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Introduction

Online marketing is a thriving sector of advertising that has taken off in recent years.(1) It is defined as a set of tools and methodologies used for promoting products and services through the internet.(2) Online marketing is considered to be an incredibly lucrative area of marketing for many industries, however, minimal evidence has been gathered around people's exposure to this form of advertising. Young people are growing up in the digital age, and a much of their lives involve the online space. A large proportion of young people spend time online, with almost 90% of people between 18 and 24 estimated to use social media in the United States.(3) It is thought that these statistics are similar in New Zealand, however there is limited research for this population.

Marketing of products online has proven to be effective as it allows companies to target specific populations, using algorithms to generate interest in these groups. Large numbers of people can also be reached on these platforms for a small financial cost when compared to other marketing strategies. (4) Sharing of content and expansive networks can also amplify the reach of online marketing, which has the added effect of normalisation and lack of recognition of direct marketing by users.(5)

Online marketing to young adults influences attitudes towards targeted products. This can contribute to an individual's current use of these products as well as promoting initiation of unhealthy behaviour.(4) So far, corporations and governments in New Zealand have ignored public health recommendations around regulations for this kind of marketing. (5) Therefore, it is important to determine how prevalent this marketing is in young populations and the subsequent effect on health behaviour.

New Zealand marketing regulations are often ineffective on the internet as they cannot be applied to foreign-domiciled sites. In addition, industries can evade regulations using techniques such as user-generated content or networked sharing.(5) The four areas of unhealthy marketing that this study will focus on are smoking, alcohol, gambling and junk food. Currently, most of these industries self-regulate their marketing. We will focus on the young adult population, which is defined as approximately 18-24 years old.

Alcohol

Alcohol consumption has been proven to be a major public health issue in New Zealand, with many young people involved in a 'binge drinking' culture. Studies show that alcohol use in New Zealand often peaks in young adulthood,(6) and that this level of consumption is increasing.(7) There is a wide body of evidence demonstrating both the acute and chronic health effects of alcohol consumption,(6,7) as well as the extensive economic burden on health systems and individuals.(8)

User consumption of alcohol is promoted through its normalisation on social media.(9) It is no surprise that in comparison to adults, young people have a higher level of exposure to, and interaction with, online alcohol marketing. (10) This is concerning for the health of young people as many studies have shown a positive association between level of marketing exposure and alcohol consumption.(9,11-15) There is also significant evidence showing exposure to alcohol marketing can influence the initiation of alcohol use, subsequent binge drinking and hazardous drinking behaviours.(11,12,14-17) These results were found across many cultures, nationalities, and age groups, and remained when potential confounders such as family or peer drinking behaviour were adjusted for.(12)

Smoking

In NZ, rates of smoking have been continuously decreasing over the previous few decades. Currently, the rate of smoking in the 18-24 year age group is 20%, which is the second highest rate following 21% in the 25-31 year old age group.(18) Therefore, it is apparent that smoking continues to be an issue in the young adult population. Due to the vast array of detrimental health and financial implications of tobacco consumption,(19, 20) it is important to assess factors that may contribute to these smoking rates.

Online media sites such as Facebook and YouTube have policies preventing tobacco marketing. However, this is only limited to explicitly paid marketing.(21) Other marketing forms such as user-generated content, music videos, and celebrity endorsement of tobacco products are not regulated, thus contributing to the exposure of young people to these harmful products.(22-24) Young adulthood is a critical age period that the tobacco industry targets.(25) Evidence shows that exposure to, or engagement with, tobacco marketing leads to an increased risk of tobacco use, initiation and progression.(26-30) In addition, there are compelling links to increased frequency of tobacco use and decreased likelihood of tobacco cessation.(30) Tobacco marketing is not only limited to cigarettes, but also includes products such as tobacco hookah, cigars, smokeless tobacco and e-cigarettes.(28) Exposure to marketing of these different tobacco products is also associated with young people initiating cigarette smoking, even though cigarettes themselves were not being explicitly marketed.(28)

E-cigarettes are a rapidly emerging commodity. While it is thought that e-cigarette use among young people has dramatically increased in recent years, there is limited evidence around the prevalence in this population. However, evidence does show that exposure to e-cigarette marketing is significantly associated with an increased likelihood of e-cigarette consumption.(28,31-33) This may be due to portrayal of e-cigarettes as a safer alternative to cigarette smoking.(33)

Gambling

Online gambling is another growing industry. In part, this is due to a shift from gambling in physical environments to online gambling due to the availability of technology and increased accessibility in the digital age.(34-36). At a public health level this is concerning due to the effect gambling has on the health and wellbeing of the individual as well as their family, friends and community.(37) Online marketing has been shown to trigger problem gamblers to increase their engagement with multiple online gambling sites and undermine gambling cessation efforts. In addition, online marketing encourages gamblers to take up other forms of gambling they did not previously engage with.(38)

