Article

Social Media Sellout: The Increasing Role of Product Promotion on YouTube

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Abstract

Since its foundation in 2005, YouTube, which is considered to be the largest video sharing site, has undergone substantial changes. Over the last decade, the platform developed into a leading marketing tool used for product promotion by social media influencers. Past research indicates that these influencers are regarded as opinion leaders and cooperate with brands to market products on YouTube through electronic-word-of-mouth mechanisms. However, surprisingly little is known about the magnitude of this phenomenon. In our article, we make a first attempt to quantify product promotion and use an original dataset of 139,475 videos created by German YouTube channels between 2009 and 2017. Applying methods for automated content analysis, we find that YouTube users indeed are confronted with an ever-growing share of product promotion, particularly in the beauty and fashion sector. Our findings fuel concerns regarding the social and economic impact of influencers, especially on younger target groups.

Keywords

YouTube, social media, product promotion, influencer marketing, topic modeling

Introduction

In 2016, an autograph session attended by several thousand people in Germany had to be canceled as teenagers were crying and fainting due to the presence of a celebrity (dpa, 2016). While this phenomenon is not uncommon for times where boy bands fascinated millions of young females in the 1990s (Scheel, 2014), the celebrity was no music or movie star, but the YouTuber Bianca Heinicke. With several million subscribers, she is one of the most popular German YouTubers, and experts estimate that she earns at least 110,000 EUR per month (Manager Magazin, 2017). Heinicke is one of several micro-celebrities of the 21st century who entertain large audiences on social media sites, in particular young adolescents (Gerhards, 2017). In a commercial context, these celebrities are called social media influencers and have been gathering an immense number of followers during the last decade. Therefore, they are regarded as valuable partners for companies interested in product promotion. With the status of such YouTubers developing from amateur to professional content creators, marketers collaborate with social media influencers for commercial purposes as they perceive their influence within their communities as decisive.

Past research has shown that product promotion can be observed on multiple social media sites, with the video sharing platform YouTube arguably being one of the most important targets. Recent studies have also provided valuable insights about the mechanisms of product promotion and addressed concerns regarding the substantial social and economic impact such influencers have especially on their younger audience. As younger target groups have grown up to use social media sites on a regular basis, YouTubers easily reach adolescents through social media content. Thus, they are potential target audiences when it comes to product promotion on social media channels such as YouTube.

However, to the best of our knowledge, not a single study investigated the actual magnitude of product promotion. In order to assess the consequences of product promotion, it is necessary to not only acknowledge the phenomenon but also to gain an understanding of how much content is produced with monetization purposes in mind. The aim of our article is to fill this gap in the literature and to provide estimates for product promotion developments. Thus, our article is motivated by the following research questions:

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- *RQ1*: How much product promotion is conducted on the platform?
- *RQ2*: How did the promotion of products by YouTubers develop over time?
- *RQ3*: How does product promotion differ across YouTube communities?

For this purpose, we compiled an original dataset of 139,475 videos created by the 100 most popular YouTube channels in Germany between 2009 and 2017. In total, these videos accumulated more than 55 billion views on the platform. Using methods of automated content analysis, we analyze how promotion of products with referral links and advertisement in YouTube videos developed over time and across different YouTube communities. We find that YouTube users are indeed confronted with a steadily increasing share of content dealing with product promotion. On average, videos in our sample contain more than two links used for product promotion. Furthermore, our results indicate that the use of referral links, but also oral advertisement in videos is especially common in the beauty and fashion sector, which predominantly targets female adolescents.

YouTube and Influencer Marketing

Since YouTube's establishment in 2005, the most popular video sharing platform has undergone significant changes. In 2006, YouTube first presented several advertising concepts to companies for utilizing the platform as an effective marketing tool. With the purchase of the platform in October 2006, Google followed a clear path to developing YouTube into a revenue-generating product (Gerhards, 2017), with a business model focused on advertisement. In the upcoming years, YouTube expanded on opportunities for businesses to monetize produced video content (Gerhards, 2017; Google 2010; Kim, 2012). With these emerging opportunities, advertisers started to recognize the potential of the platform for monetization. Although YouTube was criticized by its users right from the start of the platform for letting marketers onto the site (Gerhards, 2017), YouTube today provides multiple advertising formats such as displays ads, skippable and non-skippable video ads (YouTube Help, 2018). As people tend to skip ad formats which remind users of traditional advertising such as on TV (McGoogan, 2016), the company was on the lookout for other formats of commercialization.

Likewise, amateurs also commenced to recognize YouTube's potential as a commercial platform. User generated content (UGC) websites such as YouTube empowered Internet users to be more creative and shaped new viewing patterns (Cha, Kwak, Rodriguez, Ahn, & Moon, 2007). Initially, videos had been uploaded by amateurs in a non-professional way in a, from their perspective, non-commercial environment. YouTube creators set up an ordinary camera, ignoring all features of professional film making. YouTubers then gradually started to invest into professional

video equipment, as cameras, lightning, microphones, and video editing software (Felix von der Laden, 2017). Some YouTube creators even redecorated rooms as filming set ups (The Beauty2go, 2017), others bought a new house for their whole YouTube crew, as their channels and communities have grown sharply (Julien Bam, 2017). Eventually, these changes resulted in YouTube to become one of the leading influencer marketing platforms besides Instagram, Facebook, and Snapchat (Carter, 2016; Jackson 2018). In 2009, the first 1 million subscribers were reached by a former amateur video content creator (Sarno, 2009). The year of 2009 is seen as the year of establishing "the phenomenon of YouTube stars" (Gerhards, 2017, p. 4). YouTube creators started to earn money by uploading videos, then gained micro-celebrity status and over time found alternative ways to run a business from a former amateurish video creator site (Reinbold, 2015a).

According to a recent survey, more than two thirds of German marketing experts reserve company budget for influencer marketing expenditures (Territory, 2016). As consumers no longer pay attention to traditional advertising, influencer marketing emerged as a potential alternative (Carter, 2016). It is regarded as a "rapidly growing industry that attempts to promote products or increase brand awareness through content spread by social media users who are considered to be influential" in their sphere (Carter, 2016, p. 2). Influencers reach users on social media platforms and are characterized by number of followers and engagement rates (Carter, 2016). Moreover, search engine ranking, content quality (Gillin, 2008) as well as brand fit and tone of voice play an essential role in selecting social media influencers for commercial purposes (Uzunoğlu & Kip, 2014). Furthermore, they are seen as influential due to their expertise in a specific field (Langner, Hennigs, & Wiedmann, 2013). Social media influencers are described as "new type of independent third party endorser who shape audience attitudes through blogs, tweets, and the use of other social media" (Freberg, Graham, McGaughey, & Freberg, 2011, p. 1). Moreover, influencers are seen as opinion leaders (Katz & Lazarsfeld, 1955) and have a predisposition to affect other consumption decisions (Feick & Price, 1987). They are stronger embedded digitally than ordinary Internet users and use "tools which facilitate more connectedness and recommendations" (Nisbet & Kotcher, 2009, p. 341).

At this point, it is important to note that influencer marketing is not a novel concept as word-of-mouth (WOM) has been examined since the 1960s (Arndt, 1967; Brooks, 1957; Dichter, 1966). WOM in a non-marketing context can be described as the act of passing information from person to person in a certain social environment. Sociologists consider WOM "as a naturally occurring phenomenon" (Kozinets, de Valck, Wojnicki, & Wilner, 2010, p. 71). In the marketing sector and the emerging Web 2.0, electronic-word-of-mouth (eWOM) "represents one of the most significant developments in contemporary consumer behavior" (Rosario,

Sotgiu, Valck, & Bijmolt, 2016, p. 297). People not only recommend products purchased via e-commerce platforms as Amazon but also start to tweet or blog about their experience with purchased goods (Rosario et al., 2016). Social media sites are potential platforms for spreading advertising messages through other consumers rather than through traditional marketing campaigns (Kozinets et al., 2010). As people trust other consumers more than commercial messages by companies, consumer-to-consumer communication about products, brands, and services is regarded as particularly influential (Nielsen, 2015).

The first recommendation videos uploaded by YouTube amateurs in Germany were not created for commercial purposes, but rather for eWOM-related consumer-to-consumer recommendations. Due to "their amateur origin, YouTube creators were considered to be particularly credible" (Gerhards, 2017, p. 4). Over the course of the platform's existence, YouTube creators were increasingly recognized as social media influencers, spreading content on their channels and eventually driving consumer purchasing decisions. Prior research on eWOM has shown that online users trust recommendations from such individuals (Rosario et al., 2016), even if they do not know them personally. At the same time, they are also considered to be experts in their field (e.g., gaming, beauty, food) and most of them reach a large audience, making them "outstanding advocates of brands" (Gerhards, 2017, p. 4).

