An Investigation of the Portrayal of Social Media Challenges on YouTube and Twitter

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A social media phenomenon that has received limited research attention is the advent and propagation of viral online challenges. Several of these challenges entail self-harming behavior, which, combined with their viral nature, poses physical and psychological risks for both participants and viewers. The objective of this study is to identify the nature of what people post about the social media challenges that vary in their level of risk. To do so, we conducted a qualitative analysis of three viral social media challenges, the Blue Whale, Tide Pod, and Ice Bucket challenges, based on 180 YouTube videos, 3,607 comments on those YouTube videos, and 450 Twitter posts. We identified common themes across the YouTube videos, comments, and Twitter posts: (1) promoting education and awareness, (2) criticizing the participants, (3) providing detailed information about the participants, (4) giving viewers a tutorial on how to participate, and (5) attempting to understand this seemingly senseless online behavior. We used social norm theory to discuss what leads people to post about the challenges and how posts intended to raise awareness about harmful challenges could potentially create a contagion effect by spreading knowledge about them, thereby increasing participation. Finally, we proposed design implications that could potentially minimize the risks and propagation of harmful social media challenges.

CCS Concepts: • **Human-centered computing** → *Human computer interaction (HCI)*; **HCI theory, concepts and models**; • **Information systems** → *World Wide Web*; • **Human-centered computing** → *Interactive systems and tools*; User interface toolkits;

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1   INTRODUCTION

A new phenomenon, known as social media challenges or online challenges, has spread across several social media platforms. These challenges involve people encouraging one another to participate by posting pictures of or recording themselves participating in these activities online. Users then encourage their peers to participate and share their experiences as well [24]. These challenges, such as the Tide Pod Challenge (TPC), the Amyotrophic Lateral Sclerosis (ALS) Ice Bucket Challenge (IBC), and the Blue Whale Challenge (BWC), vary in their inherent level of self-harm behavior and risk to individuals [69, 103]. Some promote philanthropic causes and tend to present lower risks of harm for participants than others, one example being the ALS IBC, which raises awareness of and funding for ALS research with minimal risk associated with it [112]. Conversely, other challenges are more harmful to their participants. For example, teenagers biting into and swallowing Tide Pods (chemical detergent pods used for laundry) as a social media challenge has resulted in more than eight cases of poisoning according to the American Association of Poison Control Centers [22, 38]. Even more extreme, other challenges require intentional self-injurious behavior. For example, the BWC, as described in the media, reportedly involves tasks such as carving the outline of a blue whale into the skin of one's arm and culminates in a participant ultimately attempting suicide [73]. However, thus far, no reports of suicide attempts worldwide, nor in the United States, have been confirmed as the result of the BWC.

Some of these challenges (i.e., the BWC) have been the subject of conjecture concerning their harmful impact; however, no definitive conclusion has been reached about whether they are a public safety risk or simply sensationalized by the news media [73, 96]. In addition, these challenges are of theoretical interest given that they may contribute to contagion effects (behavioral transfer from one person to another), peer pressure, a vulnerability for self-harming behavior, the normalization of self-harm, and social modeling [42]. As such, some of these online challenges are considered online risks since even the activities involving the least amount of harm are treated as a game encouraging broad participation that rapidly spreads through social media [28]. Prior research has documented the widespread existence of risk, self-harm, and suicide-promoting content online [8]; however, little research has investigated the connections between the portrayal of these challenges on social media platforms, their relation to self-harm, and their potential contagion effects. Further, no research has investigated whether those who do not directly engage in the challenges, or in fact find them difficult to understand and entirely unappealing, may still propagate these potentially harmful messages because of the emotions they elicit in viewers. Surprise, disgust, fear, or anger can motivate recipients of viral messages to post about them [21], as can altruism and concern for others [39]. To address these gaps in the literature, the objective of this study was to investigate the portrayal of viral online challenges on social media platforms to understand the nature of what people post about these challenges and determine whether their portrayal and posts could potentially decrease or increase their spread. More specifically, this study investigated how social media users post about these challenges and compares their portrayal themes across social media platforms and different challenges, specifically ALS IBC, TPC, and BWC. Subsequently, we used the social norms theory [23] in a post hoc analysis to understand why people post about the challenges and determine the extent to which this portrayal contributes to the spread. This research answers the following questions:

RQ1: What are common themes associated with social media posts directed toward these popular social media challenges, and how do they vary across different social media platforms and challenges?

RQ2: Why do people post about the different social media challenges on YouTube and Twitter, and what are the potential risks associated with their portrayal?

To answer these research questions, we collected and analyzed digital trace data from YouTube and Twitter to understand the dissemination of information about the three viral social media challenges, specifically ALS IBC, TPC, and BWC, including what types of messages are being created and for what purpose they are being shared. We qualitatively coded 180 YouTube videos and 3,607 comments on these videos as well as 450 Twitter posts about these challenges. Our analysis indicated that the users primarily posted about the challenges to raise awareness, to criticize and make fun of the participants of the challenges, to provide details about the participants' personal life, to illustrate how to participate in a challenge, and/or to suggest reasons on why they believe people are participating in the challenges. Overall, we found that YouTube videos contained detailed information about people who have said that they participated in a challenge in the past and step-by-step instructions for how challenges can be performed. Although most ALS IBC and BWC posts tended to be about raising awareness (promoting the ALS IBC and warning against the BWC), the majority of the TPC posts criticized the participants. In addition, YouTube videos contained detailed descriptions of self-harm methods, whereas Twitter posts (due to the different affordances of the platform) did not provide detailed accounts of how to perform the challenges. Our research makes unique contributions to the literature in the field by exploring the relationship among social media, self-harm, and suicide contagion (the spread of suicidal acts through observing and mimicking others) based on a qualitative analysis of social media trace data. We compare our findings with the past literature and the social norms theory to determine the factors that significantly contribute to the viral spread of these challenges. Last, we provide design implications for practitioners on how this phenomenon could be minimized.

2 RELATED WORK

In this section, we review the literature on the social norms theory and how it affects human behaviors. Then we summarize the current literature on online risk and viral social media challenges.