There is a range of marketing strategies implemented across online platforms.(39) Simulated gambling sites are used as a hook to engage young adults in gambling-related activities. These sites enable people to develop gambling confidence leading to a greater likelihood of engagement with monetary gambling and a higher risk of pathological gambling.(40,41) Bonus offers such as cashback, free bets and free deposits are used as incentives to “account hop,” where gamblers take advantage of multiple sites (39). Social media is one online platform that is used to increase peer-endorsed credibility of gambling websites.(36) This platform can be used to promote key marketing messages that convey positive outcomes of gambling, rather than gambling related harms. In addition, this contributes to the normalisation of gambling within the online community.(34-36,42,43)

Junk food

Worldwide there have never been higher levels of obese young adults.(44) In New Zealand, 21.6% of people aged between 18-24 were classified as obese in 2017 (having a BMI of 30 kg/m² or more).(45) Compared with the general population, young adults have the highest rate of junk food consumption and weight gain.(46) A contributing factor to this may be the increase in online marketing of junk food, which parallels the increase in popularity of social media sites among young people.(4,44,46,47) Junk food can be defined as energy dense and nutritionally poor food (EDNP). Exposure to marketing promoting junk food fosters a positive attitude and trust towards associated brands. This leads to unhealthy purchasing choices and increased daily intake of these products.(48) Young adults are especially susceptible to junk food marketing, as this period of development involves a progression toward independently making food choices.(49)

Companies employ many different online marketing techniques to engage young adults. Popular strategies use celebrity and sport endorsement, competitions, giveaways and user generated content. (4,50,51) Constant exposure to images of junk food can cause users to perceive it to be part of a normal diet, rather than for occasional consumption.(51) Online marketing attracts less scepticism in comparison with traditional methods, as young people do not always recognise engagement with brand related content as a form of promotion.(4) Due to the many negative health outcomes, strategies need to be developed to reduce the exposure of young people to online junk food marketing.(44,46,50,51)

Aims

We have conducted a pilot study to develop a methodology to assess online exposure, and engagement with, marketing of unhealthy commodities. These include alcohol, smoking, gambling and junk food. This is important for testing the feasibility, practicality and ethico-legal aspects to guide development of a similar study in children. To our knowledge, no capturing of online activity in real-time has been conducted internationally. This study would aim to fill this gap in the research to provide important insights into online marketing and future interventions.

Methods

Ethics approval

A Category A application was submitted to the University of Otago Human Ethics Committee, with the information sheet and consent form left incomplete to be written up by the student researchers for their learning experience. This study received approval from the committee on September 6 2018 (Ref No. F18/008). The information sheet and consent form was developed shortly after the initiation of the project, once the researchers had finalised the methods.

Participants

Participants were recruited from the same group of 4th year medical students undertaking the research topic. This group consists of 18 students aged ≥ 21 , from the University of Otago, Wellington (New Zealand), during their 5-week Public Health rotation. Participants were selected from this group for convenience and established acquaintance, in order to optimise feedback provision and data collection. Details of the project were provided by the research supervisor and consent for the study was gathered from 16 students.

Screen Recording

Screen recording is the process of creating a video recording of a device's screen activity. Screen recordings alone do not include recordings of the device's audio or from its camera or microphone. Screen recording was completed using Zoom, software that enables video conference meetings, instant messaging and screen sharing. Participants were instructed to download the Zoom software onto the devices they wish to screen record for the study. Participants were briefed and given written protocol information. When Zoom is activated, a "meeting" is started, which allows users to then join the meeting and communicate. A meeting can be commenced with just one user, which was utilised in our study. Participants were to start a Zoom meeting which included only them. Once commenced, the user can then share their screen to the meeting. Screen sharing can be turned off and on by the user, and turns off automatically when the device's screen is off. Screen sharing must be reactivated by the user. Zoom automatically uploads a copy of the meeting to its restricted access internet service. At the end of the meeting, the recording can then be viewed and downloaded via Zoom's website. Zoom allows for a single user to be connected to multiple meetings simultaneously. This allowed for screen recording from multiple devices simultaneously by one participant.

Trial Study

Trial screen recordings were carried out prior to the proper study. An initial briefing session was held with the participants to inform about how to download and use Zoom, and how to record simultaneously across multiple devices. Participants were then instructed to do a trial recording using Zoom. The purpose of the trial recordings was i) to familiarize participants with the recording software and process, and ii) to troubleshoot for any technical difficulties prior the true screen recording. Feedback forms were sent out to all participants to complete anonymously following the trial. Information gathered include the devices used, technical difficulties faced and participant experience. Results from the feedback forms were used to develop the protocol for screen recording and data coding in the proper study.

Protocol development

Study protocol informing participants of the conditions of the trial and providing information on coding results were developed and sent out to participants. Participants were advised to turn off ad blockers, in order to better simulate children’s online experience. Screen recordings were taken for the entirety of two days (Friday 28th September 2018, and one of the Saturday or Sunday). All device use on these days were to be screen recorded when wifi was available. Within each day, one hour was to be dedicated to using devices with screen recording. Participants used Zoom reminder lockscreens and sticky notes to remind themselves to begin recording each time. Participants were also asked to trial editing their screen recordings, and instructions for this were included in the protocol.