While a large body of literature already examined YouTube as a video sharing platform in different contexts, only few researchers have analyzed the use of YouTube for commercial intentions. Kim (2012) argues that YouTube will change from a UGC website into a professionally generated content (PGC) website, because of the lack of amateurism which he perceives as one "core philosophy" of the video sharing site (p. 59). Furthermore, several studies demonstrate how German YouTubers exploit the platform for advertising reasons (Döring, 2014, 2015a, 2015b). Another study by Gerhards (2017) surveys video creators regarding uploading paid content on their channels. She found that "product placement on YouTube is a widespread practice" and that almost two thirds of the surveyed persons have already uploaded video material containing product placements (p. 4). By creating a hypothetical situation, Wu (2016) examines how companies could benefit from sending YouTube creators free product samples. These studies provide valuable insights and indicate that product promotion on YouTube is an important mechanism used for monetization. However, due to their qualitative research designs, earlier studies are helpful for answering the question of how product promotion works on YouTube but cannot answer the question of how much product promotion is in use. At the time of writing, not a single study provides insights into the actual magnitude of product promotion on YouTube. The aim of our article is therefore to fill this gap and to provide estimates for product promotion developments over time. Moreover, we broaden current knowledge of how product promotion across YouTube communities differ.

Product Promotion on YouTube

When it comes to product promotion as a concept, there is no single definition scholars agree upon. In a general marketing context, promotion can be described as "communication-persuasion strategy and tactics that will make the product familiar, acceptable, and even desirable to the audience" (Kotler & Zaltman, 1971, p. 7). Kotler and Zaltman (1971) consider advertising, personal selling, publicity, and sales promotion as major activities of promotion. Some scholars do not differentiate between product promotion and advertising at all (Babutsidze, 2011), while others make a clear distinction between those two concepts (Schultz, 1987). For the context of our article, our aim is to study product promotion in a broader sense. We therefore define product promotion as (informal) communication about a product, brand, or service in order to raise interest of potential customers. On YouTube, this is not necessarily achieved by direct recommendations, for example, by explicitly asking the YouTube audience to buy a certain product. Product promotion is also possible by communicating a positive sentiment toward products or brands, for example, testing a product and speaking about its use in a positive way or adding a link to the video description box. In the following sections, we will give further examples for different ways to promote product on social media platforms.

As prior research has shown, there are various ways for YouTube producers to monetize their previously amateur-orientated channels (Gerhards, 2017; Wu, 2016). One way for doing so is by reviewing products in YouTube videos and afterward inserting referral (affiliate) links into the corresponding video description boxes. These referral links lead online users to external shops for which the video creators participate in affiliate programs. YouTubers can register to affiliate marketing programs, such as Ebay Partner Network or Amazon Associates (Amazon Partner Net, 2018; Ebay Partner Network, 2017) in order to be compensated with a commission when users purchase products via these referral links (Wu, 2016). Figure 1 includes an image and a description box for a video uploaded by YouTuber Bianca Heinicke. Bianca Heinicke uses the nickname *Bibi* and her beauty, fashion, and lifestyle channel *BibisBeautyPalace* is among the most popular German video channels. In the image of the video frame captured in Figure 1a, she promotes a shower gel as one of her favorite December products. In addition to speaking about and advertizing the shower gel and several other products, she also includes referral links under her video, which can be seen in Figure 1b. She inserts referral links to a higher-priced designer watch (approximately 220 EUR), but also lower-priced items like a selfie stick (approximately 10 EUR). In her study, Gerhards (2017) observes that Heinicke "includes affiliated links with nearly every
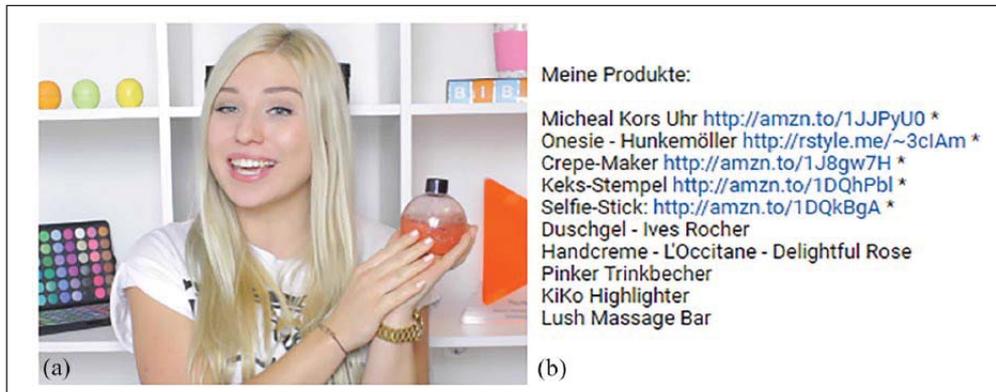
Figure 1. Product promotion by *BibisBeautyPalace* including affiliate links in description box. Video available at https://www.youtube.com/watch?v=c5zsh09edBQ: (a) BibisBeautyPalace presenting her favorite December products (b) BibisBeautyPalace description box with affiliate links.

video, which guide users to pages where the camera equipment she has used for her video production is directly available" (p. 6). Posting camera equipment in the description sections via referral links is common practice in the YouTube sphere.

The above mentioned example shows that it is not unusual to combine different monetization forms on YouTube. Gerhards (2017) shows that product placement is another possibility for YouTubers to use their prominence on the video sharing site commercializing their uploaded content. YouTube content creators use product placements embedding products into their videos in primarily non-commercial situations. Since YouTube creators enjoy the reputation as reliable endorsers, companies search for appropriate influencers in the social media sphere in hope of finding credible people disseminating their brand's message. Product placement can be described as "the purposeful incorporation of a brand into an entertainment vehicle" (Russell & Belch, 2005, p. 74), while purposeful in this context means that companies have commercial intentions by placing products in particular media formats (Hermann, 2012). So far, product placements were prominent in movies (Newell, Salmon, & Chang, 2006) and TV (Hackley & Hackley, 2012). However, product placements can be applied on all media forms and therefore are not limited to movies and television only. Diverse versions of paid product placement are observed on YouTube, in particular when it comes to different YouTube channel categories. Hauls and lookbooks are formats beauty and fashion YouTube creators use to place products within their videos. Lookbooks are fashion videos in which YouTuber present whole outfits and serve as inspirations for viewers. Typically, this video format is not too long and accentuated with music. Some creators change locations within their videos and name the fashion brands in the video itself or in the description box below the video (Bathelot, 2016). Hauls, as another format of product placements on YouTube, aim at "display[ing] recent clothing, accessories, and makeup purchases, sometimes simply showing the items" (Jeffries, 2011, p. 59).

Usually YouTube creators mention price, brand name, and the shop they have purchased the product (Ebru Ergüner, 2015). Gaming channels review games including comments throughout the video. This video format is known as Let's Plays; however, in this context, gamers are paid by companies to review games and comment them (Nam, 2013).

In order to increase visibility on YouTube, video content creators collaborate with each other and cross-promote their channels. Consequently, YouTubers are advised to "upload two different videos to both collaborators' channels. This way, both audiences have a way to discover the collaboration and be introduced to the other" (YouTube Creators, 2018). By sponsoring products, so called giveaways via YouTube channels are another opportunity for companies to gain brand awareness. YouTubers are paid for working with the brands, or receive PR (Public Relations) samples which they keep for themselves (Gerhards, 2017). Combining these compensations is conceivable too. While collaborating with brands "the whole video might be produced in the usual style of the YouTuber, but the production or distribution of the content is controlled by the brand" (Gerhards, 2017, p. 4). Some marketers send free products in hope of being featured by YouTube creators in their videos or other social media platforms without actual collaboration agreements (Gerhards, 2017). In addition, as YouTubers gained micro-celebrity status in Germany, they promote their own products such as merchandise or created products in collaborations with firms (Julien Bam, 2015; Nilam, 2017).

Although products on YouTube can be promoted in a variety of ways, since recently, German influencers have to consider legal issues as well. The case of Germany's drug store Rossmann is seen as precedent in the influencer marketing sphere, as the company was convicted for not identifying sponsored content properly (Wabnitz, 2017). Social media influencers in Germany are forced by law to commence labeling paid content appropriately as surreptitious advertising is not allowed in Germany (Böhm, 2015). Many video creators on YouTube responded with more precise

identification of advertising content on YouTube (Fiebig, 2017) and other social media platforms, particularly on Instagram (Rondinella, 2017). As a result, YouTubers now more often embed a textual message about advertising in the first seconds of related videos.[1] Moreover, YouTube asks content creators in its advertisement policies to check a related settings box whenever product placements or endorsements are included in a corresponding video (YouTube Ad Policies, 2018).