2.1 Human Behavior and Social Norms

Human behavior is strongly driven by *social norms* [32], defined as "mental representations of appropriate behavior in society and smaller groups that, consequently, guide the behavior of individuals" [95, p. 2]. Social norms are those shared by several individuals in a society or a small group, who, in turn, either approve or disapprove of these norms [23]. People tend to compare their own behavior to others to decide whether their actions are appropriate, and subsequently, people develop social norms intentionally because they reflect what the group considers a public good that advances a collective [27]. In other words, pro-social behavior can be influenced positively by social norms [27]. For example, burning fewer leaves in the neighborhood means a reduction in air pollution for the people living there [20] or eliminating smoking leads to better public health [74, 76, 106].

The application of social norms theory to risky behaviors began in the 1980s to explain the heavy alcohol consumption on college campuses in the United States [80, 82]. Researchers found a significant difference between individuals' actual alcohol consumption and the perception of their peers' consumption. According to the social norms theory, the overestimation of peer alcohol consumption led individuals to increase their own consumption. Moreover, the underestimation of

protective behaviors marginalizes individuals with low alcohol consumption and reinforces those with heavy alcohol intake [7, 89]. This led to excessive drinking becoming socially acceptable and more students involved in alcohol abuse regardless of the accuracy of their perception [33]. Social norms research has found that misperceptions are prevalent in not only alcohol abuse [33, 82, 83, 98] but also injection drug abuse [18], sexually transmitted disease [59], bullying [81], and the spreading of rumors on social media [106]. Therefore, we believe it provides an appropriate basis for understanding the impact of posts on social media on challenge participation and the development of potential interventions.

Observing the reinforcement from fellow group members can help establish behaviors that are approved and desirable within a particular context even if the behavior is seen as undesirable to the individual [13, 52, 53]. For example, in team sports, it is likely that individuals play through injuries [14, 36, 40]. The players have frequent interactions and high cohesion [34], providing the opportunity for observations and reinforcement and creating social norms within the team [57, 58]. This situation is similar for self-harm behaviors and suicide related to the BWC in particular, as they carry a social stigma of devaluation for vulnerable individuals and their families [64, 104]. This social stigma enhances the risk factors for suicide and self-harm such as isolation [43, 44] and shame [99, 100] and serves as a barrier to suicide prevention [16, 17, 56]. Therefore, it is important to address the social contexts in which suicide and self-harm occurs in addition to recognizing warning signs and referring individuals to appropriate services where they can receive help [71]. For this reason, we applied a naturalistic approach to understand the social norms regarding posting about risky social media challenges that involve self-harm and risky behaviors.

2.2 Online Risk and Viral Social Media Challenges

Most of the literature on online risk to vulnerable individuals has focused on protecting them from being exposed [108] to information breaching [61, 62], cyberbullying [45], and sexual solicitation [94], and exposure to violent content [63]. Most of this work has focused on understanding the key factors contributing to online risk exposure through mixed method approaches such as controlled studies, surveys, and semi-structured interviews [63, 67, 87, 88]. Others have achieved the same goal using naturalistic approaches such as content analysis to find more authentic information [19, 110]. Researchers have identified factors that increase the likelihood of engaging in risky behavior, including high frequency and intensity of exposure, depicting or modeling the behavior in detail, high similarity of the model to the observer, normalization of the behavior, and favorable perceived consequences of the behavior (e.g., the behavior is rewarded or glamorized, or is perceived to result in minimal risk [6, 90, 107]. Social media exposes users to a multitude of risks including cyberbullying, peer pressure to experiment with self-injurious actions, and glamorized graphic videos that include images depicting lethal means, all of which are believed to influence Non-Suicidal Self-Injury (NSSI) and suicide contagion [93]. In addition, according to the social norms theory, the frequency of this exposure normalizes this behavior and increases the chances of someone participating in it [23].

As for risks related to social media challenges, the existing literature focuses either on a single challenge and its implications for public health and safety [5, 30, 73] or more generally on the relationship between viewing self-harming content and engaging in self-harm [70, 111]. For example, Grant-Alfieri et al. [30] discussed the impact of participating in the Cinnamon Challenge (an online challenge that involves swallowing a spoonful of ground cinnamon) on someone's body and encouraged children to "weigh the risks and rewards of yielding to peer pressure when considering senseless and risky behavior" [30, p. 834]. Lupariello et al. [66] reviewed five cases of hospital admissions related to the BWC to identify the factors that led these individuals to participate in

the challenge. In their study, they warned about the fast spread of self-harm engagement through social media and its influence on vulnerable individuals.

To date, the literature has attempted to explain the personal factors that could contribute to the spread of risky behaviors as well as the contribution of the internet and social media in magnifying the spread of posts. To the best of our knowledge, there is no research investigating how viral social media challenges are portrayed online from the perspective of non-participants. Even though there is a significant amount of controversy around these viral social media challenges, there is limited research on what is portrayed in their content that could result in potential harmful outcomes. These viral social media challenges represent a possible risk to vulnerable individuals, even if the user does not actively participate and only posts about them, due to the potential of self-harm and suicide contagion effects [110]. In other words, those who do not directly engage in the challenges, or in fact find them unappealing, may still propagate these potentially harmful messages because of the emotions they elicit in viewers. For instance, surprise, disgust, fear, or anger can motivate recipients of viral messages to spread them further [21], as can altruism and concern for others [39]. Thus, a user who hears about an online social media challenge that the user perceives to be a threat may forward the message as a means to warn others or speak out against the challenge, but in doing so may unwittingly contribute to the contagion effects. To address these gaps in the literature, this research has the following goals:

—Identify how people post about risky social media challenges.
—Recognize the contribution, if any, of posting about risky social media challenges to their spread.
—Provide implications and recommendations for social media platforms that help reduce the spread of risky and harmful messages.

Three challenges (ALS IBC, TPC, and BWC) were selected to be investigated in this study because they vary in the level of self-harm involved. The BWC is the most harmful, as the last stage reportedly requires the participant to attempt suicide. The TPC has a moderate level of harm and involves swallowing laundry detergent. Finally, the ALS IBC is the least harmful and involves having participants drench themselves with ice water. We make comparisons among the three challenges to assess whether certain patterns are generalizable to other social media challenges and which characteristics are unique to each challenge. In this study, we focus on both the portrayal and the perceptions of these three types of challenges, with an emphasis on factors that may contribute to their contagion, as well as how these factors differ across challenge types. To support our goals, we applied the social norms theory as a post hoc analysis to help us understand the themes identified.

