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DISSECTING FLEECEWARE APPS: THE MILLION-DOLLAR MONEY-MAKING MACHINE

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ABSTRACT

Have you seen a horoscope or screen editor app with a three-day trial subscription charging $89.99/week? Have you or has anyone you know signed up for such a trial and then got charged before you remembered to unsubscribe? If you have read, heard about or experienced this, then you might know that we are talking about subscription-based apps called fleeceware.

Subscription-based payment models are popular and often used by businesses from streaming services to media outlets. Subscriptions with auto-recurring payments are also becoming popular in app stores. There are many legitimate apps making use of this model to provide great content and value for money. At the same time, thanks to high revenues and easy setup, the subscription model is also attracting unwanted attention from fleeceware developers. As subscription-based apps are becoming popular, we are seeing many fleeceware apps charging hundreds of dollars per week for simple apps that appear on app stores. They can change costs and switch to a subscription-based model easily and quickly without much scrutiny from the app stores. This is making them difficult to spot and remove from the stores. We have been researching fleeceware apps since last year and in this paper we share our findings on their work flow, use of fake reviews and promotional campaigns to reach a wider base, the app subscription business model, and the top grossing fleeceware app revenues.

FLEECEWARE

We have seen collections of apps on both the *Google Play Store* and the *Apple iOS App Store* that make use of the subscription business model to overcharge users for apps with very basic functionalities. In most cases, there were already similar free versions of the apps available. We refer to these apps as 'fleeceware'.

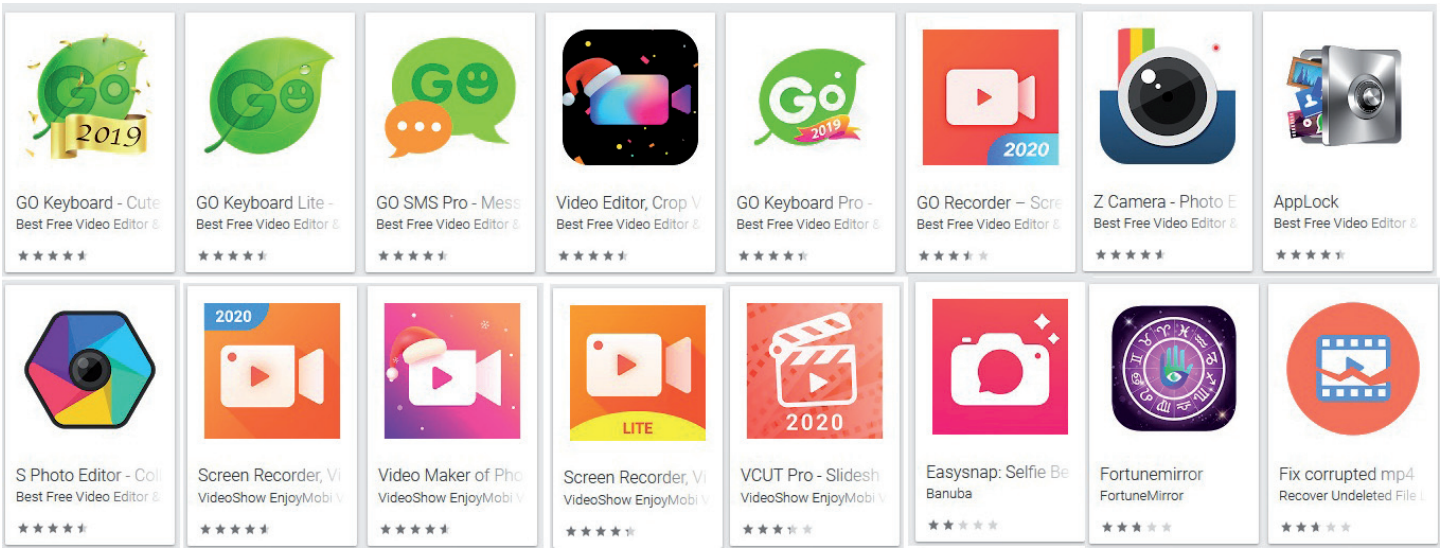

Figure 1: Fleeceware apps.

Fleeceware apps range from QR code readers to calculators, horoscopes, palm readers, video editors and many more. The apps themselves do not contain any malicious code, though they might have some useful feature which is already available in other free apps.

Fleeceware app developers take advantage of a business model available within the app store market ecosystem in which users can download and use apps at no charge for a short trial period. When the trial period expires, if the user hasn't both uninstalled the application and informed the developer that they do not wish to continue to use the app, the app developer charges the user.

When you download these apps, you are either prompted to sign up for a short trial – usually three days – from the outset, or you are prompted to sign up for a short trial when you try to access the highlighted features of the app.