Target Groups for Product Promotion on YouTube

When social influencers promote products on social media sites like YouTube and other online environments, they create content with specific target groups in mind. On YouTube, these target groups manifest in differences for socio-demographic attributes across communities, for example, a male-dominated gaming community in comparison to a female-dominated beauty and fashion community. For this reason, one of our research questions is about potential differences for product promotion across different communities (RQ3), and it is worth highlighting the importance of socio-demographic attributes at this point. Regarding the age of users, predominantly digital natives (DNs), who were born after 1980 (Palfrey & Gasser, 2010), are the main audience reached by social media influencers. DNs have grown up in a digitized era and are therefore accustomed to using social media sites. For this reason, they feel familiar interacting on such digital platforms without being taught or being socialized to do so. They are regarded as "'native speakers' of the digital language of computers, video games and the Internet" (Prensky, 2001, p. 2), making them one of the main target groups when it comes to product promotion on social media platforms. In Germany, about 90% of DNs use YouTube as a social media site, while the share is continuously declining with increasing age (Faktenkontor, 2018). Many social media influencers are DNs by themselves, which helps to create a relatedness between them and their younger followers. According to a recent survey, half of 14- to 19-year-old respondents, and one third of 20- to 29-year-old respondents bought a product or used a service due to a recommendation by a blogger, YouTuber, or other prominent person. In comparison, only 10% of respondents between 40 and 49 were affected by influencer recommendations (Faktenkontor, 2017).

Besides user age, gender is another key socio-demographic attribute for influencer marketing and marketing analysis in general (Wolin & Korgaonkar, 2003). For product promotion on YouTube, targeting by gender is especially relevant because of two reasons: first, gender affects which products are of interest for YouTube users. Although many content creators have a mixed audience of female and male followers, girls and women are in general more interested in products related to beauty, fashion, and lifestyle. In contrast, boys and men rather prefer products related to gaming and sports. The unsurprising result is that different products are promoted across different YouTube communities. Second, gender not only affects which products are of interest but also the way these products are presented in YouTube videos. "Social media platforms have enabled new ways of communication, participation, and interaction, favoring relationships among consumers and encouraging them to share different aspects of their consumption experience in the form of stories" (Pera & Viglia, 2016, p. 1142). Qualitative inspections of several YouTube videos by the authors of this article suggest that the aspect of storytelling is more important for female users. In the majority of promotion videos in the beauty and fashion community, YouTubers create entire videos around the promoted products. Women watch videos due to the reason that products are actually the main video content. They are also more likely to buy products due to a recommendation of influencers than men (Faktenkontor, 2017). In comparison, male users and gamers in particular rather seem to accept product placement if it is not the main focus of a video, but rather if it is performed along the way.

In summary, age and gender of YouTube users are both important aspects for product promotion on YouTube. Both attributes lead to different products being promoted in different ways depending on the corresponding YouTube community. We therefore consider community effects as an important aspect for quantifying product promotion in our analysis.

Data and Methods

To analyze product promotion on YouTube, we compiled a dataset which includes information for videos uploaded by the most popular YouTube channels in Germany. On YouTube, a common indicator for popularity is the number of channel subscriptions. We therefore identified the top 100 channels with the most subscribers on the platform as of June 2017. We limited our sample to the top 100 channels as they receive a large share of views of the German YouTube community. For more details about these channels and a comparison of views generated by the top 100 and the top 1,000 channels, we point the readers to Appendix 1. In short, all cumulative video views generated from the top 100 channels account for almost half of all views generated by the top 1,000 channels. Another reason for focusing on the top 100 channels is to manage resource constraints as our analytical strategy described below is computationally intensive and requires processing a large text corpus and millions of links.

After identifying the top 100 channels with the *YouTube Channel Crawler*,[2] we extracted additional data for every single video uploaded by these channels between 2009 and May 2017 using several open source tools.[3] To download video meta-data from the YouTube API, we relied on the *YouTube Data Tools* software (Rieder, 2017), which takes YouTube channel IDs as input, parses API data, and then returns basic info and statistics for all channel videos in a

Table 1. Summary Statistics for YouTube Videos and Channels.

Statistic	Mean	SD	Minimum	Median	Maximum
Video views	399,686	2,766,789	0	120,294	433,915,822
Video likes	9,266	24,458	0	2,608	1,570,213
Video dislikes	434	7,393	0	63	2,319,721
Video duration (minutes)	13	12	0.02	11	617
Videos/channel	1,394	2,325	21	513	18,060
Subscribers/channel	1,736,681	928,316.70	937,105	1,412,454	5,502,592
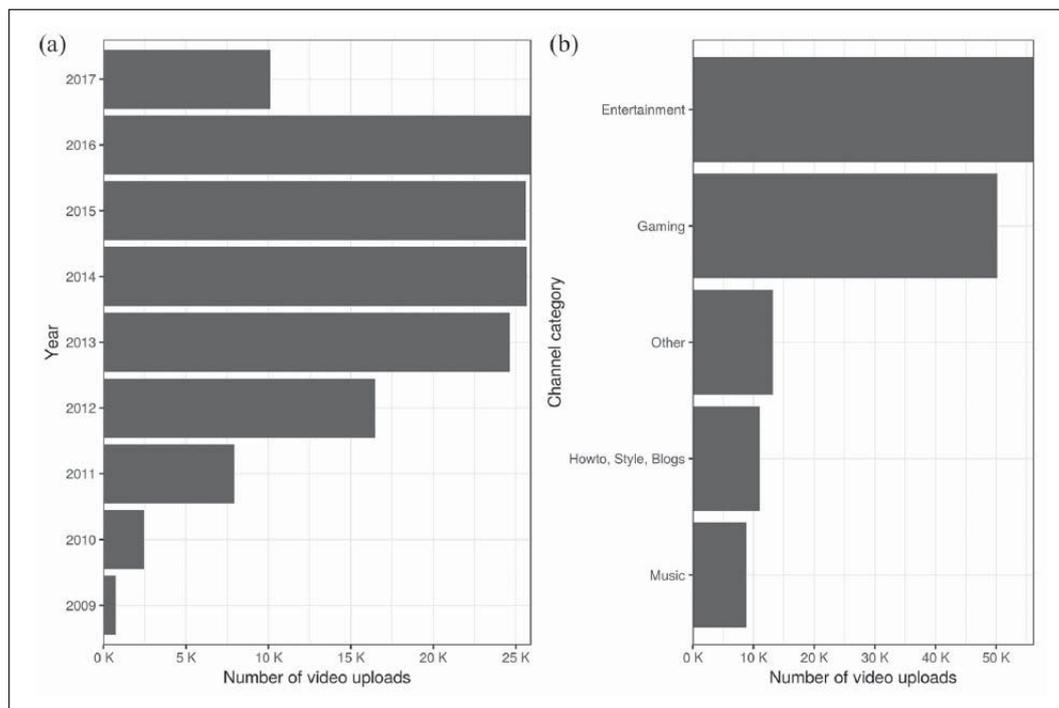
Figure 2. Descriptives for the total number of video uploads in thousands: (a) Uploads by year and (b) uploads by channel category.

tabular file. Afterward, we utilized the R programming language (R Core Team, 2017) and several packages from the *tidyverse* (Wickham, 2017) to combine the tabular files for all 100 channels. The resulting dataset includes information for a total of 139,475 videos, for which Table 1 shows descriptive statistics.

As can be seen in Table 1, content uploaded by the most popular YouTube channels in Germany reaches a large online audience, with a median number of about 120,000 views per video and a maximum number of 433 million views. It also becomes apparent that productivity regarding video uploads varies across YouTube channels. Some channels did only upload a very small number of videos, while other channels uploaded several thousand videos. The varying degree of video uploads and popularity statistics also depends on channel categories. Music channels, for instance, mostly upload few and short music videos, which nevertheless receive a lot

of views. For other categories like gaming, the sheer number of uploads accumulates a lot of views. Figure 2 shows the number of video uploads per year and across channel categories. Up until 2013, the number of video uploads steadily increased and reached a somewhat stable state afterward.[4]

In order to empirically quantify product promotion in YouTube videos, we focus on two aspects in particular: usage of referral links placed inside video description boxes and direct, oral promotion within the actual videos. As explained above, these aspects are particularly common ways for promotion on the video platform.

Referral Links

Referral (affiliate) links are used by YouTubers to promote products on external sites for which they take part in an affiliation program. An issue for measuring the use of such

referral links was the common use of URL shortening in video description boxes. As an example, a referral link for a product on amazon could be *https://www.amazon.de/ gp/product/B004MKNBJG/ref=as_lo_qf_sp_asin_il_tl*. The link consists of the domain *amazon.de*, a path to the product, and the referral id used to identify which amazon partner advertised the product. While such unmodified links can be parsed via string matching procedures, video creators often used URL shortening, resulting, for instance, in an URL like *https://bit.ly/1sNZMwL*. Without requesting the content of short URLs, it is neither possible to identify the corresponding domain nor any affiliate patterns. We therefore used a programming script for identifying all URLs in our dataset and afterward requesting the content of every URL to retrieve the original links. With this procedure, we identified a total of 1,675,509 links from 6,798 different domains.