For one hour each day, participants were asked to use their devices in a way which would maximise exposure to advertising, and a list of suggested activity was provided. Participants were then asked to code for advertisement exposures from this hour only, as to thoroughly assess the coding process (as part of methodology). A standardised Excel spreadsheet was sent out to participants, asking participants to enter advertising exposures as data points. Other details about each advertising exposure were also gathered, these include type of advertising, subject of advertisement, brand(s), app or website, context of exposure, participant interaction with marketing. *See Table 1.*

Table 1

Heading	Drop-down list options
Type of advertising	Non-invasive; video; pop-up/ invasive; user generated content; promotional material; sponsored material; email; interactive; other
Subject of advertisement	Alcohol; gambling; smoking; junk food; other
Brand(s)	<i>(No drop-down lists: participants to type this information)</i>
App or website	App; website
Context of exposure	Facebook; Instagram; YouTube; music streaming service; Snapchat; BuzzFeed; Twitter; Reddit; Tumblr; news site; blog post; email; game; other
Participant interaction with marketing	No engagement; closed advertisement; social media interaction; entertainment interaction; clicked/ followed link

Repeat exposures were not coded. For an advertisement to be included at least 50% of the logo, brand name or registered trademark must be visible. Detailed information on coding instructions and definitions was available to the participants in the study protocol document. Participants were then asked to anonymously upload to Dropbox their completed Excel documents, along with screenshots of advertising material relevant to the four categories of interest (i.e. junk food, alcohol, smoking, gambling). These data were made available to the results team for further analysis.

The methods team developed definitions for the categories recorded in the Excel spreadsheet. Due to the variance in defining the term ‘junk food’, the definition was adapted from Kelly & Chapman, 2007 (ref). A literature search conducted to seek definitions in classifying marketing exposure types revealed the limited information currently available. Thus, researcher experience and expert consultation were instead used to develop working definitions for marketing exposure types and interactions.

The Study protocol and Excel spreadsheet used can be found in the appendix.

Focus Groups

Following completion of the screen recording, data coding and video editing, focus groups of up to 5 participants were interviewed about their experience. The focus groups were selected based on the subgroups (introduction, methods, results and discussion team) of this research project team and only included those that had participated fully in the screen recording and data collection.

The focus groups were held by an investigator who asked questions relating to screen recording and coding experience, privacy concerns, video editing and applicability of this methodology to children. The interviews were audio recorded and the transcript for each focus group was transcribed by the participating interviewees. The investigator was later interviewed the same questions by the research supervisor of this project.

Results

In order to fully understand and determine the feasibility, ethicality, legality and practicality of our research method, we interviewed the participants on their thoughts, both preceding and following the study. Our results can be broken into 2 main categories: *questionnaire responses* and *focus group responses*.

Questionnaire Responses

Initial Responses

Prior to the study, our sample population (n=18) was asked to submit a questionnaire detailing their initial feelings towards the trial and only correctly filled in questionnaires were analysed. When asked the likelihood of participating in the study based on first impressions, only 7 (38.9%) people feedbacked positively (27.8% “very likely”, 11.1% “likely”). 4 (22.2%) responded that they were very unlikely to participate in the study.

There were an overwhelming number of concerns related to the study, specifically related to technology. Participants were worried that the data recording would slow down their devices. Others were concerned about the ownership, storage and security of the trial data recorded on the university cloud server, but were reassured and given more information about the technology used in the study.

Of the participants who were willing to participate (n=16), majority (75%) were agreeable in showing their usage of social media websites e.g. Facebook (Total: 16 users) and Instagram (Total: 12 users) in recordings.

Use of Adblockers

As part of our preliminary findings, we enquired if respondents used Adblockers on their devices. 4 (50%) out of our 8 Desktop users had Adblockers (Half use it always; Half use it sometimes) while 13 (72.2%) of our 18 Laptop users had it (69.3% use it always, 30.7% use it sometimes). It is also interesting to note that Adblockers were only used by 2 (25%) of our 8 Tablet users (100% use it sometimes) and 3 (17.6%) of our 17 Smartphone users (33% use it always, 66% use it sometimes).

Trial Responses

In preparation for the study, the 16 participants were asked to trial the recording software for 30 min on their devices. Participants were then asked to feedback on the experience in order to anticipate and troubleshoot any problems that may arise during the actual study. 15 participants trialled recording on laptops (HP Pavillion/Intel, Apple Macbook, Acer Aspire), and 12 participants trialled the recording on their phones (Samsung Galaxy, Huawei Nova-Lite, Apple iPhone). 4 people trialled the use of 2 devices (e.g. Laptop and Phone) simultaneously while 1 participant trialled the use of a tablet and 2 other devices.

When asked how they found the recording process, 5 participants reported that they found it easy (2 found it “very easy”(12.5%); 3 found it “easy” (18.8%)). 5 participants found it difficult (1 “very difficult” (6.25%) and 4 “difficult” (25%)). The majority of the participants (6; 37.5%) found it neither easy nor difficult.

Technological Issues

There were various issues that had arisen from the trial recording process, particularly a general dissatisfaction of the Zoom Application. Many had issues with recording process where Zoom failed to work upon lock or sleeping of screen and others noticed considerable drain on their Laptop or Phone batteries, making it difficult to use their phones for an appreciable amount of time. Some also experienced audio diminishment and slowing of their laptop or phone. For the tablet, only problem noticeable was slowing and heating of device, probably due to increased processing.

