and long-term during their tenure on YouTube. Therefore, creators' perceptions, expectations, and behaviors keep changing. Challenges specifically related to creators' sustainable career life emerged in the process: (1) discouragement, (2) mental burden, and (3) an unfriendly ecosystem.

By repeatedly experiencing the negative aspect, it is easy for participants to lose their motivation to continue working. Several participants quit their original job and chose to work full-time when they realized that being a YouTube creator may bring a decent financial profit. However, unpredictable algorithmic effects partly contributed to their economic instability (P1, P4, P5).

Additionally, creators feel pressured to continuously pay attention to the algorithm throughout the creative process, which eventually influences their psychological well-being. As other creators'

successes were visible and quantifiable (e.g., view counts), participants stated that they compared themselves with other creators' performances, which was very stressful. Furthermore, they thought that taking a rest made them fall behind on YouTube, so they were afraid of taking enough rest. For example, P5 stated that they recently took a 3-month break, after which she felt like her channel was abandoned by the algorithm. This caused her to be regretful about taking a break. Even if participants thought their channel became dead, they could not take any more action on their channel to overcome for several reasons, so they were just stuck. For example, though P4 perceived her channel to be dead, she chose to stay with it and continue working. She could have created new channels, but it would have required a lot of effort, and she would have had to endure some period without revenue in the new channel.

Participants felt the algorithm made the platform an unfair, inconsistent, and biased ecosystem. After having been experiencing algorithms and platforms for a long period of time, P4 pointed out that "I think algorithms need to be more consistent. I think there should be a chance for everyone to be successful if they upload high-quality content consistently. Still, it seems like an ecosystem where opportunities are gradually disappearing for people who have been active for a long time." Furthermore, P10 felt a filter bubble negatively affects creators because it limits exposure and hinders new spread to viewers.

6 STUDY 2: PARTICIPATORY DESIGN WORKSHOP

We aimed to discover design opportunities and considerations for a creator-friendly algorithmic platform with the participatory design workshop. With the challenges acquired from the interviews, we reorganized those challenges and grouped them into values that are highly relevant to creators with a bottom-up approach: *financial benefit, motivation, content creation, planning, identity, performance & success, audience, platform ecosystem, and work life*. In this workshop, we invited UX of AI researchers who could provide design perspectives for AI-infused systems and technical perspectives for the algorithmic experience. As the main facilitators, they prompted YouTube creators to derive specific design solutions during workshops. Overall, we ran four sessions with 12 YouTube creators and two UX of AI researchers.

6.1 Recruitment

We followed a similar process of recruitment to Study 1 (Section 4.1). We recruited creators (1) who have been working as a creator for more than a year and (2) who are either earning financial income from their creator activity or strongly willing to earn financial income but failed — highly blaming the algorithm for this failure. In a recruitment survey, we asked one open-ended question — “Please briefly share your dissatisfying points about the YouTube recommendation algorithm as a creator.” — and screened creators who did not submit any response. As we used a similar process of recruitment and channels, we had several duplicate volunteers who already participated in the interview. We did not screen them as the purposes of the two studies were different.

6.2 Participants

For every workshop, we had three participants who were creators and one UX of AI researcher as a facilitator. Participants were running different genres of channels. 5 of them were full-time, and 7 were part-time. The average age of participants was 27.33 (SD = 4.05, min = 22, max = 35), and 4 were female. We compensate them with 100,000 KRW (Approx. 72 USD). The reason behind the lower compensation than Study 1 was that even though the expected length of the studies was the same, we assumed that the participation density in Study 2 should be less than the individual interviews requiring more contributions (e.g., sharing personal tips) from each individual.

We had two participants who both participated in the interview (Study 1) and workshop sessions (Study 2). To prevent bias in the workshop sessions, we did not let other participants know about their previous participation and assigned them different sessions. Below, we use an abbreviated form, W2C4, to denote Creator 4 who participated in Workshop 2. The UX of AI researchers who joined as facilitators were senior Ph.D. students in industrial design who were doing research on designing AI-infused systems and had experience designing user experience scenarios incorporating novel technologies. They were compensated with 250,000 KRW (Approx. 180 USD). The research team focused on running the workshop based on timetable and protocol, not providing any tips or advice to participants. Participants’ information is presented in detail in Table 2.

6.3 Workshop Protocol

Four workshop sessions were conducted remotely over Zoom. The process of the workshop was approved by Institutional Review Board (IRB) at our institution. Before running the workshop, we shared the workshop plan and protocol in detail with the facilitators in the *Pre-training session*. Since the output guided by the workshop is open-ended, we tried to make a consensus on the level of expectation toward the workshop results. The overall process of the workshop is demonstrated in Figure 4.

Introduction and ice-breaking. We first introduced the purpose of our research, the goal of the workshop, and how the workshop will be operated. Then, participants were asked to introduce themselves, their YouTube channels, and their working experiences.

Activity 1: Understanding and reflecting on challenges. To understand participants’ challenges, we provided 23 challenge cards written from the creator’s perspectives, with 9 categories of creator-specific values (See Appendix A.1). Participants chose 5-7 cards most relevant to their previous algorithm-relevant experiences. While choosing relevant cards, we asked them to reflect on their experiences, why they chose that card, and how it appeared in their context. After reflecting on the challenges, participants presented what they wrote on their challenge cards. A moderator summarized all chosen cards at a high level. As the final goal of this workshop was to design solutions for two of the challenges (Activity 3), participants decided on two challenges they would develop solutions for through discussions.

Activity 2: Connecting challenges with algorithmic perception. To envision what aspect of the algorithm causes the challenges, we asked participants to discuss and choose the ‘algorithm hashtags’ to match with challenges. We derived nine hashtags from perceptions about the algorithm from our interview data. They contain the feelings and perceptions creators have toward the algorithms when they face challenges — which implies negative sentiments including *uncooperative, authoritarian, favoritism, bothersome, inconsiderate, difficult to know, malfunctioning, capricious, and unstable rewards* (See Appendix A.2). During the discussion, participants shared why the specific algorithm hashtags fall under each challenge.