3 METHODOLOGY

We analyzed social media trace data related to the Ice Bucket, Tide Pod, and Blue Whale challenges posted on YouTube and Twitter, two of the most popular social media platforms [68, 77, 78]. In the following, we describe how we collected and analyzed our data.

3.1 Data Collection Approach

To identify relevant social media posts, we first conducted keyword searches on YouTube and Twitter. We used YouTube's native search engine to manually collect videos using the keywords shown in Table 1 on March 2018. The results were sorted by "relevance," an option provided by YouTube that ranks videos in descending order relative to the keyword queries based on such factors as how well the title, description, and video content match the query, and which have driven the most engagement as measured by the number of clicks and views [113]. Inclusion criteria for

Table 1. YouTube and Twitter Search Terms

Challenge	YouTube Keywords	Twitter Keywords	Twitter Hashtags
BWC	Blue Whale Challenge	"Blue Whale Challenge," "Blue Whale Game," and "BWC"	"#BlueWhaleChallenge," #BlueWhaleGame," "#Blue_Whale_Challenge, "#Blue_Whale_Game," and "#BWC"
TPC	Tide Pod Challenge	"Tide Pods Challenge" and "Tide Pod Game"	"#TidePodChallenge," #TidePodGame," "#Tide_Pod_Challenge," and "Tide_Pod_Game"
ALS IBC	ALS Ice Bucket Challenge	"ALS Ice Bucket Challenge," "Ice Bucket Challenge," "ALS Ice Bucket Game," and "Ice Bucket Game"	"#ALSIceBucketChallenge," "#IceBucketChallenge," "#ALSIceBucketGame," "#IceBucketGame," "#ALS_Ice_Bucket_Challenge," "#Ice_Bucket_Challenge," "#ALS_Ice_Bucket_Game," and "#Ice_Bucket_Game"

the YouTube videos were as follows: (1) they had to be about the challenge, and (2) they had to be in English, translated in English, or have English subtitles. The first 60 videos that met these criteria for each challenge were downloaded, totaling 180 videos. Then, the comments on each YouTube video were sorted by "top comments," with the first 30 comments being collected for analysis. Top comments are based on how many individuals liked versus disliked a comment [113]. The inclusion criteria for the YouTube comments stipulated that they be in English and contained words, meaning Emoji-only comments were excluded. This data collection strategy was chosen to mimic the typical user behavior search strategy as suggested by the literature [10, 65, 92]. Some videos had fewer than 30 comments. A total of 1,112, 1,305, and 1,190 comments were collected for the BWC, TPC, and ALS IBC, respectively. The Twitter posts were collected using the social media analytics tool Radian6 [114] for the period between February 2012 and February 2018 using the keywords and hashtags shown in Table 1. The keywords and hashtags were determined by an iterative process. First, we identified multiple related posts for extraction of relevant keywords and hashtags. Second, we conducted the search using one of the keywords. Third, we added one keyword/hashtag at a time until no additional posts appeared in the search. A total of 150 Twitter posts were randomly selected for coding. Inclusion criteria for the Twitter posts were that the post had to be in English and related to the ALS IBC, TPC, or BWC. It is important to note that YouTube and other social media platforms may have deleted posts about the BWC and TPC. Therefore, the findings of this study are limited to the remaining posts that met the inclusion criteria for these platforms.

3.2 Data Analysis

Since the focus of this study is to investigate the portrayal of three challenges on social media, we inductively coded the data obtained from Twitter and the YouTube videos and their comments. This analysis helped us answer the first research question concerning the way social media users

talk about online challenges. In this section, we describe how we conducted the thematic analysis. Then, we illustrate how we compared the themes across the platforms and challenges.

To answer RQ1, a thematic analysis was conducted on the YouTube videos, YouTube comments, and Twitter posts to identify emergent themes. We followed Braun and Clarke's [9] six-step analysis process of (1) familiarizing ourselves with the data, (2) assigning preliminary codes to the data to describe its content, (3) searching for themes in the codes across the different posts, (4) reviewing the themes, (5) naming the themes, and finally (6) analyzing the themes. We collected the preliminary codes into codebooks to help determine the common themes illustrating the conversation among social media users about these online challenges and to explore the similarities and differences between their portrayal patterns. YouTube and Twitter have different policies, technical affordances, norms, and audiences [77–79]. Therefore, we first built codebooks and analyzed the data for each type separately. Thus, three codebooks were built, one for the YouTube videos, one for the YouTube comments, and one for the Twitter posts. These codebooks went through two phases of generation (i.e., two rounds of coding) to ensure that they accurately represented the data. First, two raters independently coded the data for each challenge (six raters in total). To build the codebooks, each rater focused on one of the three challenges, watching 20 YouTube videos, reading the related comments, and reading 50 Twitter posts. Each pair of raters individually built codebooks, then discussed the common codes among the different types of data. This process resulted in preliminary codebooks.

The raters then completed preliminary coding on a subset of the data to ensure that the codebooks were comprehensive. Round one of coding involved 120 YouTube videos (40 videos for each of the three challenges), 2,364 comments, and 300 Twitter posts (100 for each challenge). For each challenge, a pair of raters coded the data individually to negate bias and then discussed any disagreement on the code for a video, comment, or Twitter post until consensus was reached. After the first round of coding, each pair of coders reviewed and discussed the codebooks, editing them to build representative and comprehensive codebooks. The final round of coding involved 160 YouTube videos (120 from the first round plus an additional 40). There were 3,607 comments for those videos: 1,112 for BWC, 1,305 for TPC, and 1,190 for ALS IBC. A total of 450 Twitter posts were analyzed in this round, 150 for each challenge. The same pair of raters coded the data individually, again to negate bias. The interrater reliabilities for coding the YouTube videos were found to be substantial, with Cohen's kappa ranging from 0.61 to 0.88. Interrater reliability analyses of the coding of YouTube comments indicated a Cohen's kappa ranging from 0.675 to 0.729, and the interrater reliability for the coding of the Twitter posts based on Cohen's kappa ranged from 0.67 to 0.77. This initial coding was followed by consensus coding. When a pair of raters disagreed on a code, the data were set aside for further discussion of the discrepancies between both raters until consensus was reached. Following this coding process, the first author performed axial coding [97] to merge similar codes into cohesive themes (see Appendix A). Then, we proceeded to code all of the data based on these common themes representing the ways social media users talk about the online challenges. In Section 4, we describe the five emergent themes.