In the next step, we ought to identify which domains were used predominantly for referral purposes. This includes domains for Amazon and other online shops but does not include references to other YouTube videos or links to other social media sites like Twitter or Instagram. Thus, we only coded domains as being related to product promotion if the signal is very clear, directly pointing to an opportunity for buying products. As the categorization procedure required multiple qualitative inspections of related links for each domain, we restricted coding to the 50 most common domains, which still account for 83.32% of all links in our sample. Due to this restriction, we capture the most referral links for the most popular domains but not for every possible domain. We therefore assume that results presented in this article can be regarded as conservative and under-estimate rather than over-estimate overall quantities for referral links.

Video Content

Arguably, the most important content on YouTube are the actual videos uploaded to the platform. However, analyzing video material at scale is challenging, as a lot of information is encoded in audio and visual data. To assess developments of product promotion, we therefore focus our analysis on audio content of YouTube videos. In order to do so, we used the open source tool *youtube-dl* to extract all available auto-generated captions for the videos in our sample, which converts audio data to textual data.[5] Relying on such captions is not ideal, as they are created algorithmically by YouTube and their quality is dependent on several factors, for example, how fast or how many people speak in a video. Furthermore, some videos either were not transcribed automatically by YouTube or did no contain audio data. Nevertheless, manual inspection of several caption texts suggested that the quality of our data is sufficient for our quantitative methodological approach.

As we expect that how often YouTubers orally promote products depends on several factors, we utilize a novel variant of topic models called the Structural Topic Model (Roberts et al., 2014). Structural Topic Models enable us to not only examine topic proportions for each video but also to analyze how these proportions vary dependent on the date of the video upload and the category of the corresponding channel. We can therefore analyze whether topics related to product promotion were increasingly used over time (RQ2) and across communities (RQ3).

Although topic modeling is very useful to automatically categorize large text corpora, one limitation is that the number of topics has to be determined by the analyst. To find the best model for our research task, we computed four different models with 25, 50, 75, and 100 topics. For each model, we then calculated semantic coherence and exclusivity, which are measures that quantify desirable statistical properties. Semantic coherence is higher if more probable words in a topic frequently co-occur together, whereas exclusivity achieves higher values if more words are exclusive to corresponding topics (Roberts, Stewart, & Tingley, 2017). The model comparison in Appendix 3 illustrates the average and median values for both measures across all topics for each model. In terms of desirable statistical properties, the model with 50 topics provides the best trade-off for both measures. In addition to statistical diagnostics, we inspected the topic models by analyzing the most frequent and exclusive words (Lucas et al., 2015, p. 19)—called *frex* terms—and captions with the highest proportions for a given topic. Based upon frex terms and highly representative texts, we at last assigned labels to each topic. During this evaluation procedure, the model with 50 topics also turned out to be the best model in relation to our research task and was therefore chosen as our final model.[6]

Results

First, we present our results for the development of product promotion with regards to referral links.

Referral Links

How common is the use of referral links for the most popular German YouTube channels? On average, description boxes for videos contain 2.24 referral links, with a standard deviation of 3.31. This means that each time a YouTube user opens a description box, she or he is on average confronted with more than two links related to product promotion. To put this into another perspective, we can calculate the highest possible reach by multiplying the total number of referral links in our sample with the total number of video views. We discovered 312,826 (312 thousand) referral links and in total all videos received 55,746,248,791 (55 billion) views, resulting in maximum potential of 17,438,876,024,293,366 (17 quadrillion) referral link impressions. Of course, this number is not realistic, as, for instance, not every YouTube user inspects description boxes when watching videos, and views could also to some extent be generated by computer programs
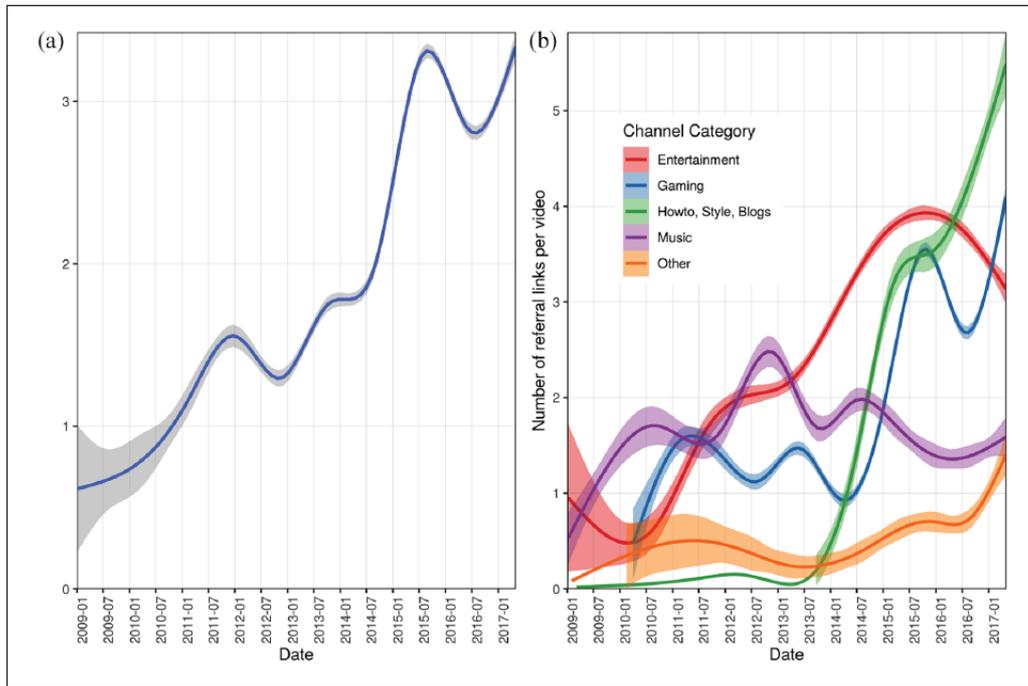
Figure 3. GAM smoothed time series for referral links per video description with 95% confidence intervals: (a) All videos and (b) videos grouped by channel category.

rather than actual users. Nevertheless, even if we would decrease this estimation by several orders of magnitude, product promotion via referral links would still remain alarmingly prevalent on YouTube.

To examine whether the use of referral links is constant across time and across different communities, Figure 3 shows time series for the number of referral links per video from 2009 to 2017.

All time series were smoothed using generalized additive models (GAM) and include 95% confidence intervals for each plotted trend. On the left-hand side, Figure 3a illustrates the overall trend for referral link usage. While the estimated number of referral links in the first years was roughly 0.8, the trend consistently increased, and in the most recent years, videos description boxes are estimated to contain on average more than three links for product promotion. The development from 0.8 links in 2009 to 3.3 in 2017 represents an increase of more than 310%. In comparison, one of the traditional media outlets commonly used for advertisement is television broadcasting. In Germany, the amount of TV advertising in minutes also increased from 2009 to 2016, but only by about 30% (ZAW, 2017).

To see how the development of product promotions differs across YouTube communities, Figure 3b further illustrates trends for each channel category. Overall, regardless of the category, all video channels distributed more referral links over the course of time. However, it becomes apparent that especially *Howto, Style & Blog* channels do so considerably more frequently than for instance *Music* channels. A

final question regarding referral links is whether their increased usage is simply related to an overall increase in the placement of any links in general. Appendix 2 includes smoothed time series for the total number of any links and the share of referral links in comparison to all links for each video. It can be seen that in general links were more commonly placed in description boxes over the course of time. Although the trend is not clearly monotonic, it becomes apparent that the relative number of referral links per video also increased over time.

Video Content

Next, we turn to the results for our topic model to examine how products are promoted orally in YouTube videos. Table 2 contains labels and proportions for all 50 topics that we identified with our model.

Labels denote the overall substantial meaning of a topic that we assigned as explained above. The corresponding proportion for each topic quantifies the related content share across all video captions. The most common topic *stopwords* captures words that are used very frequently in German YouTube videos without relating to a specific semantic category. The topic *social media promotion* relates to YouTubers advertising either their own content on other social media platforms or prompting users to like a video or subscribe to the channel. Video content about school activities as well as social and romantic relationships, which is captured by the topic *school/relationships*, is also very common. Furthermore,

Table 2. Topic Labels and Proportions.