Activity 3: Designing solutions to address these challenges. Participants first chose two major challenges that they would like to solve the most and had time to discuss how they could solve those two challenges. Selecting only two challenges was intended to derive detailed solutions in a limited time. Inspired by Zang et al. [76], we provided five intervention types for solution ideas: (1) platform feature (e.g., keyword, hashtag, etc.), (2) third-party apps, (3) collective information sharing, (4) external sources of financial income, and (5) creators’ mental changes (perception, behavior, goal reset, etc.). We intended to use intervention types to help participants brainstorm specific types of solutions. We asked participants to choose one intervention type and imagine the solution ideas based on it. With selected challenges, participants expanded their ideas of potential system features or third-party applications ideas to solve their challenges. A facilitator helped participants to contemplate the specific solutions by asking questions related to algorithmic characteristics and potential side effects of their suggestions.

Workshop session	Participant ID (Gender, Age)	Channel category	Active duration of channel	Total number of subscribers	Level of commitment
W1	C1 (F, 23)	Vlog, University life	6 years & 3 months	6.3K	Part-time
	C2 (M, 25)	Classical music	3 years & 6 months	65K	Part-time
	C3 (M, 23)	Kids, Handcrafts	1 year & 3 months	160K	Full-time
W2	C4* (F, 32)	Beauty, Fashion	7 years & 8 months	120K	Full-time
	C5 (M, 25)	Classical music	3 years & 8 months	17.5K	Part-time
	C6 (M, 26)	Soccer, Sports	3 years & 8 months	3.3K	Full-time
W3	C7 (F, 22)	Nail arts	2 years & 9 months	90K	Part-time
	C8 (M, 35)	Car review	3 years & 4 months	27K	Full-time
	C9 (M, 28)	Music cover	2 years	150K	Part-time
W4	C10 (F, 30)	Vlog, Beauty	7 years & 2 months	189K	Full-time
	C11* (M, 28)	Pop music review	4 years & 5 months	5.3K	Part-time
	C12 (M, 31)	IT, Programming	3 years & 8 months	1.7K	Part-time

Table 2: Participants’ demographics, channel information, and their level of commitment.
W2C4 and W4C11 are P4 and P7 in the previous interviews.

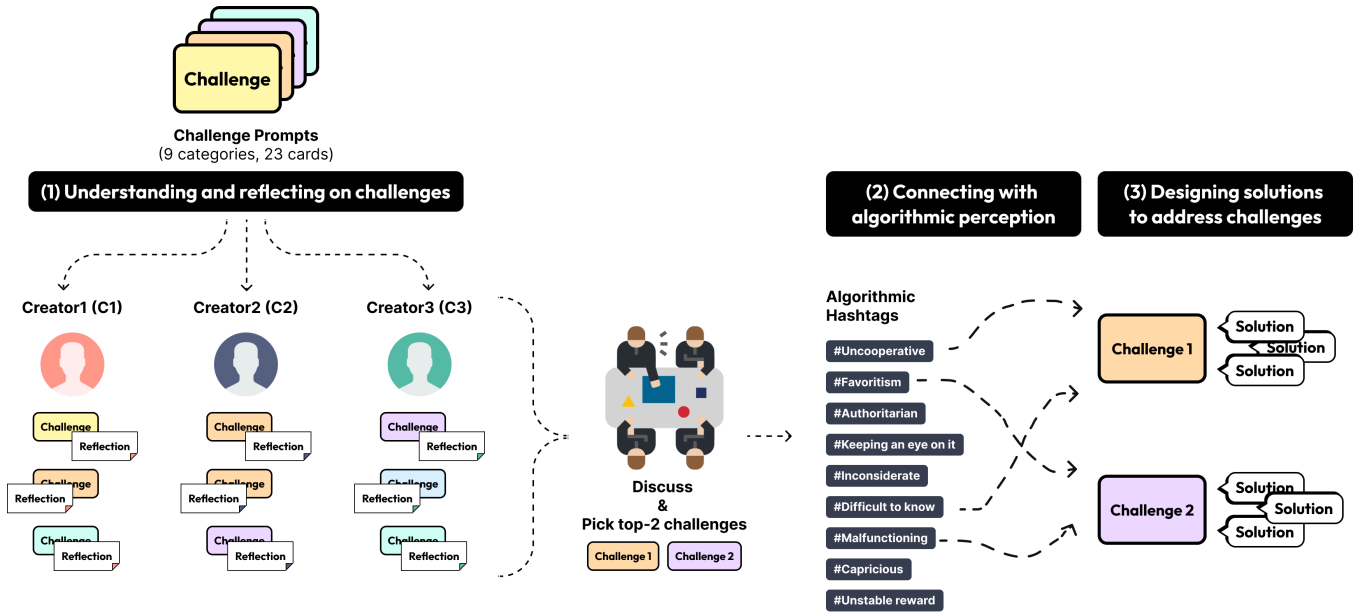


Figure 4: The illustrative process of a participatory design workshop. We demonstrated the main three steps which used the Miro board. The first activity was done individually, and the second and third activities were done by group discussion.

6.4 Data Analysis

The workshop sessions lasted for 112.25 minutes on average (min = 102, max = 117 minutes). All sessions were recorded via Zoom. The recordings were transcribed, and workshop results on the Miro board were documented in Google Docs. Two researchers first tried to separate chunks of transcripts based on each design solution. We excluded chunks of design suggestions that were irrelevant to the algorithm or related features, such as ‘moderating gossip videos’. Then, we conducted thematic analysis [11] by reading transcripts and coding notable patterns and topic sentences. After

coding workshop data, we generated high-level themes by grouping those solutions by the purpose of solution design. Through discussion, we reached a consensus on the group name – which we use as a subsubsection title in the next section. The quoted statements in this paper were translated into English. We categorized the emerging themes into three groups, which we will describe in the following section.

7 HOW TO DESIGN A CREATOR-FRIENDLY ALGORITHMIC PLATFORM

We organized the design suggestions from the workshop into three high-level themes: 1) fostering diverse and creative expressions, 2) achieving success as a creator, and 3) motivating creators to continue their job. These themes represent the common goal that the creators expect to achieve through the design solutions. The creators suggested improving algorithmic features and adjusting the algorithm. Based on the findings, we present an end-to-end design scenario that covers multiple design suggestions following the creative cycle of creators.