To answer RQ2, we analyzed the frequency of each theme, comparing the most frequent across the challenges and platforms. Our goal was to determine the similarities or differences in the conversations about the challenges on social media. We used the social norms theory to explain any variation in the themes and posts found across the three challenges or the social media platforms. In the next section, we discuss the themes and how their frequency differed across challenges.

4 RESULTS

In this section, we first describe the results of the thematic analysis and the common themes in the videos, posts, and comments from the social media platforms to answer RQ1. We then describe

Table 2. Themes Identified Across Platforms and Challenges

Theme	Source	BWC (%)	TPC (%)	ALS IBC(%)
Promoting Education and Awareness	YouTube Videos	83	4	75
	YouTube Comments	28	25	11
	Twitter	65	33	69
Criticizing or Blaming the Participants	YouTube Videos	10	72	22
	YouTube Comments	29	41	36
	Twitter	16	49	2
Sharing Detailed Information About the Participants	YouTube Videos	45	38	53
	YouTube Comments	16	3	3
	Twitter	1	5	0
Giving Viewers a Tutorial on How to Participate	YouTube Videos	25	23	43
	YouTube Comments	N/A	N/A	N/A
	Twitter	N/A	N/A	N/A
Understanding Seemingly Senseless Online Behavior	YouTube Videos	16	68	88
	YouTube Comments	3	0	0
	Twitter	3	0	0

each theme for each challenge separately to help us understand how these themes vary across challenges to answer RQ2.

4.1 Thematic Analysis and Comparisons Across Social Media Platforms and Challenges

We identified five common themes in the posts from the social media platforms investigated in this study. Appendix A provides a detailed description of the five themes, and Table 2 shows the percentages of posts corresponding to each challenge. In this section, we provide an overview of and high-level takeaways from each theme and a detailed description including examples from the data for each challenge. We paraphrased illustrative verbatim quotes without changing their meaning to hide the identity of the users who made the post and to correct any grammatical mistakes or typos made by the writer.

4.1.1 Promoting Education and Awareness. The first theme included posts where social media users were trying to raise awareness about the challenges and/or educate parents to reduce the risk of participation. The type of posts that fall under this theme from the ALS IBC data were slightly different from the ones from the TPC or BWC. The posts about the ALS IBC were mainly focused on raising awareness about ALS, whereas the TPC and BWC posts focused on raising awareness about the risks associated with these challenges. Most of the posts in this study fall in this theme, possibility due to the ban of the BWC and TPC from social media. In fact, most mentioned that YouTube and other social media platforms have banned these two challenges, meaning that the videos of those potentially participating in the challenges have been deleted, which could be the reason for not finding personal videos on YouTube about the BWC and TPC but not the ALS IBC. This led to finding that the majority of the BWC YouTube videos were intended to raise awareness about the challenge. This theme shows that pro-social norms were prominent among posters for online challenges, indicating that these social media platforms were potentially used to reinforce norms geared toward health promotion. A further spread of this theme may be due to the "norms" effect. In other words, people follow their peers and post in similar ways. Thus, when people see

that posts in their social network are in relation to the promotion of education and awareness for a cause, they tend to follow suit and post in similar ways [95].

The ALS IBC posts were trying to raise awareness as well, although the media type was different with primarily personal videos perhaps due to the purpose of the challenge itself. Even though the ALS IBC involved a level of self-harm, albeit a minimal one, it was created for a philanthropic cause. However, the BWC is potentially deadly because it can cause harm to people with mental health issues. Therefore, most of the people participating in the ALS challenge mentioned why it is important to donate and help find a cure for the disease, which led them to fall under this theme. In the following, we describe this theme for each of the three challenges.

This was the most common theme in the BWC YouTube videos (83.33%) and BWC Twitter posts (65.33%). Education and awareness as the most common theme shows that most of the users on both YouTube and Twitter are trying to spread the word about the BWC to eliminate potential participation. BWC YouTube videos in this context were either news or blog clips that listed different names of the BWC, statistics on how many people died by suicide due to this game, and the tasks involved in the BWC, including that the only way out of the game is to commit suicide. These videos tend to provide brief clips from interviews with victims' parents/families or provide pictures of the victims while describing the BWC. The YouTube comments surrounding education and awareness of the BWC were primarily against participation in the BWC and suggested that parents and authorities pay attention to children's safety. For example, a comment read:

> This is getting ridiculous. I think the government, or someone needs to do something about it.

Similar to the YouTube videos and comments, the BWC Twitter posts were centered around awareness and education concerning this dangerous game:

> Please understand and beware of Blue Whale Challenge. For the parents.

YouTube videos about the TPC pertaining to this theme were, to some extent, similar to the BWC YouTube videos. Their main purpose was to increase awareness about the TPC so that parents would pay attention to their child's safety. The videos were primarily news clips and a few blog posts describing the TPC and providing examples of teenagers participating in the challenge. These videos commonly provided facts about the challenge, such as indicating how many people they believe were poisoned by participating in the TPC. Additionally, the TPC YouTube comments in this theme were intended to tell parents or children to "do their laundry" using the Tide Pods instead of doing the TPC. TPC Twitter posts were very similar to the YouTube comments, stating things like:

> Hey teenagers, here is the real Tide Pod Challenge: put the pods in the washing machine and do your own laundry.

Another post reads:

> The viral trend on social media, the Tide Pod Challenge, has driven teenagers to biting into, and sometimes eating, these poisonous little pods.

However, the education and awareness theme did not appear frequently in the TPC YouTube videos (3.83%) but appeared more often in the YouTube comments (25.30%) and Twitter posts (32.87%).

Education and awareness were the most common themes seen in ALS IBC videos (75.00%), which were primarily personal videos posted by people and bloggers who had actually participated in the challenge. These videos commonly explained ALS, emphasizing the importance of donating

money to find a cure for the disease. Approximately 11.00% of the YouTube comments fell under this theme and were mainly comments approving the content of the videos. For example:

> *Bro, I can see the passion in your eyes. You make a difference with this. I have known what ALS is and its effects but hearing and seeing you talk about it with first-hand experience shows me just how much damage it can do. Be a strong man, and know this video spreads a strong message to me and I am sure to others.*

The majority of Twitter posts also fell into this theme (69.33%) and often gave general information and positive outcomes about the challenge, such as how much money the challenge has raised or making positive comments about the person who created the challenge:

> **person name* just signed the "Ice Bucket Challenge" bill honoring *person name* and his family for their incredible work on ALS.*

Overall, this was the most dominant theme across the three challenges as well as the different data types.