Study Responses

The study was done using the same devices as the trial. For the study, 15 people recorded their laptop usage and only 12 people recorded their phone usage. None recorded their tablet usage during this study.

With the help of the trial data, some issues like the inability to record on 2 devices simultaneously with Zoom were circumvented, proving that our study methodology is possible and practicable. Attached in the Appendix (Document 1 and 2) is the data generated from our study, providing an idea of what future research may look like.

Technological Issues

However, the study was unable to solve a large majority of the participants’ original technological issues from the trial and new issues had even arisen.

Firstly, one participant noted that other people were made aware that he/she was screen recording e.g. on Snapchat (using their phone). Secondly, others noted that their devices and internet got slow when recording, resulting in the Zoom application crashing multiple times for users. This also meant that video-heavy social media websites i.e. YouTube, were unable to be used due to the slowing of their devices.

Lastly, participants reported problems with the screen recording quality/process, cloud storage and coding experience. When reviewing their recorded data, playback was slow and replay quality was poor. The recorded video produced had random ‘blanks’ in the recording and distorted images (due to quick browsing on websites) that were difficult to code. Some discovered that a few of their screen recordings either unsaved or ‘blank’ (showing a black screen), especially phone users. Participants also discovered that the recording stopped automatically when the Wi-Fi connection dropped and that they were unable to record multiple desktops simultaneously with Zoom.

Trial Conclusion

Despite having a trial run with the Zoom application to familiarise users, according to our post-trial questionnaire, a majority of our study participants still had difficulty with the recording process or were indifferent to it (6 people found it “Difficult” (37.5%); 6 found it “Neither difficult nor easy” (37.5%)). 4 people (25%) found the recording process easy (1 person responded with “very easy” (6.25%) and 3 with “easy” (18.8%)). None found the recording process extremely difficult, maybe due to increased familiarity with Zoom.

However, with a longer screen-recording duration as compared to the trial, the study may have led to increased difficulty with the recording process, as more technological and other issues were uncovered.

When asked for other reasons behind their difficulties with the recording process, some attributed it to Zoom’s user interface, saying that the “drop down bar [at top of the screen] was annoying, [as they had to] make display pages smaller” and that it “limits some of the screen view”. Others remarked that it was “very easy to forget to start recording again” once the screen sharing process was unintentionally stopped due to technological issues.

The technological difficulties and participant concerns highlighted in the sections above will be explored further in the next section, which summarises participant experiences based on Focus Group responses.

Focus Group Responses

Overall, participants felt that the study method could be successful, provided changes are made to the software and/or the recording conditions. There was also concern regarding the privacy of other people’s information on social media being unknowingly recorded for the study. Participant responses to the focus group questions were grouped into six themes: Recording experience, Privacy concerns, Video editing experience, Coding experience, Applicability to children, and Recommendations.

Recording experience

The recording experience of participants was mostly negative. The most common complaints were a significantly increased battery drainage, the inconvenience of having to restart the software every time the device was opened, and some recordings not working on some iPhone™ devices. The battery drainage was variable, but everyone noted an increased rate compared to normal. However, for some participants this was mitigated by the use of chargers and battery packs. Many participants found this an unwanted effort that made them less likely to use their devices or share their screen on Zoom, which would bias the results.

“Just in my head, it was just a bit of a hassle. Especially with the phone. Like laptop was I think was much easier, because you could just do it and leave it but with the phone it was just kind of, I don’t know, I just didn’t really want to as much, and I think this is because I do use my phone mainly for messaging... and so it was quite easy to justify not needing to record what I was doing.”

Seven participants found that their iPhone recordings didn’t upload for one or both of the days they tried recording, despite having previous successful recordings from the trial and following the same instructions as other participants with iPhone devices (some the same model) that did successfully record. There appeared to be no easily identifiable factor that resulted in a failed recording. This led to a loss of nearly half the smartphone data and would be a major issue if it happened in a larger trial.

“(I1) Annoying on your phone because it stops every time you lock it, but then my phone recording didn’t work anyway in the end so that’s another thing.” “(I2) Yeah my phone recordings didn’t work either. I don’t know why it was but I feel like we did something wrong?” “(I1) It happened to lots of people though.”

Other recording issues noted by the participants were the inability to use audio on your phone while recording, Zoom only being able to record one desktop on Apple computers, a high CPU use making

devices “slower” (and overheat, in one case), and difficulty managing multiple devices. Positives of the recording experience were that cloud recording didn’t use space on the devices, and that Zoom seems to be the best tool for this study compared to what else is out there.

Privacy concerns

Participants had two main concerns with privacy in this study and the proposed children’s study: others knowing that they were being recorded, and data being unwillingly recorded and shared with third parties. Participants quickly realised that in some instances their friends would be notified that their Snapchat™ “stories” (a collection of temporarily available photos and videos) were being recorded, which was alarming for the participants. This led to participants not viewing Snapchat stories, which resulted in a data loss as some Snapchat stories contain brands and advertisements, which we found in the study.