7.1 Design suggestions on a creator-friendly algorithmic platform

In each session, participants discussed and chose the two most important challenges in their algorithmic experience in the creative process. Since we did not intercept participants from coming up with challenges that were not in the prompt, participants from Workshop 3 added a new challenge, ‘Hard to know how the algorithm works’ from a higher-level perspective. Through an analysis of the workshop results and transcriptions, we discovered three major goals of design improvements: 1) fostering diverse and creative expressions, 2) achieving success as a creator, and 3) encouraging and motivating creators to continue their work. (See Figure 5.)

7.1.1 Goal 1: Fostering diverse and creative expressions. All sessions chose either *content creation* (Difficult to cover diverse topics in one’s channel, Difficult to focus on creating high-quality content) or *channel identity* (Difficult to create what they want) category as one of two major challenges. Participants aimed to achieve the goal of enriching diverse and creative expressions and representing their identity through these design suggestions. In other words, participants wanted to get support on their creative process in the platform. Participants desired the algorithm to be aware of the complexity and flexibility of their channel identity and understand them. Furthermore, they also wanted the algorithm to support part of their creation process, such as generating a thumbnail with decent quality for their video.

Respecting diverse identities within a channel. Creative work could not be simplified with just one single identity and could be potentially changed or complex. However, it is hard for participants to deliver their varied channel identities to the algorithm and platform (P9), and even they do not know how they are recognized by the algorithm (P4). For instance, W1C2 usually uploads videos as a ‘classical musician,’ but he sometimes composes his own songs as a ‘singer-songwriter.’ The classical musician and the singer-songwriter are separate identities of W1C2, though both of them are revealed on his single channel. For creators, it is easy to lose their channel identity, either by caring too much about the algorithm or being wrongly recognized by the algorithm. As a solution, W1C2 suggested submitting specific keywords or video categories conveying his channel identity to the algorithm. Like updating one’s Instagram profile, creators wanted to have greater control for determining their channel identity and content at various time points so that the algorithm could act as intended. Depending on creators’

self-expressions at the moment, understanding the channel characteristics differently and adapting recommendation methods would be interesting approaches.

Supporting new and experimental attempts. Many participants were eager to create diverse and experimental content, often in an artistic and creative manner. However, several participants were discouraged to do since it may not be feasible for their channels’ identities. To alleviate difficulties when making new trials, participants wanted the algorithm to support their experimental attempts, such as by guaranteeing high performance or returns. During the session, W3C9 suggested a specific UI example, “If creators upload a new type of content, I think the algorithm ‘must’ expose it in a separate section, such as the current ‘Discover New’ section.” Participants expected that, with the increased exposure, they could have a higher chance to be incentivized to produce more creative content—potentially achieving better performance in the long term.

Inspiring creators. What if the algorithm can inspire the creators? From participants’ perspectives, algorithms could be a creative partner inspiring them in their creative processes such as the planning stage and video production. W2C5 proposed an idea that the algorithm could recommend potential video topics. He wanted to get potential suggestions that are innovative like ‘Why don’t you lie down and play the violin? Can you play with your eyes closed?’. He would like to observe whether producing videos with the suggested topics would reward him with an algorithmic impact. Participants also wanted to take the design suggestions within the video production such as co-creating the thumbnail and title with them (W3C9). Their reason behind this idea was that they want to create content that guarantees algorithmic performance. W2C5 stated that covering popular songs was a way he can gain attention from the algorithm. He was looking for creative ideas that could break away from a slump, thus he would be happy to follow the unexpected and surprising suggestions from the algorithm as a guide.

7.1.2 Goal 2: Achieving success as a creator. Most full-time or part-time creators cared about their success or performance in platforms, which leads to their popularity, lifetime income, or collaboration opportunities (e.g., product placement). Because creators put in much time, energy, and resources to publish content, they expect to achieve popularity through their creative expressions. Based on the workshop, participants want to get chances to understand the algorithm to better utilize it. Also, they want to get adaptive scaffolding by the algorithm so that they could adjust their strategies to get a bigger accomplishment as a creator.

Enabling testing or simulations. Participants would like to make objective and informed decisions based on concrete evidence. They agreed that they no longer wanted to rely on their uninformed assumptions, or imaginaries when interpreting algorithmic behavior. To overcome the challenges related to algorithmic invisibility, the ideas related to evaluative outcomes that could predict actual performance were presented. For example, W3C8 suggested an ‘algorithm test board’ where creators can simulate their videos before uploading with the algorithm, to confirm whether his channel is an algorithm-friendly channel or not. Due to the absence of tools that provide early-stage feedback, getting early-stage feedback right