4.1.2   Criticizing or Blaming the Participants. Distinct from the first theme, the second theme included posts that either criticized the person who participated in the challenges, made fun of them, or mentioned that the participants deserved any harm they experienced. Interestingly, most of the TPC posts were found to be critical or sarcastic. Since most participants, according to the video makers, participate in this challenge for such reasons as to increase their visibility through adding to their views and likes, peer pressure, or curiosity (as shown in the theme Understanding Seemingly Senseless Online Behavior), most of the posts harshly judged people willing to do anything for the social media views, which, according to the social norms theory, is the "norm" to do when posting about a senseless behavior [23, 93]. This analysis was also reflected in the way the YouTube videos creators spoke about these challenges. Unlike the speakers in the BWC videos who expressed sorrow about the victims and encouraged their families, the speakers in the TPC were discouraging participation by being rude and harsh to the participants. This theme presents another social norm to reduce participation in potentially harmful social media challenges, which is using criticism as a form of social control [60], just like criticizing excessive alcohol use [46] to prevent people from doing so. Subsequently, people may use others' social media challenge posts as guidelines for what is considered appropriate and therefore develop these social norms intentionally by reflecting on what their social media network considers a public good [27]. Based on these findings, we conclude that the portrayal of the challenges on social media, specifically YouTube, appears to vary partially based on the level of self-harm involved in the challenge. In the following, we describe this theme in each of the challenges.

A small percentage of the BWC YouTube videos fell under this theme (10.00%). These videos mentioned that adolescents participate in BWC just to "show off" and criticized them harshly or made fun of them. This was the most prevalent BWC YouTube comments category (29.41%), and most of these comments criticized the BWC participants, saying things like:

> *People who play this game are more stupid than the game itself. How can one lose his sense and be manipulated by others like this? Grow up guys. You have brains to think and decide what is good and what is bad.*

This could be due to the social stigma around people with mental health problems and their families [62, 100]. Twitter posts in this theme (16.00%) were primarily sarcastic:

> *Husband silently downloaded the blue whale game on his wife's phone. 50 days later the blue whale died by suicide.*

This theme was the most frequent among TPC posts. The majority of TPC YouTube videos (71.62%) fit this category and were mainly bloggers making fun of and criticizing the people who participate in the TPC. Most began by saying that they were participating in the TPC or by mimicking participation but then stopping and saying, for example, "I am not stupid to do this thing to get more views." A very high percentage of YouTube comments (40.69%) and Twitter posts (48.98%) were critical and sarcastic. For example, one of the YouTube comments was:

> *I recommend eating them in cupcake form, savor the flavor.*

A user on Twitter wrote:

> *An actual challenge for people to eat a pod with detergent in it. If you partake in this challenge, you are an idiot, and you deserve every bit of what is coming to you.*

This theme was not as common in ALS IBC YouTube videos (21.67%), and their content was distinct. These videos were mainly failed completions of the challenge. For example, in one, the water was to be poured on the participant from a second-floor porch, but the person pouring lost control of the bucket and it fell on the participant's head.

This theme was very common in the YouTube comments (36.21%), with most focusing on the participant's reaction while doing the challenge, for example:

> *Laugh out loud. The girl at minute 4:22 sounds like a bird* 😂 *.*

This theme was not very common in Twitter posts (2.00%). Only a few posts mentioned that this challenge is a waste of water and that people were doing it without donating the money to ALS.

4.1.3 Detailed Information About the Participants. The third theme included posts that tend to speak in detail about someone who already participated in a social media challenge; however, how the posts provided information about these participants varied across challenges. For example, the videos of the BWC tend to include a considerable amount of victim-specific information, such as quotes that the victims posted on their social media platforms before they attempted suicide and pictures of their hands or other body parts showing evidence of self-harm. In addition, these videos included clips of interviews with the victims' parents providing details about their child's personal life. Unfortunately, these videos that were intended to raise awareness could be harmful since romanticizing individuals who engage in suicidal behavior and providing details about people who died by suicide have been found to contribute to suicide contagion [25, 26, 102]. The TPC videos included clips of people eating Tide Pods and participating in the challenge. Similarly, the ALS IBC videos primarily depicted either individuals participating in the challenge or a combination of clips of many people participating, all mentioning who nominated them and nominating other people to do the same. Since this challenge was intended for a positive cause and involved a minimal level of harm, no social media platforms banned it, making it easy to find videos of people doing the challenge online, perhaps contributing to the spread of this challenge [3, 85, 91]. The success of the ALS IBC depended heavily on the public perception of the challenge. This pro-social challenge is potentially propagated due to positive perceptions of the challenge and social norms supporting participation due to its possible desirable impact on public health. In other words, more people "pouring water on their heads" was perceived to increase the chance of someone with ALS surviving. A more detailed description of Theme 3 across the three challenges follows.

For the BWC, this theme frequently overlapped with the first theme of education and awareness in the YouTube videos (44.94%). Videos often gave information through interviews with the participants' parents and pictures showing evidence of self-harm. This theme was less common among

the YouTube comments (15.64%), with these posts focusing on the experiences of acquaintances or users who were asking to participate in the BWC. For example:

> *I want to play the blue whale game. Please give me the link.*

Very few Twitter posts fell in this theme (0.67%), with most detailing stories about acquaintances:

> *We just had a meeting here at work and this lady told us that her 10-year-old niece died by suicide because of the Blue Whale Challenge.*

This theme occurred frequently in the TPC YouTube videos as well (38.33%). Many of the news and blogger videos showed teenagers eating and biting on Tide Pods. This theme was not very common in YouTube comments (3.21%) and Twitter posts (5.36%), with most involving users describing an experience related to the TPC. For example, one of the Twitter posts was:

> *A third teenager in the Phoenix area has been sickened by taking part in the Tide Pod Challenge.*

A large number of the ALS IBC YouTube videos were in this theme (53.33%), and these videos were usually posted by the actual participants doing the challenge. These videos commonly mentioned the person who nominated them to the challenge and then challenged at least three others to do the same. Only a few YouTube comments fell in this category (2.77%) and no Twitter posts.