“(15) One thing I found is when you are on your screen share and go on snap chat it actually screen records all of their stories and it looks like you’re stalking them and other people were like “[15] why did you screen record that” and I was like “ooh shit” sorry swearing but yeah I think there are some huge privacy issues of watching other people’s content that they’re viewing that they might not know about.”

The other potential issue is that the information and media that participant’s friends and family shared on their private social media and messaging platforms is unknowingly recorded and given to a third party without their consent. This issue was mitigated in this study by participants only analysing their own recordings. In a larger study of children, this may not be an issue since it is less likely that the investigator has any social connection to any of the child participants’ friends and family, and that they will have the opportunity to edit out any of the recording they do not want to share before the investigators see it. Some participants mentioned this may lead to a loss of data, however.

“(12) Even so you can still see the name and stuff in the chat so it’s not just your privacy its other people’s privacy that is a concern.” “(13) Yeah and if someone else was to say something that you know, for example, something illegal or something they wouldn’t want other people knowing yeah it puts them at risk as well.”

Video editing experience

Video editing was mostly reported as a pleasantly simple experience, and participants thought that children would easily be able to edit out parts of the video provided that were given adequate instructions beforehand. Of the two video editing programs that were tested, iMovie™ was found to be more user-friendly than OpenShot™. The only issues were the inconvenience of having to download new software if it wasn’t already installed, and that exporting (which was only tested on OpenShot) took a considerable amount of time due to the large file size.

“(M3) I found it a little bit tricky at first. Once I got the hang of it, it was alright. But the one thing I found annoying is once you save a video and try and export it, it took a lot of time. Once I had done the video editing and pressed Export, it took probably an hour and a half to do what was probably a 20 minute recording on my phone. So very time consuming.”

Coding experience

Overall, participants found the coding experience simple if not time consuming. They reported that the pre-developed study protocol and spreadsheet were easy to follow and fill in. The time varied between participants, most estimated about 60-100 minutes for an hour’s recording, but one reported 2-4 hours for one hour of recording. Some issues that arose were that the participants would scroll down a webpage or app too fast for the software to record effectively, which made it difficult to identify ads in some cases. The other notable point was that there were examples of user-generated content (e.g. posted photos, memes, etc.) that contained examples of junk food, alcohol, and smoking, but without any obvious brands, and so were

not coded. An interesting finding was that many of participants, despite knowing what they were looking for, didn't notice a lot of the ads that they coded for the while recording their activity.

“(I3) Yeah cause half the stuff I actually ended up coding for or screenshotting I don't actually remember seeing the first time around... Which was quite interesting as well, it was quite cool watching it all again and being like ooh I missed quite a lot when I scroll.” “(I1) You don't know what is subconsciously going in though. That's the weird thing, you might not think you are noticing it.”

Applicability to children

When asked about how the study method would apply to 12-year-old children, the participants had three points. One was that they would likely change their online behaviour, because it is obvious that recording is happening due to visual components (a red bar at the top of screen on iOS™ devices, overlay buttons on Android devices, and a toolbar on computers), and the constant restarting of the software after closing their devices. Participants also thought that children might be less likely to remember to restart the software, since they themselves sometimes forgot despite being in the research team, which would lead to missed recordings and data loss. Finally, participants weren't sure how many 12-year-old children used ad blocker software, which would make a big difference to the amount of visible advertisements.

“(M2) I think it would definitely change the way they use their phones, especially with things like we figured out that if you recorded someone's [Snapchat] story, the other person knows that you've recorded their story, and like even that would have like changed what I viewed, and so in terms of getting a realistic kind of snapshot of what they do, of what they see online I don't know if you'd get that.”

Recommendations

Participants were asked if they had any recommendations for applying this method to a study with 12-year-old children. The main recommendation that participants from all groups was that the recording software needs to be improved or changed due to the problems outlined in the “Recording experience” section. Something to get around this, suggested by a few participants, was a “simulated environment,” one where they could use a computer already set up with recording that they could simply log into their various accounts and use for a set time period. However, another participant found that this would not give enough variety of content and advertisements, which change throughout the day. Other recommendations included ensuring the kids had good incentives/renumeration to do the study, a training session, and to only study one device per participant, rather than multiple devices.

“(I3) I think if they have like a training session and actually sit down and get told how to do it I think it will be fine. Um and yeah have good reminder systems to keep turning it on and stuff like that. I think it should work. Like it wasn't hard but yeah you just have to know exactly what to do.”

Discussion

To our knowledge, this is the first study capable of capturing screen exposure utilising the users' personal profiles on their own devices. While previous studies have looked at online marketing via social media for unhealthy food marketing using screen capture technology (52), this is the first time that we are aware of using screen recording software installed on personal internet able devices to record actual users' online activity. Further, live recording using screen capture technology improves the validity of the sampling, providing a more accurate sample than methodologies reliant on participant recall (53). As marketing uses cached user profile information to direct the viewer to targeted advertising (54), this methodology better enables researchers to capture the users' actual exposure.

Screen capture technology using participants' own devices and through their personal online profiles offers an important improvement to the methodology previously used to examine online advertising. This approach

satisfies privacy concerns while providing a more representative sample of advertising that would be accessed under real world conditions. Our extension of previous sampling protocols provides a superior data, reflecting the targeted nature of online advertising.