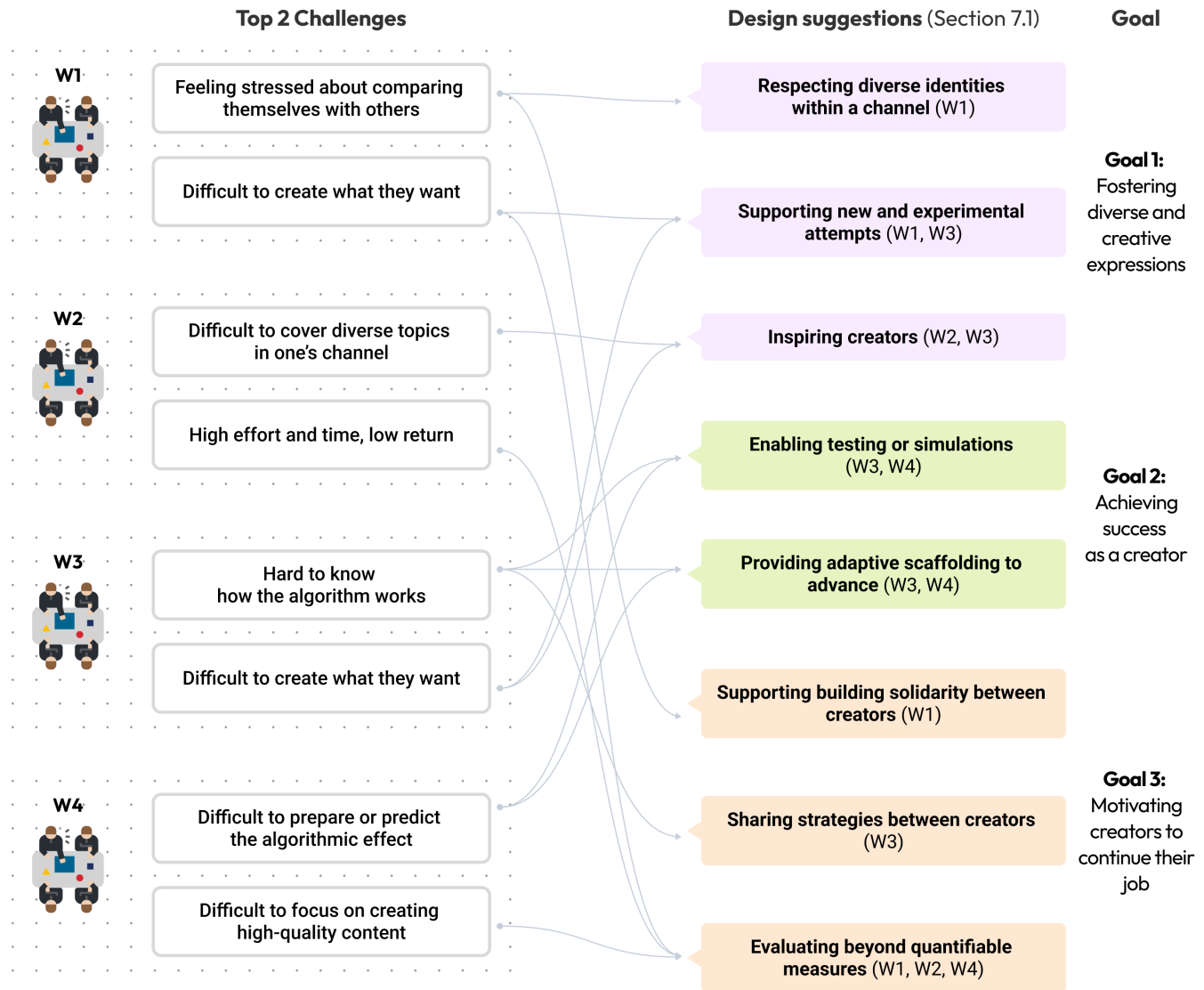


Figure 5: Challenges and design suggestions from each workshop session. Each session’s participants successfully designed two to five solutions that were relevant to their selected challenges.

after uploading was also proposed. By getting simple analytics or performance prediction by comparing it with their previous content, participants perceived that they would gain insights into how to elicit early reactions from the audience and high performances in their channel, comparing their own video results.

Providing adaptive scaffolding to advance. Depending on the goal or professional level of creation, creators might need different instructions and guidelines to overcome or improve the current situation [44]. Participants imagined algorithmic features such as providing personalized suggestions appropriate for their status. W3C9 likened it to ‘completing a game quest’ about getting personalized action items to improve their channel performance. After completing each quest, creators can get advanced suggestions to continue their creative work to achieve better performance. A short

example scenario was generated in workshop 3: the algorithm can explicitly say, ‘The reason that your video is not getting popular is due to the lengthy but loose video.’ Then, creators can shorten the length of the video. If a creator is in a slump but does not know how to overcome it, the algorithm can proactively suggest ways to motivate them, like ‘Your thumbnail could be more vibrant and colorful.’

7.1.3 Goal 3: Encouraging and motivating creators to continue their job. The creator is a voluntary job in which any person could participate by sharing their own work. However, the platform cannot be actively performed or maintained without their participation [15]. Therefore, participants insisted that the algorithm should encourage and motivate creators to either stay on the platform or quit their jobs. Participants devised controlling recommendation algorithms

to ease the competitive atmosphere of creators and strengthen their sense of solidarity. Adding to this, participants wanted to learn from others' analytic data or strategies. Finally, they asked for qualitative evaluation which is far beyond current measures, which are all quantified with numeric values.

Supporting building solidarity between creators. Participants agreed that the competitive atmosphere on YouTube to 'get more exposure' made them stressed and increased their mental burden. To mitigate the competitive atmosphere, participants from workshop 1 suggested creating opportunities for cooperation between creators who don't know each other. For example, they proposed controlling the algorithm of the suggested video features by making connections with other creators. W1C2 said, "Currently, the suggested video, which auto-plays after the watched video, feels like it is recommended randomly based on YouTube's algorithm. Can we decide which videos get suggested after our video?" However, when the facilitator suggested provoking questions ("What if the creators pay each other money to appear in someone's next video? Would it be fair or transparent?"), W1C2 revised her idea to be that the algorithm can initially provide the suggested video candidates so that the creator can choose one by themselves— which could be seen as creator-algorithm collaboration. She expected that recommending another creator's video after her video could make creators feel like they are 'working together' and not competing against each other. Even though the purpose was varied, Solidarity brokers [61] aimed to build solidarity between crowdworkers, with the purpose of mobilizing workers to help each other during their onboarding process.

Sharing strategies between creators. Participants wanted to learn about other creators' strategies and analytics, as shown similarly in gig economy [76] and crowdsourcing platforms [60]. For instance, W3C9 wanted to refer to another creator's analytics, whose performance and popularity rapidly grew. W3C8 also mentioned that he wanted to know the performance analytics of creators in a similar situation, in terms of the number of subscribers and the period of channel operation. "It would be better to show data of creators whose levels are similar to mine rather than those of people who have too much difference. Because I think it would be better to apply it if I am in a position where I can accept the feedback immediately, which is hard to follow." Nevertheless, all participants in the session agreed that the interpretation of analytics and actionable strategies should be provided in detail so that they could apply them to their practices.