How this works

Fleeceware developers drive users to their apps using variety of promotional campaigns. We will talk about the promotional campaigns later in this paper. When a user visits a fleeceware app page, the page itself will say that the app is free, and the user will only realize that this is not the case after he installs the app. The page does say 'Offers in-app purchases' but it doesn't clearly tell the user that they would be signing up for auto-recurring payment.

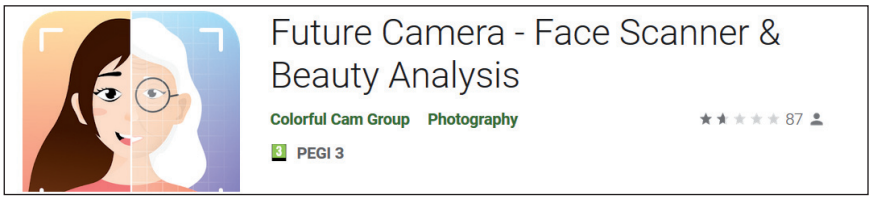

Figure 2: A fleeceware app.

The user is asked to sign up for a three-day or seven-day short trial when they run the app.

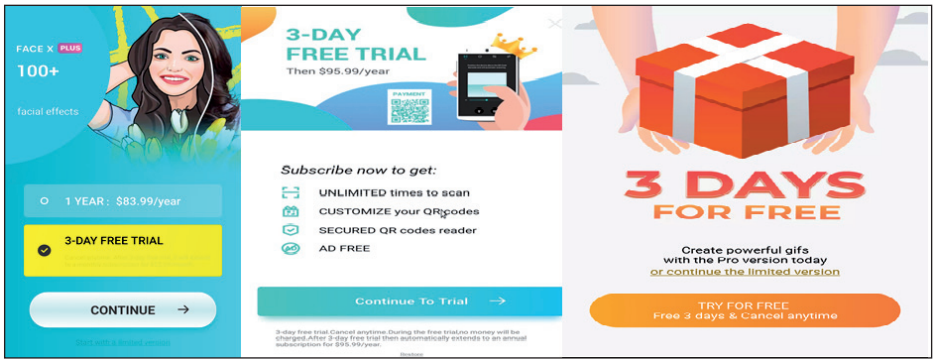

Figure 3: These apps offer a three-day free trial.

Some fleeceware apps ask you to sign up for the free trial upfront, whilst others ask you to sign up for a free trial when you try to access the specific features of the app.

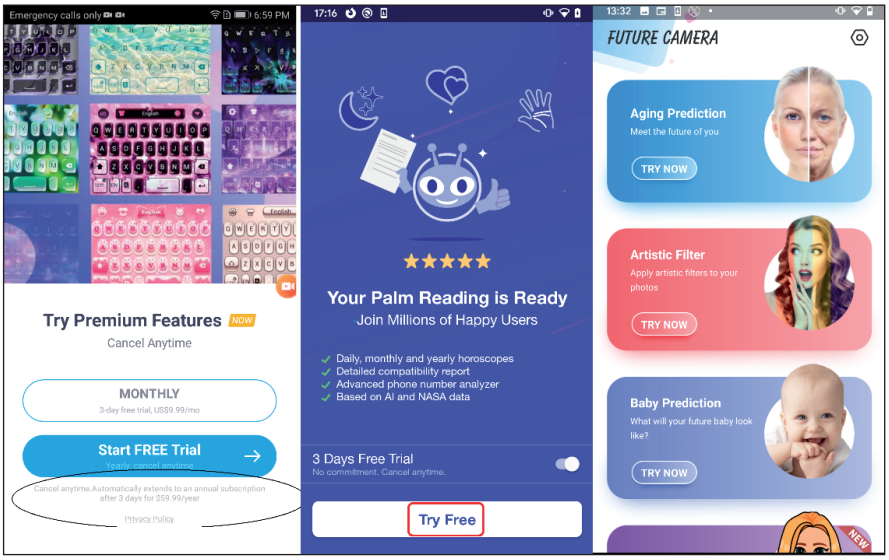

Figure 4: These apps require the user to sign up for a free trial in order to access key features.

As you can see in Figure 4, fleeceware apps employ a variety of techniques to entice their users. Apps sometimes just display 'Try Free' or 'Free' buttons to fool unsuspecting users, and display the small print often in very small font size or using faint coloured fonts that blend in with the background and are difficult to read. This way they satisfy the requirements to comply with app store rules but also get users to subscribe to fleeceware apps without arousing suspicion. If you click these 'free' buttons assuming the app is free, you get signed up for the trial. If you fail to unsubscribe within 24 hours of the trial expiration, then you will be charged on a recurring basis until you cancel the subscription.