Limitations

The challenge in extending data collection beyond experimental conditions is in maintaining the acceptability to participants while ensuring that the data collected is valid and reliable. First, the authors cannot establish if the participants selectively filtered out screen recordings that might be expected to skew the data in a particular direction, distorting the final view. Our focus group feedback illustrated some of the tension regarding third party material that may be expected to cue systematic filtering of recordings. This is particularly concerning in light of the role that social desirability has been shown to play and the vice-like nature of the data under investigation. Further, the authors cannot be certain that the user profile being used during data collection matched that of the participant; however, given the control over the data sampled, this fidelity threat seems unlikely.

Finally, technological limits were exposed, challenging how complete our data sample was. The screen recording software used had a small degree of compatibility problems, particularly on mobile phones, leaving some devices less able to reliably record the participants' online experience. However, the principle complaint was related to battery drain, with devices needing to be recharged prematurely. Our data collection protocol was dependent on participants remembering to turn the recording software on, for each online session, and for having a data stream and battery reserves that could accommodate the volume of data being transmitted. Our study participants only generated data while they had access to land-based data network. Recent developments in location-based marketing suggest that advertising using mobile networks may generate a different result.

Recommendations for future applications of this methodology include upgrades to the recording software that ensure a more complete device compatibility and automatic data collection. Further, a mechanism that securely transmits screen information without the participants' own mobile data usage would open the opportunity to generate data in the community without introducing an additional source of sampling bias.

Conclusions

The ability to record screen captures from participants' own devices adds a valuable quality to advertising data collected. This data is expected to provide a more valid representation of the marketing targeted to users, based on their existing online profiles, and enhance the insight into selective advertising to younger or more specifically defined online populations. As governments and policy makers seek to control unhelpful messages to vulnerable groups, an improved data would be expected to provide a more reliable basis for their decisions.

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Methodology of Lit Review:

To gain an understanding of what is already known about the marketing exposure of tobacco, alcohol, gambling and junk food in the young adult population, we thoroughly searched PsycInfo, Medline and Google Scholar for all papers from 2013 onwards. We used an age range of 18-25 years to define 'young adults' and reviewed all papers that were relevant, in English and included participants in this age range.

Appendices

Document 1: Data Recording Analysis

Marketing Exposure on Different Media Platforms

16 people participated in laptop recording, a total of 31 hours were recorded and 687 advertisements were counted. 9 people participated in phone recording, a total of 12.5 hours were recorded and 290 advertisements were counted. The total number of advertisements was divided by the total hour of recordings to calculate the average number of advertisements seen per participant per hour during the study, this was 22.16 advertisements for laptop recording and 23.2 advertisements for phone recording.

The numbers of different advertisement categories seen on different social media platforms were calculated. The following numbers are expressed as the average number of advertisement seen per person per hour during the study.

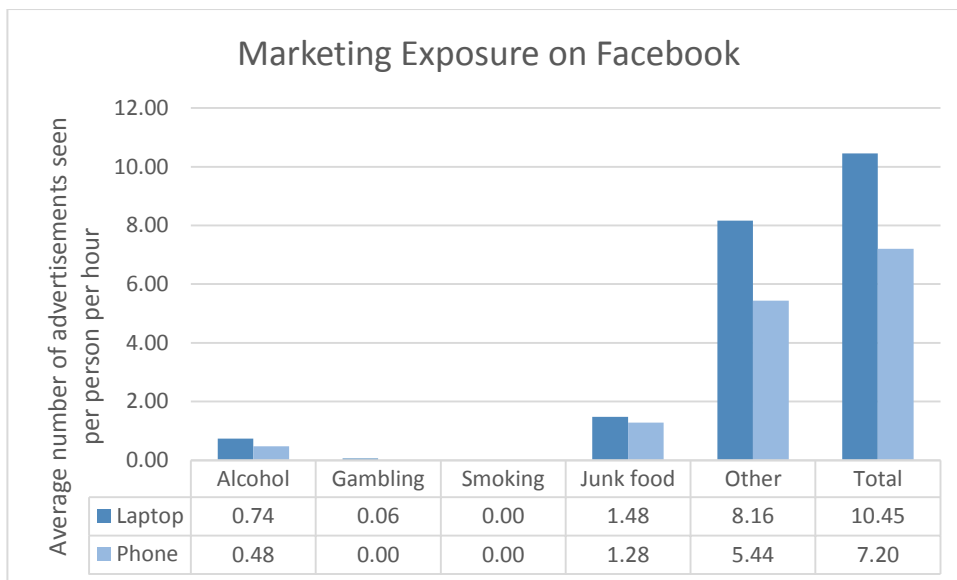


Fig 1. Facebook had 0.74 (7.10%) alcohol, 0.06 (0.62%) gambling, 1.48 (14.20%) junk food and 8.16 (78.09%) other advertisements on laptop recordings, and 0.48 (6.67%) alcohol, 1.28 (17.78%) junk food, 5.44 (75.56%) other advertisements on phone recordings.

