Investigating Suicide-Related Subliminal Messages on Instagram

A Frame-by-Frame Analysis of Video Posts

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Abstract. *Background:* Suicide is the second-leading cause of death among 15–29-year-olds and Instagram is one of the most popular and fastest-growing social media platforms among this age group. A previous study presented preliminary evidence for suicide-related "subliminal messages" on Instagram, defined as very brief presentations of suicide-related content in video posts that users have no conscious awareness of. *Aim:* A systematic quantitative study was pending. *Method:* We conducted a quantitative content analysis of 100 Instagram video posts. A frame-by-frame coding procedure allowed for an assessment of whether suicide-related content was depicted in very brief segments, even when this content could not be consciously recognized when watched at regular speed. *Results:* Analysis indicates that a substantial amount of suicide-related content is presented in very brief shots. We identified 67 very brief shots that appeared in 21 video posts. Of interest, 13 of these video posts presented more than one very brief suicide-related shot. *Limitation:* The subjective threshold of conscious awareness differs inter-individually. This complicates the operationalization of subliminal messages. *Conclusion:* Subliminal messages are ethically highly problematic. There is a need for a greater awareness of possible suicide-related subliminal messages on Instagram.

Approximately 800,000 individuals die each year due to suicide and suicide is the leading cause of death among 15–29-year-olds (World Health Organization, 2017). Therefore, suicide is one of the most relevant global public health issues, also affecting our youth (Wasserman & Wasserman, 2009). Among many factors, the media are deemed to play a key role in suicide prevention (Mann et al., 2005; Niederkrotenthaler & Stack, 2017). In fact, the role of the media can be perceived as a double-edged sword: On the one hand, depictions of suicide in the media can elicit imitative effects leading to additional suicides (Phillips, 1974; Stack, 2005). On the other hand, responsible depictions of suicide such as providing alternatives to suicide or offering a reference to a telephone counseling service can decrease the suicide rate (Niederkrotenthaler et al., 2010).

The rise of the Internet has changed the way in which suicide is depicted and how it is publicly available, both in terms of quantity and quality; it can provide positive and negative content for at-risk individuals (Pirkis, Mok, & Robinson, 2017; Reid-Chassiakos, Radesky, Christakis, Moreno, & Cross, 2016). During recent years, social networking sites (SNSs) such as Instagram – an application that allows users to watch and share pictures and videos – have become increasingly popular, especially among the youth (Pew Research Center, 2015). Instagram is an especially important SNS due to its high and steadily growing number of users, corresponding to approximately 800 million monthly active users in 2017 (Instagram, 2018).

Despite Instagram's popularity among the youth, researchers have only recently begun investigating suicide-related content on Instagram (Arendt, 2019; Brown et al., 2018; Miguel et al., 2017; Moreno, Ton, Selkie, & Evans, 2016; Nock & Favazza, 2009). The negative consequences of exposure to suicide-related content may include a disturbing effect on (young) users and a contagious triggering effect on self-harming and suicidal behaviors (Baker & Lewis, 2013; Brown et al., 2018). In fact, recent evidence from a two-wave panel study among young adults indicated that exposure to self-harm and suicide on Instagram was associated with suicidal ideation, self-harm, and emotional disturbance (Arendt, Scherr, & Romer, 2019). As predicted, exposure to self-harm and suicide on Instagram at the first panel wave prospectively predicted self-harm and suicidality-related outcomes at the second panel wave 1 month later. These findings are consistent with the idea that exposure to self-harm and suicide on Instagram can lead to contagion in vulnerable users.