APP SUBSCRIPTION MODEL

The subscription business model has existed for a long time. It has existed in different forms in the past, for example in newspapers and magazines. In modern times, digital subscriptions for news content and subscription-based streaming services like *Amazon Prime* and *Netflix* are well known and popular.

App stores offer developers various business models [1] such as the free/freemium model, subscription model and paid/paymium model. Developers have several ways to earn money [2] through various models, including ads, in-app purchases, in-store purchases and subscriptions.

We will investigate the subscription model, which is relevant to our research. Auto-renewing or recurring payment subscription models are offered in both the *iOS App Store* [3] and the *Google Play Store* [4]. The content and services of the apps are offered to users on an ongoing basis until the user decides to cancel their subscription, and payment is deducted from the user's account automatically. Developers are expected to provide feature enhancements, ongoing service and novel app experience to justify the recurring payment [3].

Figure 5: Legitimate Ocean Journal subscription.

Under the app subscription model, there are two relevant topics that should be discussed in relation to fleeceware research.

Free trials

Free trials offer users the chance to try apps out before they commit to the recurring payment. Free trials are suggested as a great tool to gain new customers [5, 6]. The user doesn't get charged during the trial period, but they must remember to cancel the subscription 24 hours before the trial period ends. Free trials can be offered for a minimum of three days or seven days, but 30-day and one-year trial periods may also be offered. To sign up for a free trial the user must enter their payment details (e.g. credit card details) into the app store billing interface. At the end of the trial period if the user does not cancel the subscription, it automatically gets converted into a full, paid subscription and payment is taken.

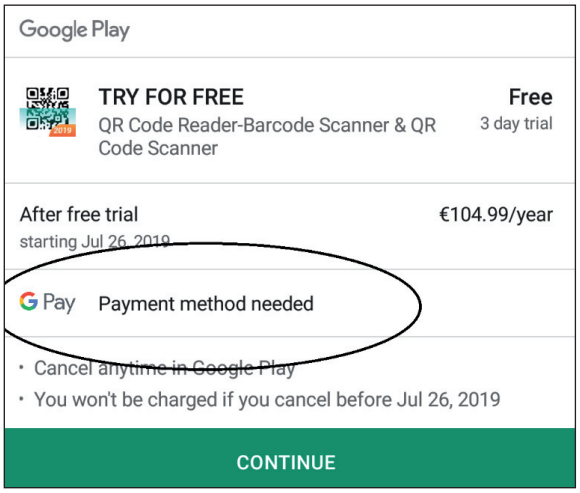

Figure 6: The user must enter payment details.

Free trials play a key role in benefiting fleeceware developers. Users are offered a three-day free trial, and since to avoid payment the subscription must be cancelled 24 hours before the end of the trial, that means the user must remember to cancel the subscription within two days. A shorter trial window is probably chosen because, in a shorter time frame, users are more likely to forget to cancel their subscription.

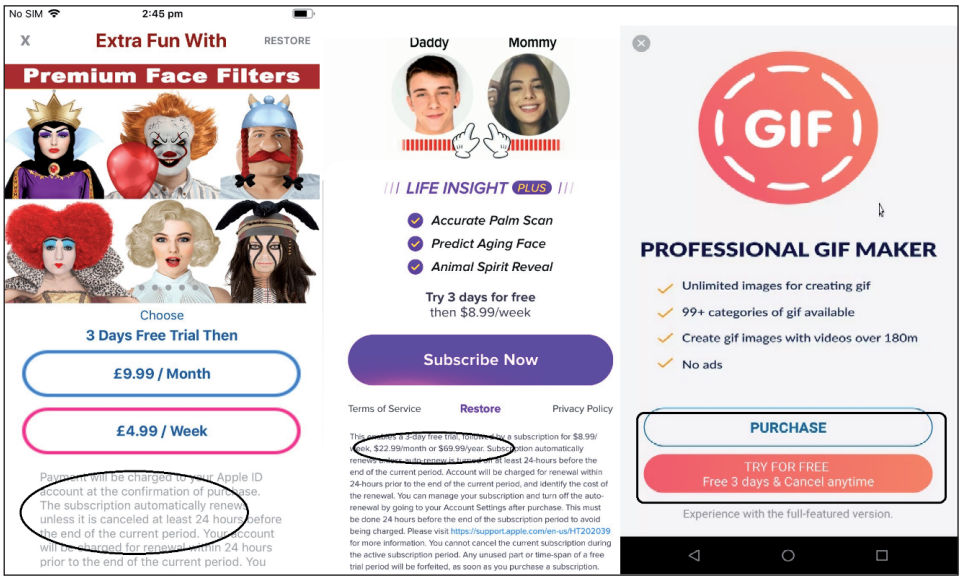

Figure 7: Payment terms are often made hard to find/read, and are often misleading.