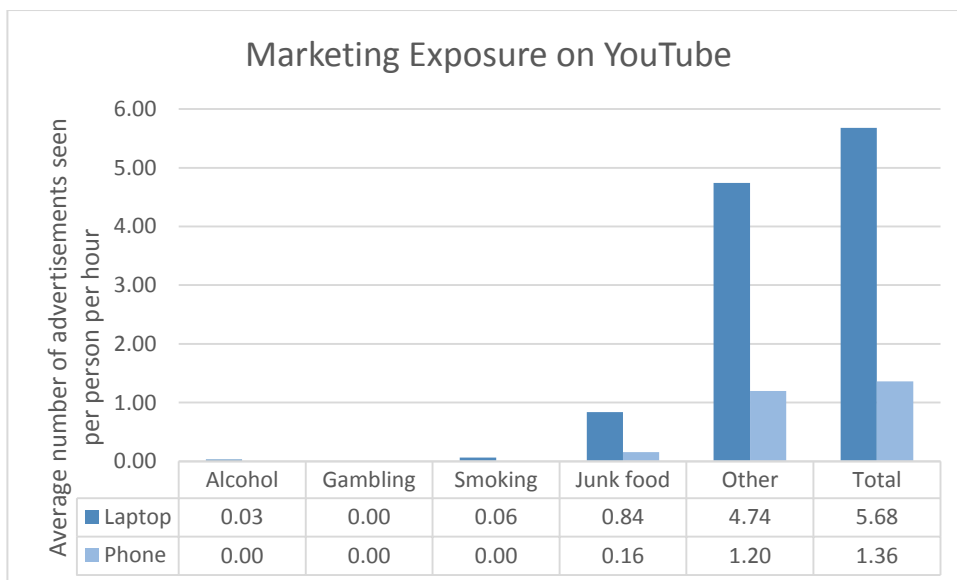


Fig 2. YouTube had 0.03 (0.57%) alcohol, 0.06 smoking (1.14%), 4.74 (83.52%) other advertisements on laptop recordings, and 0.16 (11.76%) junk food and 1.20 (88.24%) other advertisements on phone recordings.

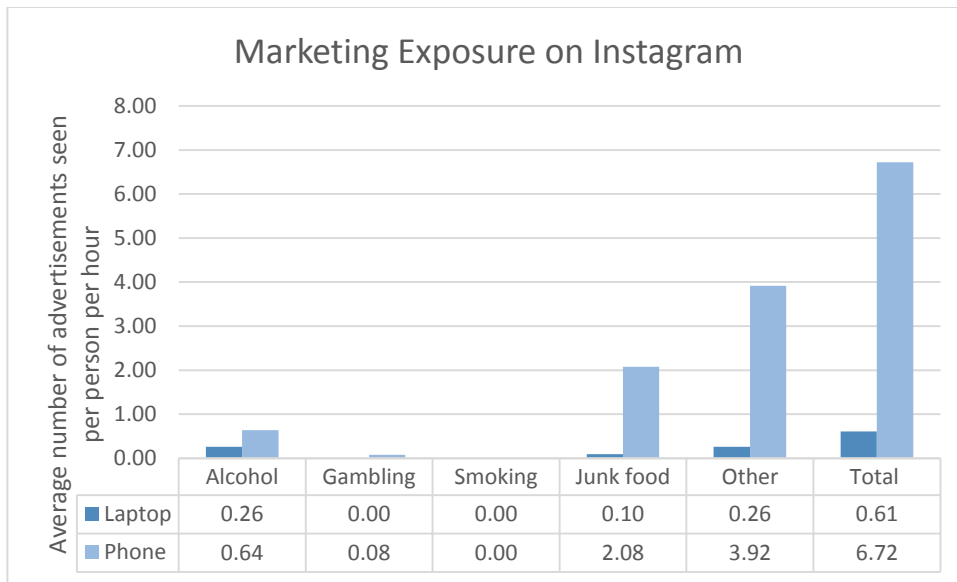


Fig 3. Instagram had 0.26 alcohol (42.11%) alcohol, 0.10 (15.79%) junk food and 0.26 (42.11%) other advertisements on laptop recordings, and 0.64 (9.52%) alcohol, 0.08 (1.19%) gambling, 2.08 (30.95%) junk food and 3.92 (58.33%) other advertisements on phone recordings.



Fig 4. News sites had 0.06 (3.17%) junk food and 1.97 (7.03%) other advertisements on laptop recordings, and 0.08 (5%) and 1.52 (95%) other advertisements on phone recordings.