Topic	Proportion
Stopwords	0.046
Traveling/time and locations	0.04
School/relationships	0.036
Social media promotion	0.035
Questions/answers	0.034
Stories and people/countries	0.03
Music—songs/bands	0.028
Gaming—Minecraft 5	0.027
Music—common terms	0.026
Dates/seasons	0.026
Conversations	0.026
Gaming—Minecraft 2	0.025
Products—hauls/fashion	0.024
Food/gaming—Pokémon	0.024
Subjects and items	0.024
Food tasting	0.024
Gaming—Minecraft 7	0.024
Gaming—Minecraft 1	0.023
Cars/racing	0.023
Fantasy	0.022
Gaming—general	0.021
Game shows	0.021
Gaming—action games	0.02
Family/ceremonies	0.02
Gaming—Binding of Isaac	0.02
Cheering	0.019
Tech devices	0.019
Abbreviations/stopwords	0.019
Nature/gaming—Minecraft 4	0.018
Products—beauty/cosmetics	0.018
Baking/cooking	0.017
Gaming—Minecraft 3	0.016
Digits	0.016
Body/sports	0.016
Shooting/weapons	0.016
Gaming—Minecraft 6	0.016
Gaming—SimCity	0.015
Music—rap	0.013
Movement	0.013
Numbers/placements	0.013
Greetings/acknowledgements	0.012
Gaming—ships and space	0.012
Movies/trailers	0.011
Stopwords/English words	0.01
Filler words/transcript errors	0.009
Comedy reports	0.008
Enthusiasm	0.007
Music/parties	0.007
Tutorials	0.007
Names/characters	0.005

a large proportion of video content is related to gaming. Especially videos about the video game *Minecraft* are

commonly uploaded by the most popular German YouTubers and therefore captured by several topics. Of special interest for the purpose of this article are two topics that are strongly linked to product promotion: *products—hauls/fashion* and *products—beauty/cosmetics*. Table 3 includes the top 15 translated frex terms for both topics. For an overview of frex terms for all 50 topics in original German language, we point the reader to Appendix 3.

The first topic related to product promotion refers to hauls, that is, YouTubers purchasing several products and discussing them in their videos. Several frex terms for this topic relate to buying things, for example, *bought, euro, cost, ordered*, and *price*. Regarding the type of products that were promoted, a focus of clothing and fashion becomes apparent. It is also interesting to note that one of the most frequent and exclusive terms for this topic is *description box*, where referral links for the products promoted in the videos are placed by the YouTubers. The second topic is—similar to the first one—related to products for altering physical appearance rather than gadgets, gaming, or tech-related products. Videos with high proportions for this topic focus on product promotion of beauty and cosmetic products, with important terms like *hair, color, lips*, and *make-up*.

After identifying the two topics related to product promotion, we turn to the question about whether proportions for these topics are stable over time and across channel categories. Figure 4 includes effects for video upload date and channel category estimated with our structural topic model. Similar to the results for the use of referral links, Figure 4a and 4c clearly illustrates a trend of increasing product promotion for both of the two topics. While for instance less than 0.2% of all video captions generated by the most popular channels relate to promotion of haul and fashion products in 2009, the share increases to more than 1.4% in 2017.

A similar trend can be seen for the topic focusing on beauty and cosmetic products. As could be expected from the type of products advertised in these topics, Figure 4b and 4d also depicts a clear signal regarding differences across channel categories. Adding up the proportions for both topics, about 15% of the content uploaded by *Howto, Style & Blog* channels is related to product promotion. In comparison, *Music* or *Gaming* channels hardly use these topics. This is, again, unsurprising, as beauty and fashion products are not relevant for the audience of such channels.

One potential issue of this text-based approach is that YouTube creators might also disseminate a product's usage or its characteristics in a negative or satirical way. Although such behavior is not very common, some YouTubers created videos related to "flop products" and particularly do not recommend these products to their communities (Nilam, 2012; TamTam, 2016). For this reason, we conducted additional qualitative analysis about whether our two topics predominantly capture videos with a positive sentiment toward the mentioned products. Results in Appendix 3 suggest no issues related to negative or satirical content.

Summing up, our results indicate that there is a clear upward trend for product promotion on YouTube not only by using referral links but also by direct advertisement in the actual video content. Moreover, product promotions seems to be especially common for *Howto, Style & Blog* channels in Germany. We discuss possible reasons and as well as implications for these findings in our concluding section.

Discussion and Conclusion

In this article, we expanded the knowledge about product promotion by social media influencers on YouTube, contributing to the literature on social media studies. Using automated content analysis, we showed that monetization of content by

Table 3. Top 15 Translated Frex Terms for Topics Related to Product Promotion.

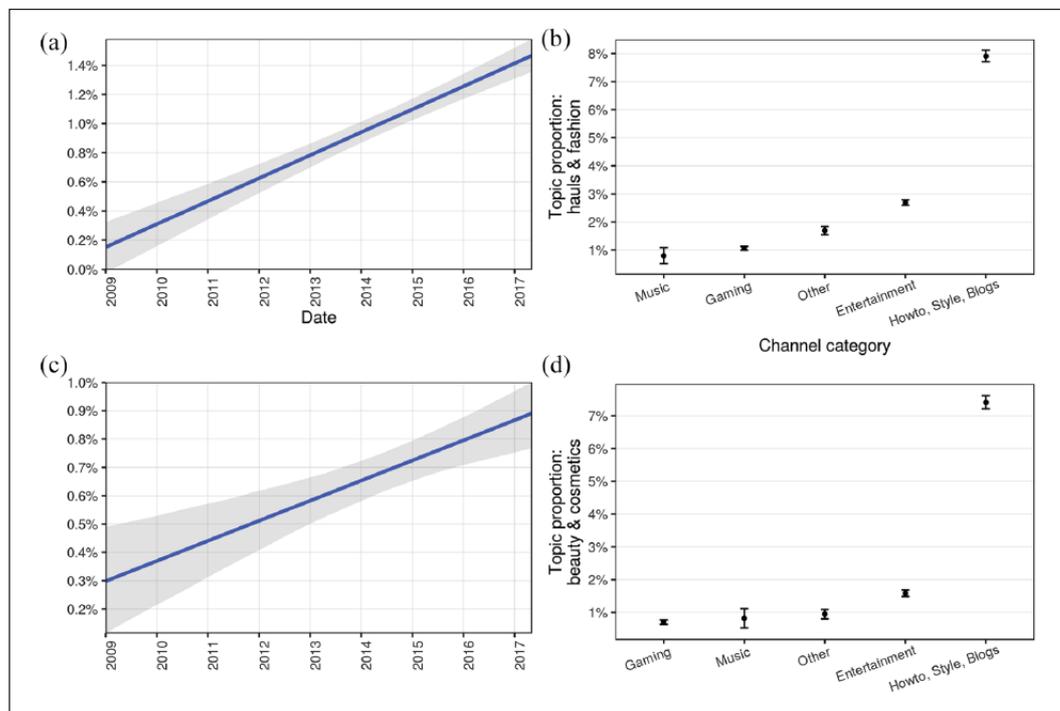| Topic	Frequent and exclusive words
Products—hauls/fashion	Bought, euro, shoes, total, description box, cost, summer, find, clothes, taking along, wearing, outfit, ordered, price
Products—beauty/cosmetics	Hair, color, products, lips, using, product, skin, colors, eyebrows, make-up, used, brush, lipstick, hairstyle, face

influencers plays an increasing role on social media platforms, particularly in the beauty and fashion community.

What are the potential implications of increasing product promotion social media sites? First, it becomes increasingly difficult for viewers to differentiate between commercial and non-commercial content on platforms like YouTube. Former amateurs started sharing their personal opinions on YouTube, then gained more and more credibility and eventually reach vast online communities. However, despite their growing popularity, these social media influencers are still seen as authentic and trustworthy within their communities. As they actively engage in discussions held by their fellowship and share major parts of their private lives, social media influencers give the impression of being approachable persons (Dredge, 2016). For this reason, video consumers don't easily recognize real and honest opinions within commercial content uploaded by video content creators anymore.

Moreover, our results suggest that product promotion via referral links and oral advertisement in YouTube videos is especially common in communities which for the most part consist of young, female users, who have nowadays grown up to use social media sites on a regular basis (Döring, 2014, 2015a, 2015b). Similar to celebrities, for instance, from the music and movie sector, social influencers established strong fan bases within their young audience and are successful especially because of their portrayed "ordinariness [as well as] their relatability" (Dredge, 2016). Consequently, YouTube

Figure 4. Estimated effects of time and channel category on topic proportions from structural topic model with 95% confidence intervals: (a/b) Topic "products—hauls and fashion" and (c/d) topic "products—beauty and cosmetics."

creators strongly influence children and teenagers in their perceptions as well as decisions (Döring, 2014). This raises concerns as especially teenagers can easily be influenced in a positive, however, also in a negative way, while YouTube creators themselves do not see their businesses morally reprehensible (Reinbold, 2015b). This highlights the growing importance of media literacy, in particular concerning the increased commercialization on YouTube as young viewers hardly recognize hidden product promotion in uploaded video material (Döring, 2014). Moreover and in line with our results, scholars found that especially female teenagers are addressed by advertisers and therefore criticize the impact of consumerism on identity formation (Hill, 2011). For companies, social media influencers are attractive brand endorsers and "a perfect match" for the beauty industry (Kinski, 2017). Young girls however may not realize that lipsticks or expensive watches are recommended by influencers like Bianca Heinicke not because of their quality but only with monetization in mind.