Most of these free trial sign-up prompts are misleading. The subscription sign-up dialog should be clear to users, it should clearly describe the total weekly, monthly and annual payments. It should display payment terms in clear text. As shown in Figure 7, one of the apps has no payment terms, in another, the terms of cancellation are in faint grey text which is hard to read, and the monthly and yearly charges in the other image are hidden in fine print. In one of the app images above, though the yearly subscription cost is $69.99, it only highlights the rate of $8.99/week, which looks like a smaller amount to the user, but in total works out to be more than $400/year if paid at the weekly rate – almost five times more than the yearly subscription cost.

Steep subscription charges

Fleeceware apps charge steeply inflated prices for even basic apps like a QR code reader. App stores have a broad accepted price range for paid apps and in-app products including subscriptions [7]. Table 1 shows the *Google Play Store* price range that can be charged in the local currencies of various countries.

Country	**Price range**
United States	USD 0.99 - 400.00
United Kingdom	GBP 0.50 - 300.00
Japan	JPY 99.00 - 48,000.00
Germany, France	EUR 0.50 - 350.00
Australia	AUD 0.99 - 550.00
India	INR 10.00 - 26,000.00
Russia	RUB 15.00 - 42,000.00
Brazil	BRL 0.99 - 1,500.00

Table 1: Google Play Store price range for apps and in-app products.

For example, the US has a maximum of $400; the UK has a maximum of £300. A US user could be charged up to $400 for a subscription to a simple app like a flashlight. The same price range applies whether an app is high quality with fresh content and advanced features or very basic without significant content or features – anything within that price range can be charged. Though there is no law or policy on how much a product or an app should cost, users are encouraged to use their judgement to decide on a fair price. Taking advantage of this lack of clear definition in price range (which is understandably difficult to monitor and set), several fleeceware app developers have published low quality apps with exorbitant prices. The fleeceware app called Professional GIF Maker, shown in Figure 8, charges approximately $240/month – which in our opinion is a clear and unethical overcharge.

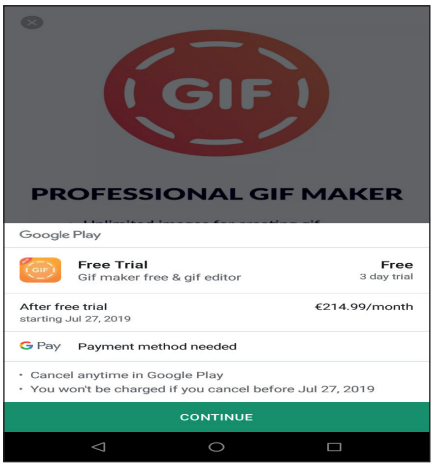

Figure 8: Professional GIF Maker charges EUR 214.99 per month.

Google's own research [8] offers insight into how much users in the US are willing to pay for subscriptions for a range of different app categories. Users were willing to pay only around $25 at most, but we still see hundreds of dollars being charged by fleeceware apps.

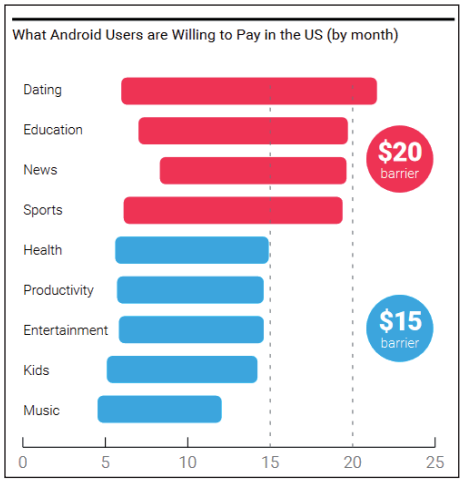

Figure 9: What Android users are willing to pay in the US [8].

SUBSCRIPTION MARKET AND REVENUE

The main motivation for fleeceware developers is the huge app store market and high revenues. Because of the nature of the recurring payments of the subscription monetization model the payments happen on an ongoing basis until the user cancels the subscription.

According to a report [9], US app subscription grew 21% in 2019 to $4.6 billion.

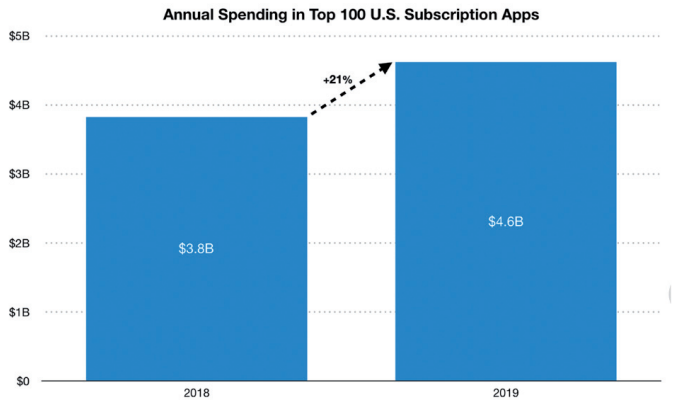

Figure 10: Annual spending in top 100 US subscription apps – US app subscription grew 21% in 2019.