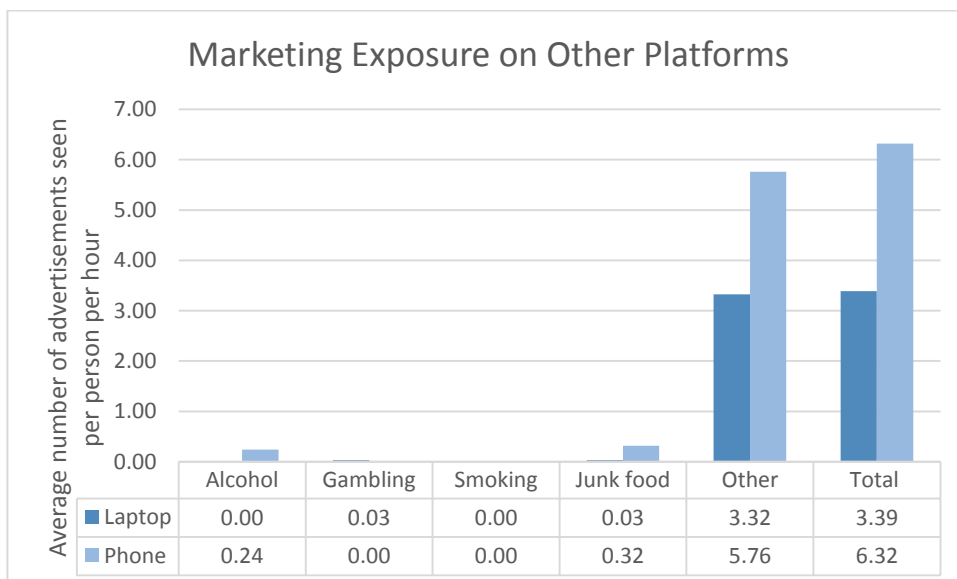
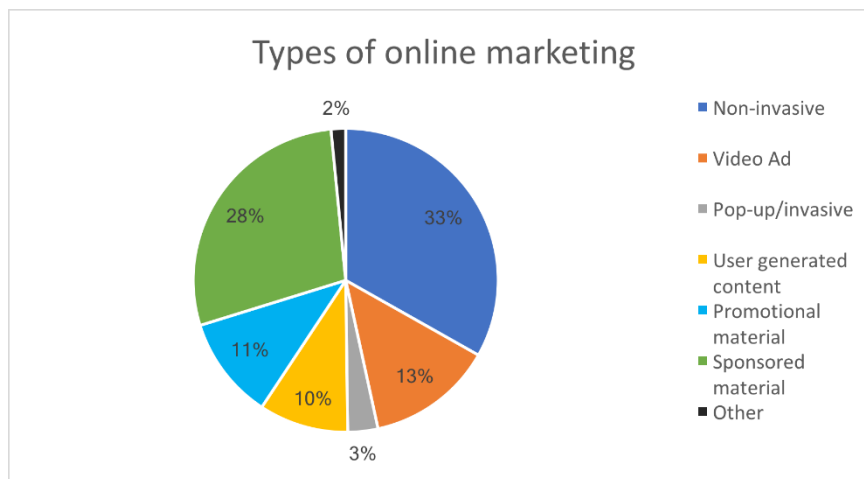


Fig 5. Other media platforms had 0.03 (0.95%) gambling, 0.03 (0.95%) junk food and 3.32 (95.10%) other advertisements on laptop recordings, and 0.24 (3.80%) alcohol, 0.33 (5.06%) junk food and 5.76 (91.14%) other advertisements on phone recordings. Other media platforms include Snapchat, Gmail, Reddit, Gaming websites and other websites.

Types of Online Marketing Exposure

Study participants counted a total of 970 advertisements across various media platforms during one hour of recording on laptop and phone. Out of the 970 advertisements, 33% were non-invasive (n=322), 28% were sponsored material (n=274) and 13% were video advertisement (n=130). 11% of advertisements counted were promotional material (n=106), while 10% were user generated content (n=92) and 3% were pop-up/invasive advertisement (n=31). Only 2% of advertisements were in the ‘Other’ category, which included



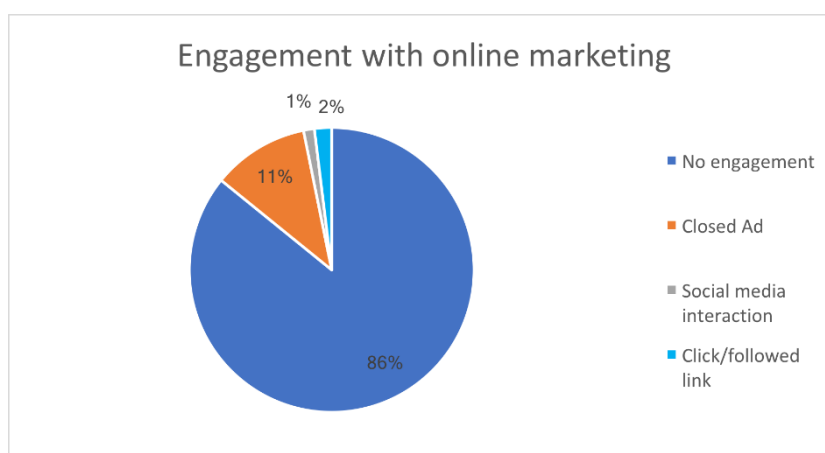
interactive marketing and email spam.

Fig 6. A pie chart showing the proportion of advertisements by different types of marketing

Engagement with Online Marketing

Majority of study participants did not interact with the advertisements, as reflected in 86% of advertisements without engagement. Some participants closed the advertisements (11% of ads), while few participants clicked/followed the link provided (2%) or actively interacted with the advertisements on social media (1%).

Fig 7. A pie chart showing the proportion of advertisements by different types of engagement



Document 2: Study Protocol – Attached

Document 3: Excel Spreadsheet – Attached

Document 4: Ethics Documents – Attached