Evaluating beyond quantifiable measures. In Workshop 2, participants insisted that content should be evaluated qualitatively, not only by quantitative measurement (e.g., view counts, number of likes). Participants believed that the current algorithm mostly works positively for the content that produces good quantitative results such as view counts, likes, audience retention, etc. Still, the algorithm should analyze and acknowledge how much effort and time creators put into making a video. They devised an idea to acknowledge the creator's trial and effort. They pointed out that the algorithm could measure behaviors or elements used in the middle of content creation (e.g., the degree of advanced video editing, and the usage of background music). However, there was a different standpoint on this idea. W2C4 pointed out that these measurements might benefit famous creators with big budgets only: "To be fair,

the algorithm should consider differences between the creator who belongs to the [management] agency and who is working alone, as their resources and the output of creation would inevitably be different." She suggested an alternative way of measuring the effort: "Uploading multiple videos is not about the quality or length of the video, it indicates how hard you worked. If newly starting or not-so-famous creators upload, for example, 20 videos, maybe 10th or 20th videos could be recommended to viewers, with higher impact than other videos."

7.2 Design Scenario

Liz has been working as a climbing YouTuber for more than 3 years. She usually uploads indoor rock climbing videos and explains her climbing tips to her viewers. One day, Liz wants to try new content to expand her channel domain as 'lifestyle.' Thus, she clicks the "Getting Inspired!" button in her YouTube Studio to get recommendations on her new topic. This feature analyzes her previous work and performance and suggests three different topics to activate a positive impact of the algorithm. Several keywords appear on the interface and she chooses the topic of 'fashion.' Specific suggestion, 'Why don't you share your outfit of the day (ootd)?' (*Inspiring creators*)

Liz shares her weekly outfit before climbing and also interviews several people nearby her so that novices can refer to what to wear when they go indoor climbing. Then, she uses a third-party app provided by YouTube to generate an impressive thumbnail for her. As she produces a new type of video, the platform promises to expose her video in "Discover new." (*Supporting new and experimental attempts*)

Liz is ready to upload a new video, '#OOTD: Climbing outfit of the day.' At the end of the video upload settings and configurations, the algorithm suggests four video candidates that will potentially be recommended as the 'next autoplay video.' Liz chooses a video by creator James, who has a similar topic to her uploaded video. James notices that his video is recommended by Liz as the 'next autoplay video.' Through this feature, James will get new subscribers who stumbled onto his video after watching Liz's. They do not know each other, but James feels like he got help from Liz and the algorithm to be exposed to a broader audience. (*Supporting building solidarity between creators*)

With the support of creator-friendly algorithmic features, Liz finally reached 10,000 subscribers. The platform sent an email with a congratulatory message and asked, 'What is your next goal?' through a pop-up window. More than 70% of her subscribers are women in their 20s and 30s, so she wants to expand her viewership. She sets her goal to 'Increase the number of male subscribers' and submits it. After that, she gets another email about how to achieve her goals — the 2030s male audience like to watch soccer and e-sports videos. Furthermore, their retention period suddenly decreases when the video length exceeds 3 minutes. Based on those analyses about targeting the audience, Liz could plan for her following content for the male audience. (*Providing adaptive scaffolding to advance*)

8 DISCUSSION

First, we discuss the contribution of our work by closely comparing it to previous literature in Section 8.1 and 8.2. Based on the workshop experiences, we share lessons from conducting participatory design methods with creators in Section 8.3. Zooming out from focusing on the creator context, we aim to expand the design suggestions to the existing practices of content-sharing and gig work platforms in Section 8.4.

8.1 Motivations behind working against behaviors and folk-theorization process of creators

Understanding creators' behaviors and motivations is crucial to learning the context behind specific challenges of platform-driven creative work. Wu et al. categorized creators' algorithmic perceptions into three personas [72] and our work further extends the investigation to provide an in-depth understanding of motivations and reasonings. As illustrated in Figure 2, creators chose their behaviors between working with or against the algorithm for various reasons throughout the creative process. Wu et al. demonstrated that a potential reason behind creators' counter-actions toward the algorithm was the breakdown of their expectations toward algorithmic blessing. In Section 5.1.2, we not only confirmed this assumption (*Doomed by the algorithm*) but also identified additional motivations; creators' counter-actions were not motivated solely by the lack of algorithmic blessing, but instead, their motivation is associated more closely with enhancing agency and keeping identity by themselves (*Unwanted results after getting algorithmic effect & Not supporting creative values*).

We further discovered the creative decision-making cycle (Figure 1) that creators' behaviors and folk theories are developed constantly. We emphasize that creators' decisions in the cycle are highly interconnected with the algorithmic interactions and the folk theorization process. DeVito investigated folk theorization for self-presentation on social media in which interplay happens between the users' folk theories and information curated by algorithms [28]. As YouTube also serves as a social media platform, creators' goals of forming folk theories are similar: trying to present self-identity on the platform. On the other hand, in comparison with social media, information in the creative process informed them about algorithms as part of folk theorization, which increases the complexity. Also, the significance of leveraging folk theories might differ. Creators tended to be more sensitive toward the algorithm as their revenue was dependent on how the algorithm operated. Our work shows that the creator context could affect the folk theorization process in another way, and how it could be represented within the creative process could assist in understanding creators.

Overall, we focused on investigating the decision-making cycle which could apply within each creative stage or across the entire process of creation. By examining the relationship between creator perception, behaviors, and algorithmic impact, we expect to capture creators' well-being issues such as exploitation, insecurity, burnout, or dropout issues in future work. Also, creators' behaviors classifying their channels as abandoned by the algorithm discourage them from continuing their job.

8.2 Creator-unfriendliness of algorithms and platform design

Our findings around creators' algorithm-driven challenges align with existing work on the algorithm's unfriendliness in work settings. Gig workers struggled with challenges around financial benefits, work-life balance, and platform ecosystem since they are under algorithmic management and highly interested in their well-being [76]. They also experience burnout [14] and health issues [41] due to high technology overload. Eventually, such challenges lead to lower the quality of their work performance. To alleviate the problems, HCI and CSCW communities have investigated the ways for motivating platform workers [38].