In Figure 11 you can see that, since 2016, spending in the top 100 US app subscriptions has increased approximately from $1bn to $4bn in total. *Apple iOS App Store* subscription revenue is almost three times greater than that of the *Google Play Store*. In 2019, the *Apple iOS App Store* had $3.6bn and the *Google Play Store* had $1.1bn subscription revenues. The amount of money involved in app subscription revenue is significant, hence we see an increase in interest in the app subscription model among fleeceware developers.

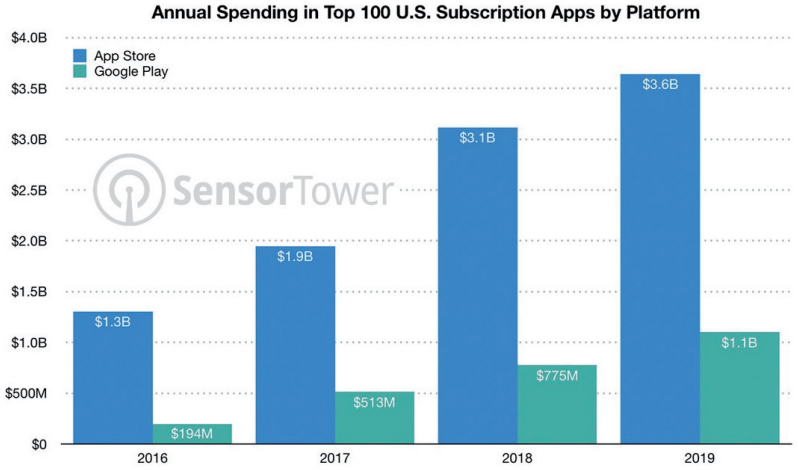

Figure 11: Annual spending in top 100 US subscription apps by platform.

Figure 12 shows the top 10 legitimate money-making apps using the subscription model in 2019.

	Overall Revenue	App Store Revenue	Google Play Revenue
1	Tinder	YouTube	Pandora
2	Pandora	Tinder	Google One
3	YouTube	Pandora	Tinder
4	HBO Now	Hulu	HBO Now
5	Bumble	Bumble	Disney+
6	Hulu	HBO Now	Twitch
7	Google One	LinkedIn	Bumble
8	LinkedIn	YouTube Music	ESPN
9	YouTube Music	Amazon Music	LiveMe
10	ESPN	ESPN	MeetMe

Figure 12: Top 10 legitimate money-making apps using the subscription model in 2019.

With the exception of *Google One* and *LinkedIn*, the top 10 is filled with entertainment and dating apps.

Top grossing charts

High revenue in the subscription-based app model has attracted much unwanted attention from fleeceware apps. If you read on past all the popular well-known apps in the top grossing chart you will find many fleeceware apps, such as horoscope apps, palm readers and screen editors.

Figure 13: The top grossing iPhone apps include many fleeceware apps.

As the title of this paper indicates, many of these apps make millions of dollars when you check their revenue estimates [10]. We will investigate couple of apps that appeared in the top 10 grossing charts in their respective app categories.

The 'Fantastic Face-Aging Prediction' app still exists on the *Google Play Store* [11]. The subscription cost for this app is $79.99/year or $29.99/month. It has been installed by over 10 million people on the *Google Play Store*.

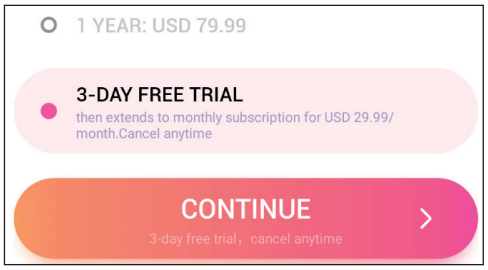

Figure 14: Fantastic Face-Aging Prediction costs $79.99/year or $29.99/month.

According to *Sensor Tower* estimates, this app made $500,000 in May 2020. This app has appeared in the top 10 grossing chart in the lifestyle category since March 2020. With a similar estimate for the next 12 months, for a year we could estimate a revenue of approximately $6 million.