Importantly for the present study, a recent content analysis of Instagram posts (Arendt, 2019) provides an important, explorative finding: This study presents unsystematic preliminary evidence for the existence of suicide-related "subliminal messages": In some of the analyzed video posts, suicide-related content was found to be presented in extremely fast segments, making it almost impossible for the average user to be consciously aware of the content when viewing the video at a regular speed. Based on this finding, the present study provides a systematic quantitative content analysis of subliminal messages in Instagram video posts. This research is important because (1) exposure to media content may elicit effects on self-harm and suicidality-related outcomes such as imitative behavior even under (or just because of) the absence of conscious awareness (i.e., no conscious rumination about the "costs and benefits" of a depicted behavior is possible), and, related to the first point, (2) there are ethical issues due to the deceptive and manipulative character of subliminal messages.

Subliminal Messages

Following research in the advertising field, subliminal messages can be defined as a technique of exposing users to pictures, words, or other stimuli without the users having conscious awareness (Trappey, 1996). To gain a thorough understanding of subliminal messages, a detailed discussion of the term *subliminal* is necessary (Dijksterhuis et al., 2006): A content element of an Instagram video has to pass an *objective threshold* to enter the sensory system. If this objective threshold is not passed, perception of this content element (e.g., a bloody razor in a video) does not occur. Thus, passing the objective threshold is a prerequisite for any possible human information processing to take place. Importantly, when a content element also passes the *subjective threshold*, it enters conscious awareness (i.e., supraliminal perception). If a content element passes only the objective threshold but fails to pass the subjective threshold, subliminal perception occurs: The content element (i.e., the subliminal message) will be processed, but Instagram users will not be consciously aware of it. Importantly, the subjective threshold depends on person-related (e.g., the allocated attentional resources), stimulus-related (e.g., the salient depiction of a content element), and context-related (e.g., distraction in the environment) factors. Thus, a general cut-off value for the subjective threshold, valid for all humans for all mediated messages under all situational circumstances, cannot be determined.

Possible Detrimental Effects on Behavior

Both supra- and subliminal messages can elicit effects on human information processing and behavior (Aarts, Custers, & Marien, 2008; Bargh, Chen, & Burrows, 1996; Olson & Fazio, 2002). For example, Harris, Bargh, and Brownell (2009) exposed children to unhealthy food advertising via a randomized controlled trial. Children watched a cartoon that included either food advertising (intervention group) or other types of advertising (control group). The food-related advertisements in the intervention group promoted foods of poor nutritional quality. Children were offered a large bowl of cheddar cheese goldfish crackers and a glass of water while watching. As hypothesized, children watching the food commercials consumed more goldfish crackers compared with children in the control group, termed a *priming effect*. In a second experiment, Harris and colleagues (2009) found a similar effect in adults. This priming effect is not restricted to the unhealthy food domain but also extends to other domains such as smoking (see Harris, Pierce, & Bargh, 2014). Aarts and colleagues (2008) provide evidence for *subliminal priming* effects on behavior (i.e., priming effects of subliminally presented stimuli). The priming effect literature supports the notion of an automatic, direct causal link between exposure to media content and behavior (Harris et al., 2009; see also Bargh & Morsella, 2008). A similar mechanism may operate in the media and suicide domain.

Problematic Aspects

From an information-processing perspective, there is no general difference between supraliminal and subliminal priming messages. Both types of messages can activate mental concepts in the memory (see previous section). However, one difference is that media users can be consciously aware of supraliminal messages, allowing them to ruminate about the messages, and, if deemed necessary, decide not to engage in the depicted behavior (i.e., a conscious decision not to exert the given behavior). Conversely, users have no conscious awareness of subliminal messages, making conscious rumination about the depicted behavior highly unlikely.

This problematic aspect becomes even more apparent when considering a fact noted by Moreno and colleagues (2016): Some non-suicide-related hashtag terms – a hashtag allows users to easily access and share posts with suicide-related content (Moreno et al., 2016) – such as *#cat* may overlap with suicide-related hashtags such as *#cutting*, possibly due to a perceived conceptual overlap of cat-related concepts such as scratching or claws and suicide-related concepts such as cutting, which both yield injuries that look similar (e.g., red lines on arms). Moreno and colleagues noted that Instagram users who wanted to see pictures or videos of cute cats by viewing the hashtag

#cat may be inadvertently exposed to posts with cutting-related (and thus oftentimes suicide-related) content due to this overlap. Although speculative at this point in our understanding, subliminal priming may elicit effects on automatic self-harming or suicidal behavior. Importantly, even if this only happens to a very limited number of Instagram users, it may nevertheless have far-reaching consequences for public health because of the high number of (young) Instagram users globally.