Regarding the limitations of our study, we focused on measuring product promotion on YouTube, but influencers often use additional platforms like Instagram and Snapchat for monetization purposes. As for our methodological approach, measuring product promotion with automated content analysis is limited to analysis of textual data. It is however, possible, that YouTubers promote a product in a video, for example, by simply revealing it, without speaking about it, or placing a referral link in the corresponding video description. We expect that such *visual-only* promotions are not very common on YouTube, but nevertheless happen, especially in communities where product promotion is not the main focus of videos. As we discussed in relation to target groups on YouTube, this might be more common for male-dominated communities, for example, the gaming community. To give an example, gamers can visibly wear a headset in a video without ever mentioning the product or brand. Capturing these *visual-only* promotions requires future research, which could build upon the insights generated in our work.

Ultimately, our knowledge about the social and economic consequences of influencer marketing is still limited. On a positive note, social media platforms led to the emergence of new job opportunities in the era of digital labor. For many content creators on YouTube, advertising and product promotion are important financial resources and part of their daily work. However, despite emerging opportunities, the challenges for a digitalized society also have to be considered. As our results suggest, the trend for product promotion on YouTube and other platforms is likely to increase even further. It remains to be evaluated by scholars to what extent social media users and in particular adolescents will be harmed by the increasing role of monetization on social media sites.

Declaration of Conflicting Interests

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Notes

1. The first seconds of the following YouTube video include a textual message about advertising in the top-left corner: https://www.youtube.com/watch?v=NiU WWOw9Os
2. The YouTube Channel Crawler is available at https://www.channelcrawler.com/
3. While the earliest videos of these channels date back to 2006, the total number of videos created between 2006 and 2008 is only 316, which translates to less than 0.3% of all video uploads. To allow comparisons between channels with a sufficient number of observations, we therefore chose 2009 as the starting point for our analyses.
4. The exception for 2017 is due to our data collection ending in May.
5. The program youtube-dl is available at https://github.com/rg3/youtube-dl
6. We used the R package stminsights to validate our structural topic models (Schwemmer, 2018).

Supplemental Material

Replication materials for this article are available at Harvard Dataverse: https://doi.org/10.7910/DVN/KENMVB

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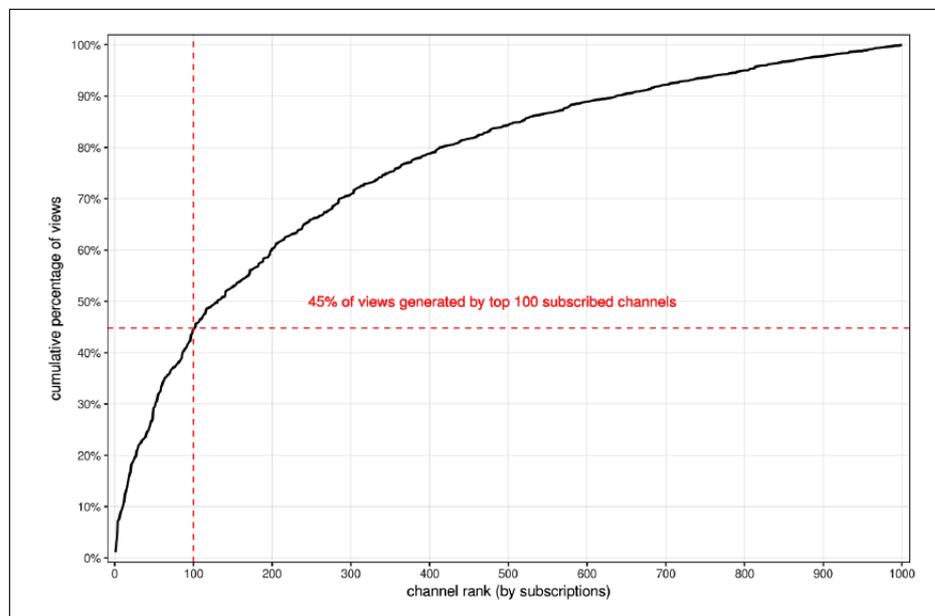
Appendix 1

German YouTube Channels

Channel Overview. The following table contains descriptives for the 100 most subscribed German YouTube channels as of June 2017.

Name	Subscriptions	Category	Name	Subscriptions	Category
Freekickerz	5,502,592	Other	URBAN DANCE CAMP	1,398,030	Other
Gronkh	4,606,603	Gaming	Nuclear Blast Records	1,393,733	Music
BibisBeautyPalace	4,471,269	Howto, Style, Blogs	Zombey	1,387,527	Gaming
Kontor.TV	4,199,853	Music	JuliensBlogBattle	1,378,127	Entertainment
Kurzgesagt—In a Nutshell	4,178,957	Other	AGGRO.TV	1,371,532	Entertainment
Julien Bam	3,847,634	Entertainment	LPmitKev	1,354,773	Gaming
ApeCrime	3,504,949	Entertainment	JONAS	1,354,466	Entertainment
Dagi Bee	3,485,520	Howto, Style, Blogs	xLaeta	1,299,650	Howto, Style, Blogs
Simon Desue	3,232,415	Entertainment	KinoCheck	1,274,111	Entertainment
LeFloid	3,099,909	Entertainment	Galileo	1,234,700	Entertainment
Julienco	3,078,083	Entertainment	Selfmade Records	1,231,109	Entertainment
Felix von der Laden	3,053,754	Other	CloudKid	1,224,486	Music
The Voice Kids	2,689,511	Entertainment	Rammstein Official	1,214,627	Music
IBlali	2,595,413	Other	Joyce	1,213,872	Entertainment
ConCrafter |LUCA	2,541,231	Entertainment	MontanaBlack	1,201,786	Howto, Style, Blogs
DieLochis	2,372,344	Entertainment	LaurenCocoXO	1,167,405	Howto, Style, Blogs
GermanLetsPlay	2,355,560	Gaming	BGH Music	1,155,243	Other
Made My Day	2,291,060	Entertainment	Julia Beautx	1,147,371	Howto, Style, Blogs
Paluten	2,166,442	Entertainment	Sturmwaffel	1,141,020	Gaming
Emrah !	2,150,754	Music	Nilam	1,137,374	Howto, Style, Blogs
PietSmiet	2,145,931	Entertainment	xKito Music	1,114,941	Music
Freshtorge	2,113,373	Other	flyinguwe	1,111,152	Howto, Style, Blogs
Shirin David	2,091,000	Howto, Style, Blogs	AlexiBexi	1,109,644	Entertainment
Ungespielt	2,071,770	Gaming	ViscaBarca	1,097,667	Entertainment
ApeCrimeTV	2,042,869	Entertainment	Ischtar Isik	1,091,879	Howto, Style, Blogs
Leon Machère	2,028,519	Entertainment	Cheng Loew	1,091,009	Entertainment
ApoRed	2,022,533	Entertainment	unsympathischTV	1,079,074	Entertainment
Robin Schulz	1,981,837	Entertainment	Herr Bergmann	1,073,145	Gaming
Sarazar	1,976,359	Gaming	SPACE RADIO	1,071,746	Howto, Style, Blogs
Rewinside	1,962,008	Gaming	BarbaraSofie	1,061,875	Howto, Style, Blogs
inscope21	1,771,119	Entertainment	Sallys Welt	1,057,935	Howto, Style, Blogs
Melina Sophie	1,753,786	Entertainment	Kojo	1,052,795	Entertainment
JoergSprave	1,749,050	Other	izzi	1,042,838	Gaming

Appendix I. (Continued)

| Name	Subscriptions	Category	Name	Subscriptions	Category
LIONTTV	1,733,488	Other	DannyJesden	1,035,551	Gaming
TopZehn	1,714,152	Other	Animenz Piano Sheets	1,023,139	Entertainment
Sami Slimani	1,650,865	Entertainment	JunkFoodTasterDotCom	1,020,733	Howto, Style, Blogs
Paola Maria	1,630,684	Entertainment	TOM SHUFFLE	1,017,953	Gaming
Kelly MissesVlog	1,586,034	Howto, Style, Blogs	SKK	1,014,165	Entertainment
Dima	1,559,544	Entertainment	Selected.	1,011,116	Music
BUSHIDO	1,545,749	Entertainment	Mert Matan	1,009,385	Entertainment
GommeHD	1,539,627	Gaming	AirwaveMusicTV	1,007,470	Music
BULLSHIT TV	1,536,823	Entertainment	Arazhul	1,000,547	Gaming
Jarow	1,535,044	Entertainment	Bundesliga	982,366	Other
BangerChannel	1,500,148	Entertainment	Craftronix	977,386	Other
GoldenArmor	1,498,078	Entertainment	SparkofPhoenix	974,321	Gaming
Digster Pop	1,493,862	Entertainment	PrankBros	972,441	Entertainment
Slivki Show DE	1,480,295	Entertainment	MySpassde	972,334	Entertainment
TheFatRat	1,454,128	Music	JP Performance	963,813	Other
ArkivaShqip	1,446,223	Entertainment	clips mix	945,986	Other
Jay & Arya	1,426,878	Howto, Style, Blogs	Bosshaft TV	937,105	Entertainment

Share of Views. The following figure depicts cumulative view counts generated by the top 1000 German YouTube channels as of June 2017. It can be seen that the percentages of views generated by the top 100 channels, marked with dashed red lines in the graph, accounts for 45% of all cumulative views.