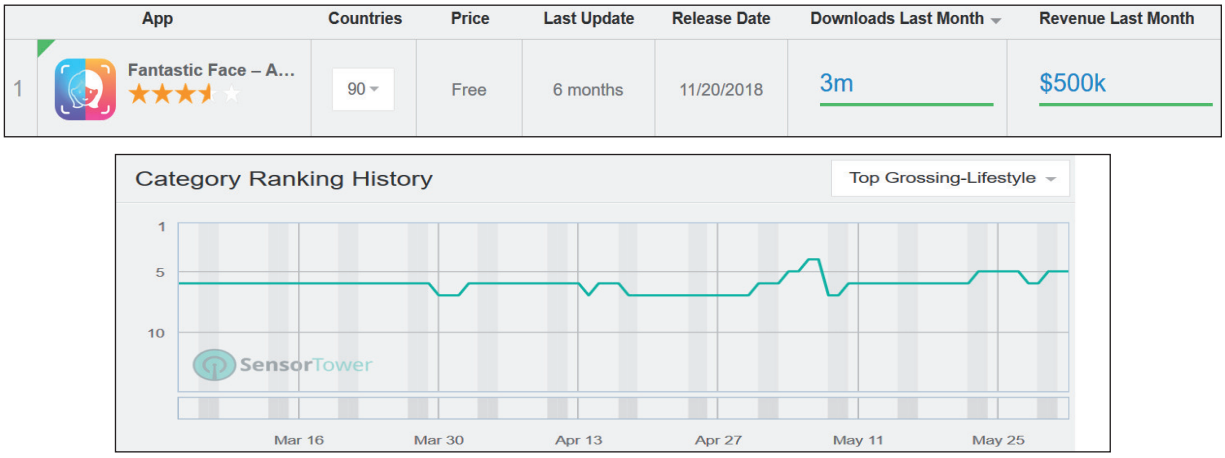

Figure 15: The Fantastic Face-Aging Prediction app made $500,000 in May 2020.

The 'Future Baby & Palm Reader' app, available in the *Apple iOS App Store*, claims to have future baby prediction and palm reading functionalities [12]. This app has many bad reviews, and many fake reviews, yet it makes more than half a million dollars per month.

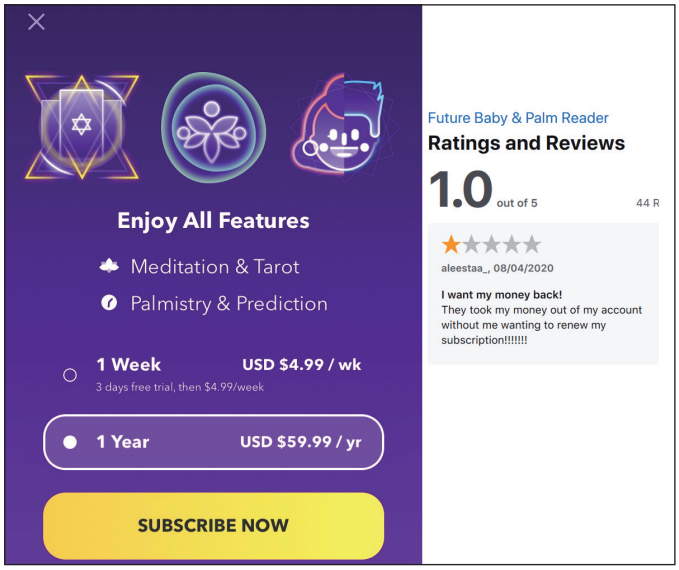

Figure 16: The 'Future Baby & Palm Reader' app has poor ratings and many bad reviews.