However, we identified unique challenges that are specific to the creator context, distinct from social media or gig economy platforms—for instance, it is hard to either quantify the subjective creative outcome or interpret reasons for performance. Quantifying work performance has been a critical feature of algorithmic management in workplaces [57], as well as in creator economy platforms. More than other forms of work (e.g., driving, crowd-sourcing), the produced content is hard to evaluate quantitatively due to its complexity and subjectivity. Yet, many platforms still provide creators with their measured performance by the number of subscribers/followers, view counts, replies, or even the amount of monetary revenue—which are believed to be highly dependent on the algorithm. Such simplified evaluation of creative outcomes makes creators feel helpless, and some creators end up blaming the algorithm for the lack of benefits.

From a broader perspective, YouTube is a platform where the creators collaborate with algorithms to spread their content to viewers. However, by taking a closer look at the working against behaviors, we could see that the algorithm seems to 'distract' people from focusing on their content itself and creative strategies, while creators attempt to optimize the chance of pleasing the algorithm [22]. In addition, creators felt that the algorithm did not support their creative values. They showed frustration about not being able to make the content they want or failing to focus on creating new, high-quality, or diverse content. When balancing between minding the algorithm and keeping their creativity, creators expressed concerns about losing their own identities. Therefore, algorithm developers or platform designers should consider ways to respect creators so that they could perceive the platform as a friendly, supportive, and collaborative counterpart.

8.3 Lessons from conducting participatory design with creators

Applying Participatory Design (PD) to design algorithmic experiences has been increasingly popular in the HCI community [26, 47, 76], as it allows researchers to gain insights into the needs and motivations of stakeholders with diverse backgrounds [78]. We found that two methodological supports were essential in scaffolding PD for the study: 1) providing clear guidance to facilitators and 2) materials assisting participants in motivating and supporting their knowledge gap. We highlight how algorithmic platforms could be designed by hearing opinions from creators.

First, we invited UX of AI researchers to facilitate the workshop sessions. The facilitators helped participants by prompting

questions on technical aspects (e.g., explainability, transparency, controllability, etc.) and real-world examples. To assist this process, we provided a sample set of questions that covered potential follow-up questions to specify designs suggested by participants. Thanks to the facilitators' help, participants were able to better understand the algorithmic concept, and expand their design solutions.

Second, we provided two materials driven by interviews; challenge prompts (Appendix A.1) and algorithmic hashtags (Appendix A.2). Challenge prompts were grouped by creator-specific values, inspired by value-sensitive design method [74, 76, 77], which helped participants to empathize with the problem space in a short time. We intentionally generated algorithmic hashtags with the word used in interviews to reflect creators' perspective—using simple terms like *inconsiderate* and *uncooperative* rather than more technical terms such as *opaque* and *random*. This enabled participants to have a similar level of knowledge among themselves.

By conducting multiple participatory design workshop sessions, we learned that concrete structural support is needed to guide domain experts in developing detailed solutions. We expect these lessons can be applied to PD with multiple domain experts, who are stakeholders around the creator economy platform, such as advertisers, viewers, and industry practitioners who have high interests but have limited technical knowledge.

8.4 Broader applications of the co-designed suggestions

Creator economy platforms contain several different platform aspects. As creators earn income on the platforms, they could be regarded as providing platform labor. Platforms like YouTube are online spaces where users share information or interests with other users — implying their nature as social media. Furthermore, as creators gain influence, power, and fandom [35], the creator economy platform serves as a form of community. Thus, creator economy platforms are uniquely positioned in terms of having mixed characteristics of workplace, social media, and community. Design suggestions devised by creators could be also applied in several other contexts. Below, we discuss three design opportunities to apply design suggestions in real-world settings. Furthermore, we expand our designs to broader contexts such as the different creator economy platforms, gig economy platforms, and crowdsourcing platforms.

8.4.1 Supporting early-stage platform workers. A newcomer who just starts content creation struggles with getting their channel on track or improving their work since they have less chance to be exposed to the public or get feedback. Furthermore, they do not know how to build their own strategies and the algorithms are hard to understand. Supporting such early-stage or novice creators is essential to activate the creator economy platform since creators can easily feel loneliness (P12) and anxiety (P10) until they could get enough reactions from the audience. Without the confirmation of the audience, it is hard for them to set the direction of their creative work and know whether their content will be loved by consumers. One potential approach to collecting and sharing *early-stage feedback* for creators would be recruiting 'beta-viewers' for new creators. Recruiting audiences who preview content can support evaluating one's created outcome and motivating creators to become more

productive [21]. Beta-viewers can not only provide constructive feedback to improve creators' content but also serve as the audience who could provide emotional support with the feeling of drawing attention. Even without the existence of an actual audience, the algorithmic simulated audience could emulate the actual audience's reactions, providing early-stage feedback to creators. Park et al. introduced a noble prototyping technique named 'Social Simulacra' which simulates social media before the intervention of users [55]. Furthermore, like how Solidarity brokers helped novice MTurkers to adjust in a work setting [61], *building a solidarity atmosphere* between creators can also be of significant help to the novices.

8.4.2 Designing a multi-dimensional reward system for creators.

One of the motivations behind several design suggestions, such as *evaluating beyond quantifiable measures* (Section 7.1.3), is highly relevant to mitigating creators' occupational instability. Different from crowdsourcing or gig economy platforms, creators' content is monetized by how much it is shared and consumed by viewers, which is financed by advertising revenues. Regardless of how they put into the effort to create content, their content is evaluated by how much the audience clicked and how much they simulated the audience. Therefore, they are not getting paid in proportion to the time or effort they actually put in, or even with the quality of their outcome. Moreover, how the revenues are distributed is invisible and creators sometimes confront demonetization according to content moderation unexpectedly. Thus, actively generating and uploading more content does not secure their economic wealth or stability. Even though financial benefits might not be the first goal of creators, still they are critical to creators, such as a recent study that investigated alternative monetization strategies outside of YouTube [37].