Appendix 2

Referral Links

This appendix contains generalized additive models (GAM) smoothed time series for number of links per video and share of referral links per video. Subfigure (a) shows the number of links in video descriptions. Subfigure (b) shows the share of links classified as referral links in video descriptions. In general, links were more commonly placed in description boxes over the course of time (left-hand side). Although the trend is not clearly monotonic, it becomes apparent that the relative number of referral links per video also increased over time (right-hand side).
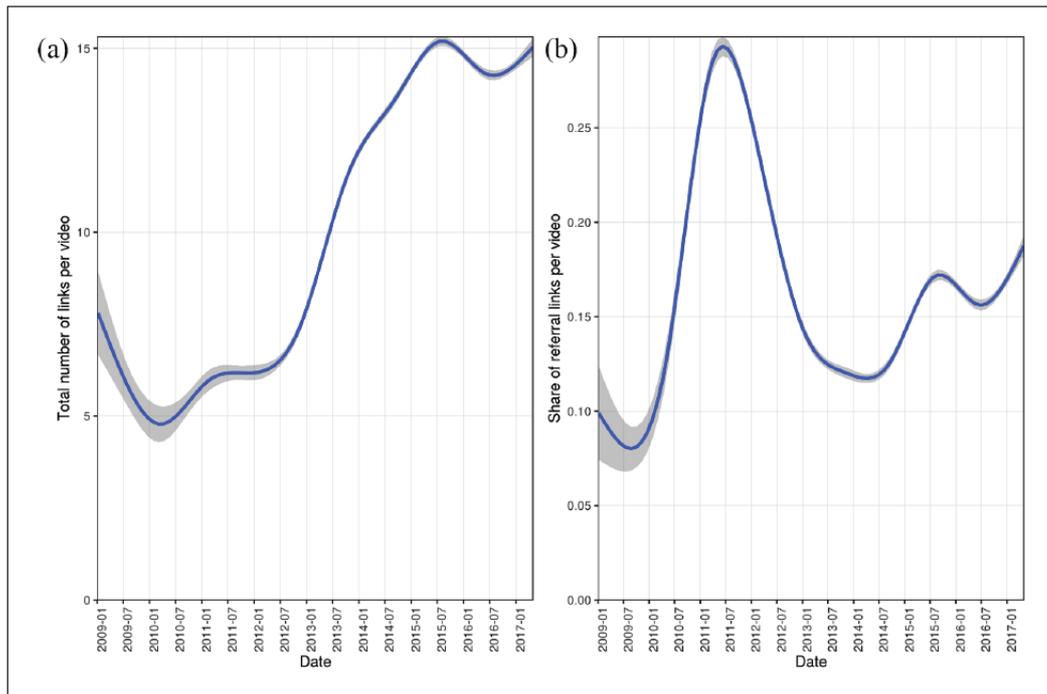
Appendix 3

Structural Topic Models

Model Comparison. The following figure illustrates median and mean measure for semantic coherence and exclusivity of four structural topic models that we fitted on the auto-generated YouTube subtitles. Semantic coherence is higher when more probable words in a topic frequently co-occur together (Mimno et al., 2011). Exclusivity is based on the FREX metric and achieves higher values when more words are exclusive to corresponding topics (Lucas et al., 2015). The authors of the structural topic model suggest to prefer topic models that achieve desirable properties for both measures (Roberts et al., 2017). While the figure shows that no model is clearly superior, the model with 50 topics achieves balanced values across both dimensions. In our qualitative validations, topics of this model were also easier to interpret in comparison to other models, which is why we chose the model with 50 topics as our final model for the analysis.
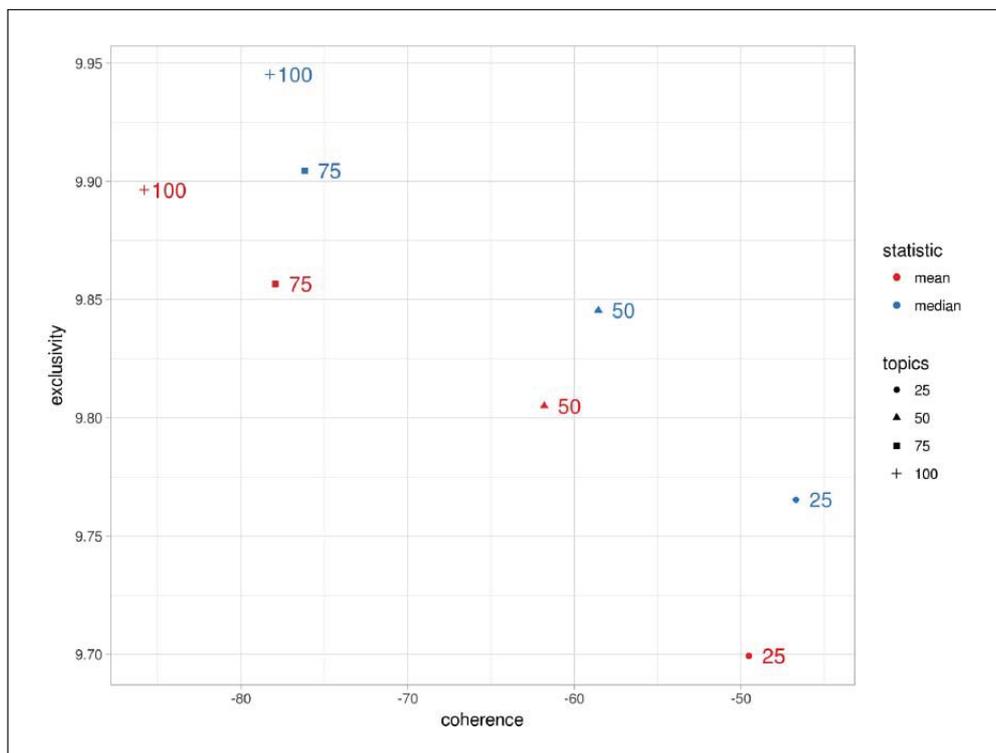
Frex Terms. The following table shows the top 15 frex terms in original German language for each topic of our structural topic model.