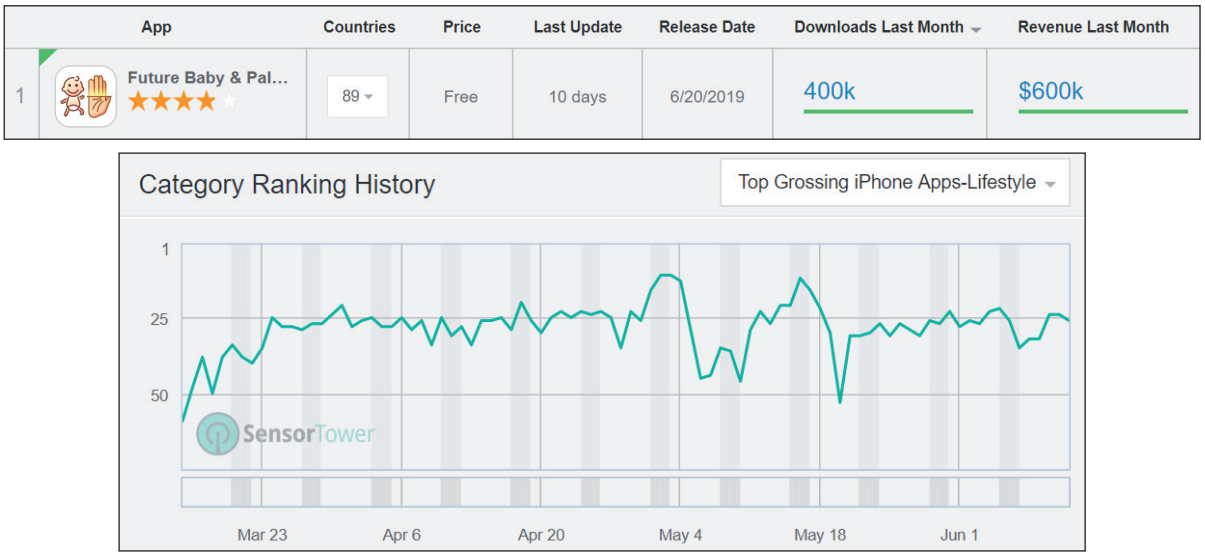

Figure 17: The 'Future Baby & Palm Reader' app makes more than half a million dollars per month despite its poor ratings and bad reviews.

In another instance, a QR code reader app [13], the function of which already exists in the built-in camera app of the *iPhone*, appears in the top 10 grossing chart in the utilities category with a monthly revenue of approximately $1 million. In the past this app was known to charge extortionate amounts – about $156/year [14]. Currently, this app charges approximately $39.99/year or $9.99/month for a pro version of the QR code reader and continues to make millions of dollars.

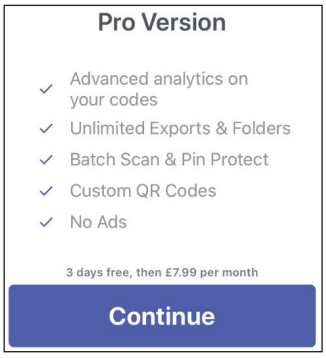

Figure 18: The pro version of the QR reader charges £7.99 per month.

The QR code reader app made about $1m revenue during May 2020 according to *Sensor Tower* revenue estimates and appeared in the top 10 grossing chart from March-May 2020.

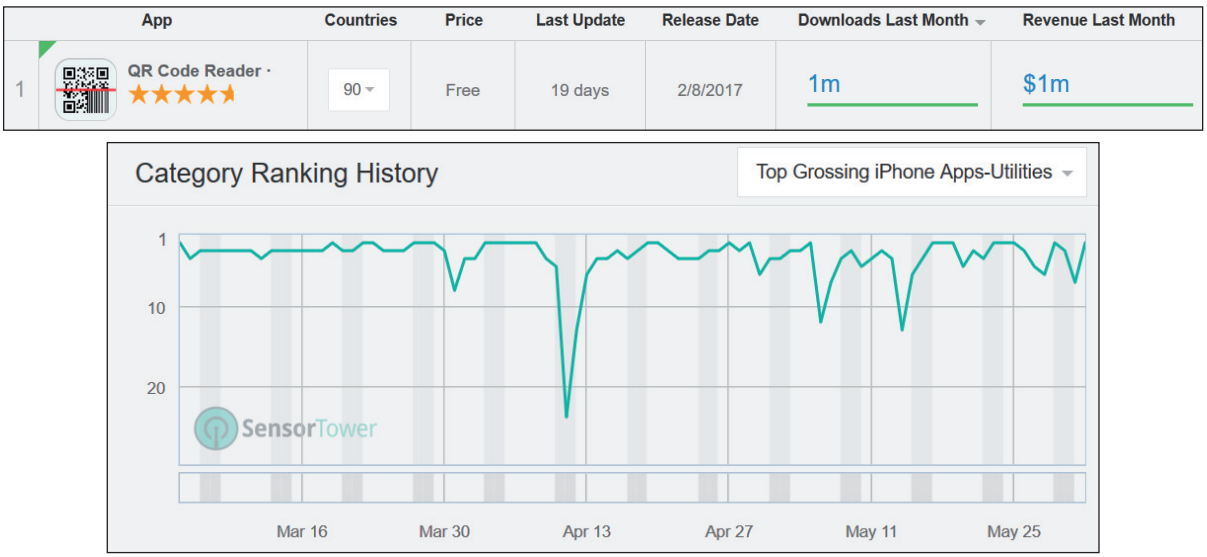

Figure 19: The QR code reader app made about $1m revenue during May 2020.

Table 2 shows some of the other *iOS App Store* fleeceware apps that we reported to *Apple* in April this year [15] with thousands of dollars of revenue every month in total exceeding $4.5 million.