4.1.4 Giving Viewers a Tutorial on How to Participate. The fourth theme covers posts that provided extensive, step-by-step illustrations of how to do a challenge. As a result, it was found in the YouTube videos only. A considerable number of BWC videos role-played interaction between the administrator and the victims, showing how the latter found out about the challenge, how the administrator approached them, or how they were convinced to participate in the challenge. TPC videos in this theme overlapped with those from the Detailed Information About the Participants theme since they were clips of people eating Tide Pods or pretending to participate in the challenge. Just like TPC videos, the ALS IBC videos overlapped with the theme Detailed Information About as the clips depicted individuals participating in the challenge or a combination of clips of many people participating. These clips may actually contribute to the spread of the challenge via social modeling effects, making adolescents more willing to participate when they see others doing so [3, 15, 37, 84, 91]. A description of this theme across the three challenges follows.

Approximately one fourth, 24.72%, of the BWC YouTube videos gave viewers a tutorial on how to participate by providing a reenactment between a participant and an administrator of the game asking the former to perform certain tasks followed by the participant fake performing these tasks. We are not listing nor describing the tasks in this article in an effort to minimize the contagion effect.

Similarly, TPC YouTube videos also featured fake participation in the challenge, with 23.33% falling under this theme. These videos begin with a person telling the viewers about the new trend on social media, the TPC, and saying they will do it. The person in the video then grabs the Tide Pod, mentioning where it came from. But the person stops as the pod gets very close to her/his mouth and say that she/he is not going to do it and expresses disbelief that other people are actually doing such a thing. ALS IBC videos, however, explain how to complete the challenge by just verbally describing it (43.33%). The video begins with the participant saying they were nominated by an acquaintance to complete this challenge. The participant then explain that she/he have to dump a bucket of ice water on her/his own head to complete the challenge and then challenge three others to do the same. Only a few participants mention that they have to donate money for ALS research, and even fewer mention where or how to make the donation.

4.1.5 Understanding Seemingly Senseless Online Behavior. The last theme we identified in YouTube videos included posts that provided or suggested reasons why individuals participate in these challenges. An analysis of this theme, Understanding Seemingly Senseless Online Behavior, indicates common motivating factors for the TPC and IBC, with different reasons offered for participation in the BWC.

Only 15.79% of the BWC YouTube videos mentioned potential reasons for participating in this challenge, stating that these participants are adolescents with mental health problems and those suffering from depression and suicidal thoughts. Additionally, these videos tended to provide clips from interviews with psychologists commenting on this phenomenon. The BWC YouTube comments (3.06%), which also described the same reason for participating, did so indirectly by providing encouraging comments to people with suicidal thoughts. For example, one post reads:

> *Love you girl so many people care about you. Depression is horrible. Stay strong girl.*

A few of the Twitter posts (3.33%) provided links to articles that discuss why teens participate in the BWC, one example being the following post:

> *The Blue Whale Challenge: What is the psychology behind it?*

This theme was frequent in TPC (68.33%) YouTube videos. The creators of these videos mentioned that adolescents are participating in this challenge to become more popular, to get more views and likes, peer pressure, and/or curiosity to see what the Tide Pods taste like. No YouTube comments nor Twitter posts fell under this theme. This theme is likely connected to the Criticizing or Blaming the participants theme for TPC posts. People disapproved the TPC since eating detergent to get more views or likes is not an acceptable social norm to them and the norm to react to a senseless behavior, as the viewers already developed by watching the criticism videos, is to criticize it, therefore, leading them to post about the challenges in a similar manner [27].

The ALS IBC YouTube videos (88.33%) depicted the participants mentioning that they are engaging in the challenge for one or more of the following reasons: peer pressure, more views and likes on the video, and the good cause of the challenge.

5 DISCUSSION

The objective of this study was to investigate the portrayal of three online challenges on social media. To do so, we conducted inductive coding on data from YouTube and Twitter to address our research questions. Next, we discuss the emerging themes and theoretical implications of our findings by relating each finding to previous literature. We also provide practical design implications resulting from our research. We conclude this section by presenting the limitations of this research as well as future directions.

5.1 Social Norms and Generalizability Among Challenges

Based on the findings of this study, we conclude that, first, when people hear about a certain social media challenge, they make appraisals of whether it fits within acceptable social norms [23, 32, 95]. In other words, people's reactions and opinions concerning social media challenges vary, largely based on the purpose of the challenge and the level of inherent risk to participants. For example, most TPC posts fell in the categories of Criticizing or Blaming the Participants and Understanding Seemingly Senseless Online Behavior, whereas BWC posts were primarily Promoting Education and Awareness. People disapproved of the TPC since eating detergent is not an acceptable social norm based on their experience. The norm to react to a senseless behavior is to criticize it, a response that we observed throughout social media posts. For the BWC, which is a suicide challenge, we found a theme of Criticizing or Blaming the Participants in the posts, perhaps due to

the social stigma of devaluation of people who have mental health concerns and suicidal ideation and their families [64, 104]. However, the percentage of posts in this theme was small, and the majority of the posts were categorized as Promoting Education and Awareness, supporting the belief that educational and awareness campaigns about suicide have achieved a degree of success as the stigma and social norms about suicide are changing and suicide is now more commonly viewed as preventable.

Second, after forming the first impression of a challenge based on postings by the first group of social media users, the "norms" effect usually dominates future posts about a social media challenge. In other words, when people see that the majority of the posts about a challenge in their social network follow a certain theme, they tend to follow their peers and post about it similarly [23, 32, 95]. According to social norms theory, social media users likely observe the dominating themes among prior posters in their social networks, using these posts to develop social norms and to determine "appropriate" behavior [27]. This could explain why there is primarily a dominant theme for each challenge in our analysis, and only a small number of the posts fall into the other themes. For example, Promoting Awareness and Education was dominant in the ALS posts, reflecting that the first few posts presented the challenge positively as a means to improve chances of survival for someone with ALS. Subsequently, the remainder of the posts followed a similar theme. This could also explain why TPC posts were mainly characterized by criticism of the participants.