Topic	Terms
Stopwords	hast, alter, musst, machst, kannst, willst, weißt, siehst, scheiß, kommst, scheiße, junge, kriegst, simon, witz
Traveling/time & locations	freunde, gestern, morgen, abend, uhr, stunden, köln, kevin, angekommen, tage, hotel, gamescom, mega, berlin, unterwegs
School/relationships	schule, mädchen, freundin, frauen, lehrer, lena, eltern, mädels, person, beziehung, sex, klasse, jungs, männer, thema
Social media promotion	youtube, videos, video, youtuber, abonnenten, facebook, twitter, kanal, kommentare, kommentar, daumen, instagram, schreibt, abonniert, beschreibung
Questions/answers	frage, fragen, würdest, fragt, antwort, willst, hast, reden, antworten, beantworten, findest, weißt, gedanken, jemanden, angst
Stories & people/countries	gesprochen, usa, menschen, millionen, verboten, deutschland, milliarden, polizei, wurden, amerika, gefängnis, krankheit, menschheit, wurde, dollar
Music—songs/bands	lied, album, song, band, songs, wissen, art, singen, menge, hören, tour, bands, tun, lieder, klang
Gaming—Minecraft 5	server, projekt, halt, minecraft, aufnehmen, folge, gebaut, folgen, haus, geschrieben, kommentare, stream, aufgenommen, finde, simon
Music—common terms	mr, ah, gonna, hmm, huh, uh, bekam, ficken, kerl, alice, erhalten, teufel, telefon, tat, yo
Dates/seasons	wochen, tagen, jahr, jahren, minuten, seit, april, daher, märz, jahres, 30, verein, sei, ersten, derzeit
Conversations	la, ehrlich, momentan, guck, kriegen, theoretisch, offenbar, ach, gucken, drüben, quasi, scheiße, dingen, inzwischen, müsste
Gaming—Minecraft 2	bogen, schwert, lucky, getötet, team, mitte, gold, rüstung, pvp, tot, gegner, gestorben, anscheinend, töten, runde
Products—hauls/fashion	gekauft, euro, shirt, schuhe, total, infobox, gekostet, sommer, finde, klamotten, mitgenommen, tragen, outfit, bestellt, kostet
Food/gaming—Pokémon	pokémon, pizza, gegessen, trinken, cola, lecker, kaffee, käse, pokémon, schmeckt, niedrig, essen, chips, trinkt, salat
Subjects & items	mund, katze, bild, fenster, tür, nase, spiegel, foto, tisch, katzen, stuhl, baby, lampe, schrank, finger
Food tasting	ordnung, yeah, ha, bye, bekam, überprüfen, denke, geschmack, schneiden, grunde, ah, ei, schokolade, mmm, art
Gaming—Minecraft 7	diamanten, höhle, eisen, spitzhacke, rüstung, fackeln, verzaubern, schwert, lava, diamant, skelett, abbauen, level, portal, kiste
Gaming—Minecraft 1	zeug, vorne, kisten, eventuell, theoretisch, außen, dran, blöcke, müsste, glas, kleines, ansonsten, jedenfalls, raus, setzen
Cars/racing	auto, autos, gefahren, flugzeug, reifen, fahren, wagen, fährt, fahre, kurve, fahrzeug, strecke, challenge, rennen, gta
Fantasy	quest, magier, drachen, quests, dunkle, schatten, geist, soldaten, leiche, wache, wächter, blut, leichen, speichern, schatz
Gaming—general	spiele, gespielt, spiel, level, spielen, sprung, mario, game, spieler, maps, map, spielt, geschafft, games, zocken
Game shows	gewinnt, punkte, stefan, gewonnen, gewinnen, fußball, punkt, raab, bayern, tor, ball, gewinner, durchgang, karten, sekunden
Gaming—action games	mission, erledigt, behaupten, episode, vorne, typen, dennis, übel, play, batman, deckung, sarrazin, scheinbar, wahnsinn, erwischt
Family/ceremonies	familie, mutter, kinder, weihnachten, geschenk, vater, geschenke, hund, schwester, paul, geburtstag, tochter, kind, schlafen, Party
Gaming—Binding of Isaac	schalter, bombe, raum, ebene, scheinbar, boss, schlüssel, bomben, adventure, klettern, herz, wenigstens, map, herzen, kaputt
Cheering	zack, heißt, fantastisch, engel, wenigstens, seht, perfekt, brauchen, definitiv, geil, sozusagen, weiteren, hiervon, wunderbar, gefällt
Tech devices	werbung, handy, app, iphone, pc, internet, schauspieler, google, kamera, ps, apple, playstation, display, xbox, apps
Abbreviations/stopwords	dr, st, apa, dpa, worden, ca, prof, red, dapd, mai, euro, 4, münchen, 8, jawoll
Nature/gaming—Minecraft 4	baum, bäume, holz, schnee, insel, steine, pflanzen, stein, wald, blumen, schafe, erde, wachsen, axt, berg
Products—beauty/cosmetics	haare, farbe, produkte, lippen, benutze, produkt, haut, farben, augenbrauen, make-up, benutzt, pinsel, lippenstift, frisur, gesicht

Frex terms. (Continued)

Topic	Terms
Baking/cooking	gramm, zutaten, teig, kuchen, torte, salz, zucker, butter, rezept, kühlschrank, backen, creme, topf, gebe, sahne
Gaming—Minecraft 3	energie, kabel, magie, maschinen, redstone, generator, jetpack, maschine, kräften, brauche, kohle, brauchen, aluminium, herstellen, kupfer
Digits	3, 6, 12, 13, 5, 14, 16, 19, k, 2, 1, 29, 27, 17, 33
Body/sports	sport, training, trainieren, körper, tipps, kilo, trainiert, tipp, lernen, gewicht, fitness, hilft, gelernt, gesund, beine
Shooting/weapons	schießen, munition, waffe, schuss, waffen, geschossen, schießt, gingen, pistole, schaden, granate, angriff, kugel, stärke, stärker
Gaming—Minecraft 6	minecraft, command, blog, blöcke, mode, block, tnt, creative, rechtsklick, effekt, beispielsweise, blöcken, mod, items, zombie
Gaming—Sim city	stadt, verkaufen, geld, gebäude, straße, häuser, norden, straßen, kaufen, arbeiter, leisten, industrie, verkauft, verdienen, bürgermeister
Music—rap	runde, runden, battle, box, rap, king, mitglied, leichten, unterhaltung, rapper, schlechter, extrem, turnier, schlecht, beste
Movement	links, rechts, drücken, oben, gedrückt, unten, springt, drückt, knopf, komme, bitte, drücke, linke, rechten, taste
Numbers/placements	fünf, nummer, sechs, vier, eins, drei, zehn, thomas, sieben, 10, top, platz, acht, neun, insgesamt
Greetings/ acknowledgements	hallo, vielen, dank, danke, willkommen, herzlich, dankeschön, clips, überraschung, zuschauen, clip, nächste, fürs, danken, tschüss
Gaming—ships and space	schiff, fliegen, roboter, planeten, mond, space, rakete, angeboten, piraten, fliege, geil, cool, fliegt, raketen, flug
Movies/trailers	kino, film, filme, harry, szene, figur, james, potter, serie, werke, trailer, star, filmen, chris, wars
Stopwords/English words	dings, sozusagen, labor, easy, roman, sowas, nämlich, flow, warte, eben, jedenfalls, besonderes, weise, norbert, karotten
Filler words/transcript errors	besuch, ach, mach, sowohl, mensch, 8, prozent, schüler, müsse, wat, speichern, folgendes, dar, aachen, schweigen
Comedy reports	herr, länder, laut, juni, toni, ski, schaffte, firma, group, besucher, löschen, kunden, diana, müller, steuer
Enthusiasm	gott, oh, wow, fuck, liefern, ok, mann, heilige, nice, o, hey, monster, shit, komm, boah
Music/parties	musik, gelächter, applaus, musiker, music, abschied, juli, playlist, verfahren, partie, fordert, leitung, geführt, übrigen, daniel
Tutorials	prozent, signal, smart, schalter, strom, praktisch, könne, folgendes, sonderlich, falle, felder, müsse, jahr, vorn, einigermaßen
Names/characters	warten, papa, mama, tom, go, c, könig, g, ticket, amp, d, j, s, b, f

Validation of Product Promotion Topics. To further validate results from our structural topic model with regard to the two topics of interest, products—hauls/fashion and products—beauty/cosmetics, we used the topic proportion estimates from our model to identify the most representative videos for both topics. In the next step, we qualitatively analyzed 10 representative videos for each topic and coded the following attributes: whether products or bands were mentioned/displayed by name, prices were mentioned/displayed, and if the video sentiment related to the products is positive/a direct recommendation, neutral, or negative/satirical.

The following tables include YouTube video ids and our coding results for both topics. Results show that the sentiment of the videos was either positive or a direct recommendation for most products and at worst neutral in some cases. In addition, the majority of products/brands in each video were either explicitly mentioned by name or listed and referred to in the corresponding description boxes.

Products—Hauls/Fashion.

Video id	Products mentioned	Price mentioned	Product promotion sentiment
IgIH2maYvGk	Yes	Yes	Direct recommendation, positive, adding ref links
jiQAK2Zu4T0	Yes	Partially	Direct recommendation, positive
Z4LFvtX6kr4	Yes	Yes	Positive
cb10NPsj6ZU	Yes	Yes	Positive, adding ref links
5d9ApJphBj8	Partially	Partially	Positive
RVzVLR0VwWA	Yes	Partially	Direct recommendation, positive
F-HAf1PDRKU	Yes	Yes	Direct recommendation, positive, adding ref links
uL2ShHNzpo4	Yes	No	Neutral
R1rCxfOe7eg	Yes	Yes	Positive
iGlW1QBheZY	Yes	Partially	Positive

Products—Beauty/Cosmetics.

Video id	Products mentioned	Price mentioned	Product promotion sentiment
9S2LNE5DcpE	Yes	No	Neutral
CVRccnvgPz8	Yes	No	Positive
secMbzRNvdk	Yes	No	Positive
GhHPaKg2KY	Yes	No	Positive
BGYHpqB84gY	Yes	Yes	Direct recommendation, positive
Bx2GMs1Rlno	Yes	Yes	Direct recommendation, positive
aTxpLelYq9l	Yes	Partially	Positive
v4pX59ITIMw	Yes	Yes	Positive
K3ROEOJfCnl	Partially	Partially	Direct recommendation (partially negative in order to recommend other products instead), positive
Oxr0c2SFLg8	Yes	Yes	Direct recommendation, positive