Research Question of the Present Study

The present study contributes to the suicide prevention literature by providing a content analysis of Instagram video posts, explicitly focusing on the phenomenon of subliminal messages. This phenomenon definitely needs scholarly attention as users may be exposed to (and possibly influenced by) suicide-related content even in the absence of conscious awareness.

Hence, the important research question of the present study is: How (and how often) do suicide-related subliminal messages occur? A previous study raised awareness of this possible problematic phenomenon by presenting explorative, unsystematic preliminary evidence (Arendt, 2019). The present study builds on this previous work through a systematic quantitative study of the phenomenon.

Method

We conducted a content analysis of video posts posted to the German suicide hashtag *#selbstmord* (suicide). We content-analyzed the 100 most recent video posts on November 9, 2017. Unfortunately, our ability to collect a random sample was restricted due to Instagram's data policy. These videos were posted on Instagram between November 1 and November 9. All variables were coded by one coder.

Frame-by-Frame Analysis

Using ELAN 5.0 software (Max Planck Institute for Psycholinguistics, Nijmegen, The Netherlands), a frame-by-frame coding procedure allowed for an assessment of whether suicide-related content was depicted in very brief segments, even when this content could not be consciously recognized when watched at regular speed. This coding procedure even allowed for the identification of the most extreme realization (which indeed appeared in our sample) when suicide-related content was presented only in one frame corresponding to an extremely brief duration of 33 ms. The time-intensive frame-by-frame analysis based on software-assisted human coding is the only way of coding for the presence of subliminal messages.

A total of 1,395 s of the 100 video clips, equivalent to 41,850 frames (frame rate = 30 frames per second), were analyzed. Each frame was analyzed for the presence of suicide-related content and the depicted suicide method (i.e., unit of analysis = frame). The concept of *subliminal messages* was operationalized as the appearance of suicide-related content in very brief shots of varying degrees due to the fact that there are no general cut-off criteria for the subjective threshold (see previous section). We used three exclusive categories: < 300 ms, < 200 ms, < 100 ms. The unit of coding was one video.

For the reliability analysis, 20 randomly selected video posts, equivalent to 10,350 frames (i.e., 345 s), were coded a second time by the same coder approximately 2 months after the first coding. We report the Krippendorff α scores in Electronic Supplementary Material 1 (ESM 1).

Coding

Suicide

For descriptive purposes, we coded whether suicide was depicted by written, spoken, or visual content within a given video post (α = 1.00).

Method

We coded whether a specific suicide method was depicted in the video: cutting (α = 1.00), jumping (α = 0.83), firearm (α = 1.00), hanging (α = 1.00), drowning (α = 1.00), poisoning (α = 1.00), and transportation (e.g., trains, α = 1.00). Each method was represented by its own dichotomous variable (*not present, present*).

Duration of Shot

We processed each video clip in a frame-by-frame fashion. We assessed whether suicide-related content was depicted in a given frame using ELAN 5.0 software. If we found suicide-related content, we coded the length of the shot. One shot is defined as a series of frames that run for an uninterrupted period of time. We coded the duration of the shot using five exclusive duration categories: ≥ 1,000 ms (long), < 1,000 ms (brief), < 300 ms (very brief), < 200 ms (acutely brief), and < 100 ms (extremely brief). For example, if a suicide-related shot had a length of 167 ms, this shot was coded as "< 200 ms." We cautiously assumed that many viewers are not consciously aware of the suicide-related content in "very brief" shots (i.e., < 300 ms).