One way to improve the current reward system could be to evaluate the qualitative elements in the submitted video and the creators' efforts put into the production process. Qualitative evaluation results could be separately utilized in the rewarding system, aside from quantified measures such as the virality or popularity of the video. Rewarding based on the assessment of the creation process could be applied to live-streaming platforms (e.g., Twitch). The streaming content shows not only the process but also the outcome of their creative expression, which is different from content-sharing platforms (e.g., YouTube), where mostly the final edited videos are posted. Analyzing and rewarding live-streaming could include, for instance, real-time storyline, participation density, and activeness of streamer-viewer interaction, which consists of live-streaming content, rather than the number of viewers or likes. Furthermore, platform developers could introduce an algorithm to analyze the quality of content with qualitative factors such as content complexity, commitment, or sincerity. Primarily rewarding creators who generated original content could be another way of acknowledging their creative attempts. Still, consideration of content genuineness might not benefit all creators — where the quality and originality of content could be a mere representation of available resources of creators, which would consequently penalize independent creators. We could further investigate the desired compensation type and evaluation methods according to the context of the creator, such as whether defining oneself as an artist or entrepreneur.

8.4.3 Balancing between the conflicting goals of diverse stakeholders. Many creator economy platforms, including YouTube, involve distinct stakeholders: consumers, content creators, advertisers, and the platform operator (the company), similar to other algorithmic platforms. The platforms are operated upon by interactions between multiple stakeholders. Even though creators are an essential stakeholder group, prioritizing their goals may not always be possible. For example, improving fairness for creators may potentially worsen the overall recommendation quality provided to consumers and their satisfaction [32]. While creator concerns are obviously important, the platform always has to strike a balance between the interests of consumers and the platform economy. Social platforms host multiple types of content (e.g., video, ads, posts) shared by multiple stakeholders (e.g., influencers, advertisers, marketers). These platforms should be carefully designed by listening to multiple stakeholders' voices [1] and balancing them. Recent lines of research show some promising directions. For example, Mostra tried to balance domain-specific goals of multiple stakeholders, such as not only maximizing user satisfaction with music recommendations but also achieving artist or platform-centric goals [13]; Weber et al. proposed a collective decision-making framework that enables stakeholders to vote for appropriate recommendations so that they themselves can make trade-off decisions that impact their competing interests [71]. When applying the design suggestions from this research, one should carefully examine the impact of such design decisions so that the platform can still be a thriving place for diverse stakeholders.

The design suggestion that many content creators advocated would also need to be carefully designed to reduce potential side effects. For example, transparent and interpretable algorithms may sound like a panacea, but they can potentially lead creators to generate similar content that optimizes for what the algorithm would prefer. Another possible side effect is more fierce competition between creators to maximally leverage the algorithm. Furthermore, creators might actively try to game the algorithm so that the multiple objectives of the algorithm could be ruined. Naively opening up the algorithm may ultimately negatively impact the platform, which could lead to reduced user engagement and ad campaigns.

9 LIMITATIONS

We acknowledge several limitations of the current study. First, the opinions of participants could have been biased since all participants are Korean. This sample selection might not identify challenges that creators in other cultures face. In their statements, there were challenges that might be caused by localized channels, but they were not related to what our study intended. Due to the limited population, the creators in our study may have had culture-specific features, such as choosing content topics based on the trends limited to the culture. We expect that our study can be further investigated across cultures and regions in the future. Algorithm challenges and perceptions were also prevalent among our participants. In the exploratory research, we found that South Korea-based creators have also shared their opinions about algorithms through a Korea-based community (KTUBE), similar to YouTube creators sharing their thoughts about algorithms on Reddit⁷. Furthermore, Google

provides the same description of the algorithm with translated languages for the creators.

Second, in Study 2, grouping dynamics for workshops could have affected creators to devise solutions. If we grouped session members who work in similar categories with each other, they might have provided much more concrete solutions. We were guided by Lin et al. [50]'s work, reporting that grouping people from different perspectives was effective in idea generation. To our knowledge, our study is the first exploration of creator economy algorithmic platform design, so we aimed to provoke diverse solutions in the workshop.

Also, the UX of AI researchers assisting thought-provoking might have affected participants' opinions. The facilitators participated in generating solutions with participants, so some thought that the facilitators might have affected participants in solidifying their ideas. To avoid such a problem, we conducted pre-training sessions with facilitators.

Lastly, we limited the scope of our study to YouTube and YouTube creators as a case study. Some findings and challenges might not be generalized to other algorithmic platforms. Future research is necessary to examine the broader purview of creator economy platforms.

10 CONCLUSION

Our research explored how algorithmic platforms could be designed to be more creator-friendly, in the context of YouTube. We first examined how unfriendly the platform is for creators, by investigating creators' work strategies regarding its recommendation algorithm and the challenges driven by the algorithm. Through semi-structured interviews, we observed that creators show different work strategies—work with and work against—based on their expectations and perceptions. We explored algorithm-driven challenges in three cases: when deciding on their work strategies, after getting the performance results on their content, and after repeatedly experiencing negative aspects of the algorithm. With associated challenges, we conducted a participatory design workshop with creators and derived directions to achieve creator-friendly algorithmic platforms. Creators wanted to design an algorithmic platform where they can foster diverse and creative expressions, achieve success as a creator and motivate creators to continue their job. Our findings suggest that the platforms should consider creators in the design of algorithmic platforms and provide a more friendly environment to continue their creative activities in the creator economy platform.