Third, our results add to the social norm theory that previous individual experiences and exposure to a challenge can affect opinions of future challenges. For example, a person who heard about the ALS IBC might have a positive first impression about online social media challenges. However, a person who heard about the TPC might assume that individuals are participating in these challenges for reasons such as social media fame. Other studies have found that people's first impressions affect their future decision making, underscoring the importance of understanding how potentially harmful social media challenges are portrayed [1, 2, 50, 51, 54, 55, 86]. In addition, as seen in the themes Criticizing or Blaming the Participants and Understanding Seemingly Senseless Online Behavior, the public opinion varies largely about these three challenges. As indicated in the theme Understanding Seemingly Senseless Online Behavior, social media users believed that people participated in the TPC and ALS IBC for reasons such as peer pressure and social media fame, both of which probably led to the theme Criticizing or Blaming the Participants, where they criticized those participants for engaging in risky behavior just to gain more views. However, as the theme Understanding Seemingly Senseless Online Behavior indicated, social media users believe that those who participated in the BWC experienced mental illness and, thus, they criticized them. However, in actuality, they glamorized and romanticized those participants by providing details about them that led to the emergence of the theme Detailed Information About the Participants.

5.2 Attempts to Raise Awareness About the Risks of Viral Social Media Challenges

As seen in the Promoting Education and Awareness theme, our data showed that most of the videos appear to try to raise awareness about the risk associated with the two harmful challenges. Instead of doing so by providing positive experiences, as Criticizing or Blaming the Participants and Detailed Information About the Participants themes illustrate, these videos tend to expose the viewers to a significant level of images depicting self-harm. Such exposure could create minimal to moderate discomfort in vulnerable viewers [109]. However, there are also potential benefits to raising awareness about social media harms. The reinforcement of health-promoting social norms could potentially encourage healthier behavior, as individuals tend to align their behavior with dominant social norms [27]. As suggested by the literature, in most cases this exposure to posts that are allegedly positive could potentially provide the viewers the opportunity to build the social

skills necessary to set proper boundaries, solve problems, and show empathy. Specifically, these posts have the potential to strengthen viewers' ability to refuse to engage in risky online behavior, resisting peer pressure and online advances by strangers. Practicing refusal can lead to preventing engagement in risky or harmful behavior in the future. To the extent that posts model safe internet practices and resistance to peer pressure, they can also encourage viewers to resist participation and to intervene or find help for an acquaintance in a harmful situation [109]. However, for these videos to have a positive impact, there are a few safety considerations that need to be addressed [4, 49, 96]. By referring to the emergent themes, we will discuss how these videos violated these considerations, both limiting the potential positive impact of these videos and contributing to the potential for unwanted consequences.

5.3 Viral Social Media Challenges and Contagion Effects

Without carefully crafting the content of posts intended to eliminate the spread of risky behaviors, these posts could negatively affect vulnerable individuals. In our analyses, we identified the following common themes: Criticizing or Blaming the Participants, Detailed Information About the Participants, and Giving Viewers a Tutorial on How to Participate. These themes indicated that a significant number of these posts contained a considerable amount of victim-specific information, illustrating how to complete a challenge by example and, in some cases, by showing clips from actual participants completing the challenge. This is in conflict with evidence-based recommendations for minimizing contagion of self-harming behavior [48, 115]. According to the Suicide Prevention Research Center guidelines, depicting means of self-harm and romanticizing individuals when discussing self-harm in the media should be avoided [47, 48, 115]. As mentioned in Section 4, doing so may actually contribute to the spread of the challenge and even suicide contagion [12, 25, 26, 102] via social modeling effects, making the viewers more willing to participate after observing others [3, 15, 37, 84, 91]. According to self-harm and suicide contagion theory, people with mental health issues and suicidal thoughts are especially influenced by narratives on suicidal behavior and NSSI, adopting this self-injurious behavior as a coping strategy [75]. Thus, when such individuals see clips from actual participants engaging in self-harm as a coping strategy for a mental health problem such as depression, they may perceive a similarity in themselves and, therefore, see the participant as a "model" for how to cope with mental health issues [29, 41].

Factors that lead an individual to mimic the behavior of another include attention, retention, reproduction, and motivation [6, 11, 31]. We believe that these social media posts contribute to the spread of these challenges by magnifying the impact of the first two, attention and retention, especially for those who already have the motivation for and capability of reproducing the behavior. We suggest that the availability of these posts to viewers on social media is a significant contributing factor to the attention and retention aspects due to social media's inherent accessibility. These videos, by providing detailed information about the participants as seen in themes Criticizing or Blaming the Participants and Detailed Information About the Participants, may potentially contribute to the development of an emotional relationship between the people who have already participated in a challenge and those viewing the challenge, who then become models with the potential to influence viewers' behavior. Moreover, having these videos perpetually available on social media has a potential impact on retention, as the viewers can repeatedly return to posts and videos to enhance their memory on how to perform the challenge.

Misperception and overestimation of participation may increase the number of individuals who participate in a challenge, such as the TPC, due to the number and types of posts on social media providing personal information about it [7, 33, 87]. Social norms research has found that correcting misperceptions is effective in reducing alcohol abuse [33, 82, 83, 98], injection drug abuse [18], sexually transmitted disease [59], bullying [81], and spreading of rumors on social media [106].

Therefore, we believe that it provides an appropriate basis for the development of potential interventions to reduce further spread of the risky challenges.

5.4 Implications for Design

We suggest that there is an urgent need to monitor social media posts related to similar self-harming challenges, especially challenges like the BWC and TPC. The findings from this study call for a multipronged approach to minimize the spread of such challenges. First, there should be recommendations and guidelines specifically tailored for social media for anyone who wants to provide a positive and preventive message about self-harm challenges. Even though guidelines such as the Suicide Prevention Research Center Safe and Effective Messaging Guidelines [48, 115] are in place, studies have shown that they are seldom followed by social media users [48, 49, 88]. Therefore, similar guidelines should be appropriately incorporated in social media websites to assist users, particularly those with more influence (e.g., celebrities, news anchors), on how to address suicide or self-harm in a safe way and minimize contagion.

In addition, it is recommended that video and content sharing platforms use automated machine learning–based video and content analysis algorithms that highlight violations in the content of the social media posts prior to making it available to the public online. The social media platform administrators could then suggest that the user to edit or remove such content. In addition, a scale indicating the level of harmfulness of the content in a post could help users understand the danger of their posts prior to posting. It could also provide feedback on how the potential risk deceases as they remove content from their original posts.