For each video post, we coded the number of shots of a given duration category that were depicted in the video post. We coded this number for each method separately,

enabling a method-specific analysis. This coding was reliable (see ESM 1). Furthermore, for each video post we calculated the number of shots within a given shot duration category across all methods: ≥ 1,000 ms (α = 0.83), < 1,000 ms (α = 0.99), < 300 ms (α = 1.00), < 200 ms (α = 0.99), and < 100 ms (α = 0.97).

Additional Variables

For our explorative analysis, we noted all written and spoken words that appeared in the video post. The software AntConc (Laurence Anthony, Faculty of Science and Engineering, Waseda University, Japan) was used for text analysis (see next section). In addition, we coded the length of the video in seconds.

Data Analysis

We calculated point estimates (percentage values) and 95% confidence intervals based on bootstrapping techniques. We report the confidence interval lower and upper limits in brackets after the percentage value. An analysis of variance was used to test for mean differences.

Results

Preliminary Analysis

Suicide-related content appeared in 66% [57, 76] of the video posts. The length of the video clips did not significantly differ between video posts with suicide-related content (M = 14.52, SD = 13.95) and video posts without suicide-related content (M = 11.79, SD = 7.24), $t(98) = 1.06$, $p = .290$. Cutting appeared in 34 video posts and was thus the most frequently depicted method, followed by a firearm, poisoning, and jumping; hanging, transportation, and drowning were depicted more rarely (Figure 1).

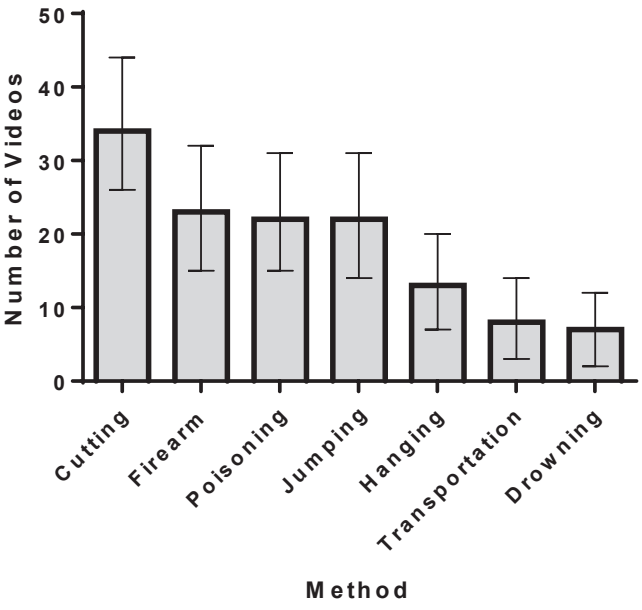

Figure 1. Percentage of videos showing a specific suicide method. Error bars indicate bootstrapped 95% confidence intervals. N = 100 video posts.

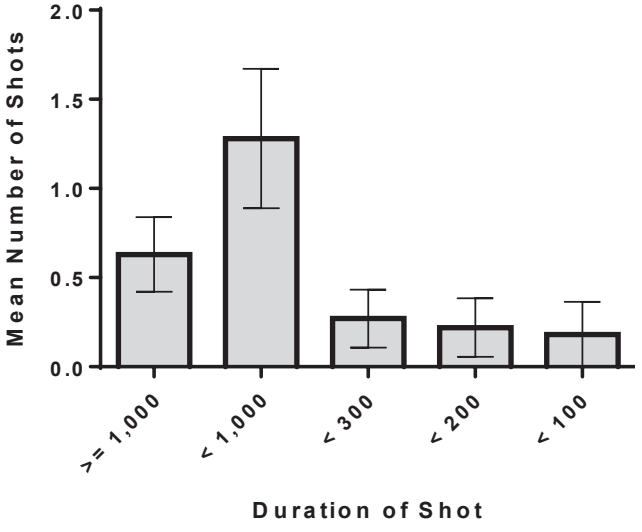

Figure 2. Mean number of suicide-related shots in terms of the duration of the shot category (≥ 1,000 ms, < 1,000 ms, < 300 ms, < 200 ms, < 100 ms). Suicide-related content was most frequently depicted in shots of a length between 300 ms and below 1,000 ms. Error bars indicate bootstrapped 95% confidence intervals. Based on N = 258 shots with suicide-related content, appearing in 100 video posts.