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⁷<https://www.reddit.com>

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A APPENDIX

A.1 Challenge cards

Creator's value	Category of challenges	Quotations (Participants)
Financial benefit	High effort and time, low return	"Even if you put in more time and effort, they [the algorithm] does not promise good rewards." (P1)
	Economic instability as being of full-time creators	"As being a full-time YouTuber, the only way to earn life income is gaining high view counts with the support of the algorithm. Thus, I become more and more sensitive and conscious of the algorithm." (P10)
Motivation	Difficult to feel accomplishment	"While I'm busy for my real life, I yet tried my best – such as creating videos that are likely to be chosen by the algorithm, and increasing the quality of the video – to please the algorithm. However, I could not get the algorithmic effect, which made me difficult to feel accomplished." (P12)
	Feeling continuous anxiety	"Since I don't know anything, I just keep creating videos (P10) in the dark cave, waiting for the algorithm to push my video."
	Feeling stressed about comparing themselves with others	"Many other YouTubers are getting popular by [riding] (P14) the algorithm, so it is easy to pay too much attention to the algorithm. However, if the algorithm does not choose the content, creators might give up on creating content by losing their motivation."
Content creation	Difficult to cover diverse topics in one's channel	"The algorithm does not show my contents that I think is novel. Although I feel satisfied to create such useful and necessary content, I felt disappointed when the view counts are too low with respect to my efforts." (P9)
	Difficult to make new trials	"It was difficult to decide categories and identity of channels to make it more exposed. So I just couldn't create a new channel." (P14)
	Difficult to focus on creating high-quality content	"I've been thinking provocative contents and topics that the algorithm would expose more. It makes me less motivated to create quality contents" (P10)
	Difficult to establish strategies	"I feel lost when I was confused if I should change the way we create contents or the way we consider the algorithm" (P10)
Planning	Difficult to prepare or predict the algorithmic effect	"We created our recent two videos by referring to popular videos to have more exposure. But it wasn't really successful." (P12)
	Difficult to do posthoc analysis	"I couldn't guess why that video gets boosted [by the algorithm]. Even, the sudden increase in subscribers and view counts happened after more than a year when I uploaded that video." (P4)
Channel identity	Difficult to create what they want	"Before getting the algorithmic blessing, I uploaded some ordinary videos like a diary. But after the blessing, I try to upload videos that I think viewers want to watch. That makes me upload more fun and interesting ones, editing some ordinary scenes" (P12)

	Too many similar contents	“Within the same category, everyone uses the same sources (e.g., background music) and the same format. Only the slight difference in the direction between creators makes the contents standardized and become uniform.” (P11)
Performance, Success	Difficult to settle as a creator	“My goal is to achieve 100 thousand subscribers on my channel. In fact, it would be impossible without the support of an algorithm.” (P12)
	Difficult to affect the performance of each content (short-term effect)	“When I create the same video with some popular video, sometimes I get the algorithmic effect together so that it exceeds a million views. Otherwise, it shows a similar performance as normal. It seems like a fortune.” (P11)
	Difficult to affect the success of overall channel (long-term effect)	“These days, every channel has its own keyword. My channel’s keyword, beauty, has been distracted as the algorithm kept choosing videos of my pet. As a result, the following videos of cosmetic reviews and make-up tutorials are not showing their best performances due to losing the keyword of the channel.” (P4)
Audience	Potentially share the video to unspecified majority	“When starting my channel, I didn’t feel burdensome as I didn’t have many viewers and it was just for fun. But as I get more viewers by the algorithm, I realize I need to be careful in my speaking.” (P6)
	Barely share the video to target viewers	“I was hoping to make our videos exposed to viewers who have a good fit our channel, which could make a place of communication between such viewers. However, I don’t think our videos have been exposed to such viewers.” (P13)
	Difficult to predict how the viewers access the video	“We suddenly got many subscribers not because of beauty but because of hamsters. That was like I wanted to share my daily life in addition to beauty, so I uploaded a video with hamsters. It had many view counts, and I got 100K subscribers probably by algorithmic blessing.” (P4)
Platform Ecosystem	Filter bubble	“I kind of think it becomes more difficult to look for information to have more balanced view as the media like online news shows part of information.” (P10)
	Provided with limited information	“There’s not enough information about exploration features. My analytics show high incoming portions by searching, so I think we can get more view counts by improving that part. But I’m not sure what the exploration is.” (P10)
	Unfair ecosystem	“I think everyone needs to have equal opportunities to be popular if they keep uploading quality content. However, I feel this system doesn’t give equal opportunities for those who have been active for a long time ” (P4)
Work Life	Hard to take enough rest	“There are many YouTubers who are not in good health condition as they cannot properly sleep and just work too much. It’s actually not true to get an algorithmic blessing when you’re not working. I wasn’t really active when the beauty industry in general had a hard time due to COVID-19, and I no longer get such algorithmic blessings after that.” (P5)

Table 3: Challenge cards that were written from the creator’s perspective for activity 1 of the workshop. The cards illustrate nine categories of creator-specific values with the related challenges and the participants’ interview responses derived from Study 1.

A.2 Algorithmic hashtags

Algorithmic perception	Quotations (Participants)
Uncooperative	"I'm not sure whether YouTube is an appropriate platform to continue my creative job. I sometimes want to give a serious message or want to grow as an artist, but the algorithm does not seem to respect me in that sense." (P10)
Favoritism	P1 was frustrated as he learned that the algorithm seemed to mostly favor contents that are addictive and entertaining, not like the educational content on his channel. He complained that he appeared to have better quality content and made more efforts than other channels but got less opportunity to be blessed by the algorithm.
Authoritarian	Contents creators are freelancers and earn as much money as they can. However, several participants (P5, P11, P12, P13) thought they were working under a boss, algorithm. They thought of themselves as subordinates, and the boss dominated them. The boss doesn't acknowledge their work reasonably, and they are also forceful in producing content even though it is unwanted.
Keeping an eye on it	"Like a lover, I'm always curious about the algorithm that 'Where is your heart heading?', 'What are you thinking now?'. Yet, I don't actually try to understand the algorithm 100% and fall it down. We care about our lover's feelings." (P9)
Inconsiderate	"After my video got blessed by the algorithm, I could not reproduce it anymore. It made me to feel that the algorithm is mean." (P2)
Difficult to know	"It would be better to give up on thinking about the algorithm, as it is too complex and abstract. However, I'm unsure whether trying hard to understand and apply it to my creative work would be helpful." (P8)
Malfunctioning	"Thanks to the algorithm, some videos were lucky to be exposed to the top search result. Yet, there are some cases where the low number of viewers converted into subscribers. The algorithm did not recommend the video to the right people." (P7)
Capricious	P7 compared the algorithm to insecure stock that people exhaust; because they cannot take their eyes off it and don't know when it is effective. Like rapidly fluctuating stock markets may give a mental burden to investors, he thought that unstable algorithm changes lower creators' creativity.
Unstable reward	"Recently, my energy has been a little bit off. I was adhering to my own strategies [such as changing thumbnails, choosing topics for algorithm], but there were no rewards from the algorithm." (P5)

Table 4: Algorithmic hashtags for activity 2 of the workshop. The nine hashtags are derived from the perceptions about the algorithm from the study1 results. Participants' specific interview responses are also illustrated in each hashtag.