Regarding the specific content of posts intended to raise awareness, we suggest that social media platforms provide guidance to their users on how to create safe content. We recommend using frameworks such as the Intervention Wheel developed by the Minnesota Department of Health [35], which suggests three levels of practice (community, systems, and individual/family) and 17 public health interventions to systematically consider as the most appropriate for combating the contagion and spread of self-harm challenges [35]. In addition, we suggest using the Nudge approach to push individuals in the right direction [48, 115] by providing positive experiences about these challenges. For example, instead of showing cases of individuals suffering from depression who participated in the BWC, one can provide an example of positive stories where an individual thought about participating but was encouraged by concerned individuals to seek mental health resources or engage in more effective coping behaviors. A previous study has found that this strategy could potentially provide the viewers the opportunity to build the social skills necessary to set social boundaries, solve problems, and show empathy [109].

5.5 Limitations and Future Research

Although people participate in viral social media challenges for reasons that vary based on the purpose of the challenge itself, we argue that there are common factors that could potentially contribute to the willingness to do so. Future work should investigate the effect of factors such as attitude, perceived norms, personal agency, knowledge and skills, salience of the behavior, environmental constraints, and habit on the likelihood to participate in such challenges. Past research has found that people's emotions, their perception of public opinion, and the ease of performance of a risky behavior directly contribute to willingness to participate in such behavior [72]. We believe that similar factors could predict participation in social media challenges.

There are additional risk factors that might lead the participants to be inclined to participate in challenges specific to NSSI and/or suicide, such as trauma history, depression, social anxiety, loneliness, lack of social support, low self-esteem, and suicidal ideation [42, 101, 105]. Since these factors could contribute to NSSI and suicide in general, and since these kinds of challenges

normally target people who already have suicidal thoughts [101, 105], it is possible that some may consider participating in these challenges as a means to investigate or engage in self-harming or suicidal behavior. It is important to further explore, validate, and quantify the actual effect of these factors on societal perception of different social media challenges and teenagers' willingness to participate, as well as studying quantitatively how the effect of these factors vary based on the nature of the challenge. Doing so will provide critical insight for developing a verified model characterizing the nature and spread of potentially harmful viral challenges on social media and, subsequently, develop interventions to minimize suicide contagion risks at a societal level.

This content analysis is not without limitations. The search criteria were very specific and may not have captured all relevant videos and posts, especially those on private accounts. Additionally, the exclusion of videos and posts not published in English may limit the generalizability of our findings to the worldwide portrayal patterns of these challenges. Last, since YouTube and other social media platforms have deleted posts about the BWC and TPC, the findings of this study are limited to the remaining posts that did not meet the exclusion criteria for these platforms. Therefore, findings from this study may not generalize to all posts about online challenges, and various themes and responses to the challenges may not have been captured. Studying the content and the reason behind posting riskier content, such as the ones that were potentially deleted by the social media platforms, requires interviewing the people who post and share this content.

6 CONCLUSION

This research involved a systematic study exploring the portrayal of viral social media–based challenges, including assessing the potential risks associated with their portrayal by examining public social media posts. We conducted thematic analysis on scraped data from two of the most popular social media platforms: YouTube and Twitter. We identified five common themes across the challenges: raising awareness, criticizing the challenge or participants, providing information about participants of the challenge, providing information on how to participate, and/or talking about why people participate in the online challenges. We suggest that people determine whether a social media challenge fits within acceptable social norms when they first hear about it. They should assess the challenge based on its purpose and the level of potential self-harm associated with it, both of which should guide how they post about it. Our findings suggest that a large number of the social media posts intended to educate the people or raise awareness about a specific behavior related to a challenge. However, the content of these posts could potentially normalize self-harming behavior and create misperceptions that the behavior is more prevalent than it is. For these posts to have a positive impact, several safety considerations need to be addressed, and we have offered strategies on how designers could help social media users provide positive and safe messages to vulnerable individuals.

RESOURCE FOR SEEKING HELP

If you or a loved one has thoughts of suicide or self-harm, please contact the Suicide Prevention Hotline: 1-800-273-8255.

APPENDIX

A DESCRIPTION OF THE THEMES IDENTIFIED ACROSS PLATFORMS

Theme	Source	Description
Promoting Education and Awareness	YouTube Videos	Videos explaining the challenge for the purpose of raising awareness or educating people about the results of engaging in it. These videos might include: - the methods for convincing individuals to participate - descriptions of the tasks in the challenge - discussions about the targeted populations - discussing the success of the challenge and explaining ALS and how to donate - providing recommendations or advice to the parents, authorities, media, or kids.
	YouTube Comments	Providing recommendations to reduce the spread of harmful challenges. OR Saying something positive about the challenge to raise awareness.
	Twitter	Content primarily directed toward parents, teens, or authorities to warn them about the challenge. OR Providing information about the purpose of the challenge and how many have participated in it. OR Saying positive comments about the person who participated in it.
Criticizing or Blaming the Participants	YouTube Videos	Videos mainly criticized the challenge and individuals who participate in it. OR Funny or sarcastic videos about the challenge.
	YouTube Comments	Making fun of the challenge or the people who participated in it. OR Scolding those who played the game, the video, the curator (the creator of the game), or the challenge.
	Twitter	Making fun of the challenge or the people who participated in it.
Sharing Detailed Information About the Participants	YouTube Videos	Videos showing pictures of the challenge's victims and how they died (mainly for BWC). OR Videos mentioning the number of people who have died due to BWC, who created it, what counties have been affected by it, descriptions of the tasks, and the various names for BWC. OR videos that talked about the origin of the challenge, how many poisoning cases have been reported due to TPC, or how many people have died due to eating Tide Pods. OR videos talked about people that participated in ALS IBC.
	YouTube Comments	Talking about experiences playing the game or the experiences of someone known who had played the game. OR User's intention for playing the game and asking for links to participate and/or agreeing with the curator quotes about cleaning the society of people with mental health issues.
	Twitter	Talking about experiences playing the game or the experiences of someone known who had played the game.

(Continued)

Theme	Source	Description
Giving Viewers a Tutorial on How to Participate	YouTube Videos	Videos of individuals accepting, participating, and inviting others to participate in the challenge. OR Mock interactions of how an individual can participate in the challenge.
	YouTube Comments	N/A
	Twitter	N/A
Understanding Seemingly Senseless Online Behavior	YouTube Videos	Videos mentioning that individuals participate in the challenge for social media fame, consequences of mental problems, the peer pressure, the good cause, the curiousness of the consequences, or other reasons.
	YouTube Comments	Expressing sorrow to the participants, their families, and their friends.
	Twitter	Providing educational material on mental health.

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