Duration of the Shot

Table E1 (see ESM 2) provides descriptive statistics for the mean number of shots of a given duration for a shot category. Importantly, as shown in Figure 2, the duration of the shot significantly influenced how often suicide-related content was depicted in a given shot, $F(4, 96) = 8.80$, $p < .001$, $\eta^2 = .27$. Suicide-related content was most frequently depicted in shots of a length between 300 ms and below 1,000 ms. This corresponds to a brief presentation of suicide-related content. Viewers are likely to be consciously aware of suicide-related content within this shot duration category. Importantly, suicide-related content also appeared in shots with a duration of < 300 ms (i.e., very brief shots). There were also shots including suicide-related content with a duration of < 200 ms (i.e., acutely brief shots) or even the extremely brief shot length category of < 100 ms (see Figure 2). We assume that many viewers are not consciously aware of the suicide-related content in these shots.

A total of 67 suicide-related shots with a duration of less than 300 ms were identified in our sample of 100 video posts. These 67 shots appeared in 21 video posts with a mean of 3.19 (*SD* = 2.86) suicide-related shots with a duration of less than 300 ms per video post. Of interest, 13 video posts presented more than one suicide-related shot with a duration of less than 300 ms. One video post even presented a total of 10 suicide-related shots with a duration of less than 300 ms.

In some of these video posts, a specific suicide method was presented only in the < 300-ms shots (i.e., without a supplementary presentation of this specific suicide method in shots that were longer than 300 ms): the "subliminal-only" presentation of cutting appeared in 6% [2, 11] of all video posts; firearms were seen in 3% [0, 7], poisoning in 1% [0, 3], jumping in 3% [0, 7], drowning in 1% [0, 3], hanging in 3% [0, 7], and transportation in 1% [0, 3].

Only 2% [0, 5] of the video posts presented some suicide-related content only in the < 300-ms shots without presenting any suicide-related content in shots with a duration greater than or equal to 300 ms. Thus, users watching these videos may have processed suicide-related content, yet possibly with no conscious awareness of processing suicide-related content when watching the full video post. These video posts contain subliminal messages, as defined in the present study.

Additional Analysis

In 67% [57, 76] of all video posts, words and sentences (written or spoken) were included. Both the English and German languages were used. For explorative purposes, we noted all written words and analyzed the frequency of word use to assess which concepts occurred frequently, possibly indicating concept accessibility within the minds of the video producers (see ESM 3 for a full list of words). We found that negatively valenced words such as *hate, lonely, tired, die, suicidal, suicide, alone, broken, worthless, afraid, end, dead, pain*, and *ugly* were repeatedly mentioned and dominated the verbal content in the video posts. Positively valenced words such as *fine, help, love, good*, and *live* also appeared, albeit less frequently. Interestingly, words expressing a self-reference (e.g., *I/ich*) occurred more frequently compared with concepts referring to others (e.g., *you/du*), possibly indicating a focus on the self by the producers of the video clips.

Discussion

Social media platforms have only recently begun to attract scholarly attention from suicide prevention researchers. We extend this literature by investigating video posts to a German suicide hashtag on Instagram. A content analysis relying on a frame-by-frame approach revealed that suicide-related subliminal messages appear on the site: A total of 67 suicide-related shots with a duration of less than 300 ms were identified. These shots appeared in 21 video posts. Importantly, 13 video posts presented more than one very brief suicide-related shot. One video post even presented a total of 10 suicide-related shots with a duration of less than 300 ms. The mere possibility that these messages may result in automatic behavior change without the user's conscious awareness is ethically highly problematic. Given that Instagram has approximately 800 million users who are active every month (Instagram, 2018), even if only a small subset of all Instagram users receive problematic suicide-related subliminal messages, this may elicit measurable effects on public health globally. Therefore, scholars should acknowledge the possibility that individuals are exposed to suicide-related content even when they are not actively looking for it.

An important finding is that in some (i.e., 2%) video posts, suicide-related content appeared in shots with a duration of < 300 ms (i.e., very brief shots) without the supraliminal presentation of suicide-related content. Regarding these durations, we tentatively assume that many viewers are not consciously aware of the suicide-related content being presented. One can argue that stimulus-presentation times are shorter in psychology laboratory studies. This is correct. Subliminal priming studies often use briefer presentation durations (e.g., 30 ms in Aarts et al., 2008, or 28 ms in Olson & Fazio, 2002). Importantly, these experiments typically utilize highly controlled settings (e.g., only one stimulus at a time on a computer screen with participants being placed in individual rooms with no distraction). Conversely, suicide-related video posts typically contain many content elements presented simultaneously, making the conscious awareness of suicide-related content less likely.

Applied to the real world and everyday life situations outside of the laboratory, there are at least three points supporting our assumption that conscious awareness of suicide-related content in very brief, acutely brief, and extremely brief shots, as we defined them, will often be unlikely: First, Instagram is often used on mobile devices and thus distractions from the environment may play a role (e.g., usage in the subway or public places). Attentional resources are constrained under the influence of distractions, rendering conscious awareness of suicide-related content even less likely. Thus, even if suicide-related content (e.g.,

presented in a very brief shot) can be consciously identified when all attentional resources are fully allocated, distractions may dampen a person's ability to consciously recognize that content. Second, social media are often used in a passive or habitual way (e.g., scrolling down posts tagged on a hashtag). Conscious awareness is also likely to be reduced in this context because users may not have a strong enough motivational goal to thoroughly process the information. Conversely, they may simply scan the content (e.g., to fight against boredom). Third, Instagram video posts are often watched on small screens (e.g., on mobile phones). Even if briefly presented suicide-related content can be consciously recognized on big screens, it may be harder to do so on small screens.

Limitations

This study has several limitations. First, the subjective threshold of conscious awareness differs inter-individually. This complicates the operationalization of subliminal messages. It is not possible to set a universally valid cut-off value that is correct (a) for all individuals, (b) for all suicide-related video posts, and (c) under all situational circumstances. Second, we only investigated video posts tagged with one German suicide-related hashtag. This decreases the generalizability of our findings. Third, related to the second limitation, we only investigated a sample of 100 video posts due to the time-consuming measurement procedure of our frame-by-frame approach. Fourth, we do not know why users posted these video clips (i.e., user motivations, intentions, and gratifications). Future research may rely on survey methodology to answer this question.

Conclusion

Instagram is run by a globally operating company. Although Instagram presents a warning message to some of its users when trying to access popular suicide-related hashtags and Instagram has recently announced that it will put more effort in managing access to self-harm content (Instagram, 2019), more scholarly attention is greatly needed. Clearly, more needs to be done, because successfully regulating (or self-regulating) harmful suicide-related content has enormous potential in terms of positively contributing to suicide prevention (e.g., reducing imitative effects).

Electronic Supplementary Material

The electronic supplementary material is available with the online version of the article at https://doi.org/10.1027/0227-5910/a000717

ESM 1. Reliabilities (content analysis) as indicated by Krippendorff's alphas

ESM 2. Table with descriptive statistics (means and standard deviations) of the number of shots within a given duration of a shot category

ESM 3. Table with frequency of word occurrence

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