App name	Weekly	Monthly	Yearly	Rank	Download	Revenue
Seer App:Face, Horoscope, Palm	$7.99	$29.99	$79.99	#153	20k	$20k
Selfie Art – Photo Editor	£8.49	£24.49	£89.99	#14	500k	$700k
Palmistry Decoder	$8.99		$69.99	#23	300k	$600k
Lucky Life - Future Seer	$8.99	$24.99	$69.99	#40	200k	$200k
Life Palmistry - AI Palm & Tag	$7.99	$24.99	$79.99	#39	100k	$200k
Picsjoy-Cartoon Effect Editor	$7.99		$79.99	-	<5k	-
Aging seer - Faceapp,Horoscope	$7.99	$8.99	$59.99	-	<5k	-
Face Aging Scan-AI Age Camera	$8.99		$59.99	-	<5k	-
Face Reader - Horoscope Secret	$2.99	$9.99	$59.99	-	<5k	
Horoscope Secret	$9.99	$29.99	$74.99	-	<5k	-
CIAO - Live Video Chat		$19.99	$74.99	#66	60k	$80k
Astro Time & Daily Horoscope	$7.99	$19.99	$49.99	#106	20k	$30k
Video Recorder / Reaction	$2.99	$9.99	$49.99		<5k	
Crazy Helium Funny Face Editor	$4.99	$9.99	$49.99	#384	70k	$7k
Banuba: Face Filters & Effects	$7.99	$24.99	$79.99	#50	70k	$100k
QR Code Reader - Scanner		£8.99	£12.49	#444	<5k	$40k
QR Code Reader & Barcode PRO		$9.49	$47.99	#103	80k	$90k
Max Volume Booster	£9.99	£19.49	£48.99	#134	20k	<$5k
Face Reading - Horoscope 2020	$4.99	$15.99	$69.99	-	<5k	-
Forecast Master 2019	£8.99	£19.99		#134	<5k	$10k
mSpy Lite Phone Family Tracker		$49.99/quarter	$99.99	#3	1mil	$700k
Fortunescope: Palm Reader 2019	$9.99			#876	80k	$200k
Zodiac Master Plus - Palm Scan	$8.99	$22.99	$83.99	#9	200k	$500k
WonderKey-Cartoon Avatar Maker	$7.99	$18.99	$79.99	#18	30k	$60k
Avatar Creator - Cartoon Emoji	$8.99		$67.99	#52	200k	$100k
iMoji - Cartoon Avatar Emojis	£7.99	£19.49	£87.99	#55	10k	$20k
Life Insight-Palm & Animal Face	$8.99	$22.99	$69.99	#26	400k	$600k
Curiosity Lab-Fun Encyclopedia	£7.99	£25.49	£87.99	#80	10k	$9k
Quick Art: 1-Tap Photo Editor	£7.99	£25.49	£87.99	#157	20k	$8k
Astroline astrology, horoscope	$8.99	$19.99	$49.99	#20	200k	$300k
Celeb Twin - Who you look like	$5.99	$19.99	$59.99	#682	<5k	-
My Replica - Celebrity Like Me	£7.99	£19.99	£49.99	#56	90k	$70k
TOTAL (estimated in USA)					**3.5 million** (approx. 3,680,000)	**$4.5 million** (4,644,000)

Table 2: Some of the other iOS App Store fleeceware apps that we reported to Apple in April this year.

Google and Apple fees

Google and *Apple* both take a 30% cut of app subscription charges in the first year and then they take 15% in the following years [16, 17].

FLEECEWARE PROMOTIONAL CAMPAIGNS

Fleeceware apps have high install counts and they make high revenues. Most of them don't even look professional, so how do so many users end up with them on their phones? It's possibly thanks to advertising. High revenues in this model probably give developers the confidence to invest in these promotional campaigns.

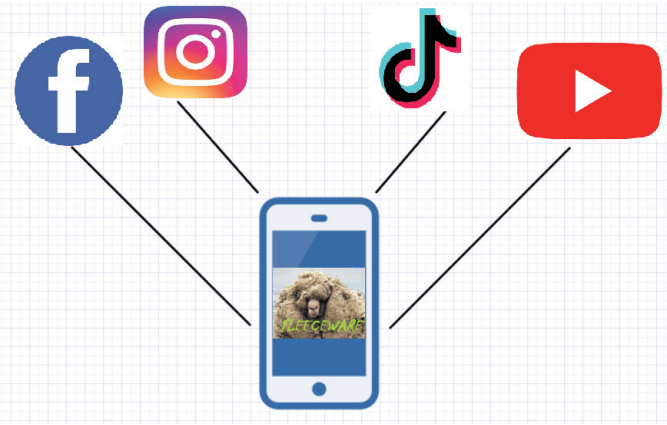

Figure 20: Fleeceware developers extensively use social media platforms to advertise their apps.

Fleeceware developers extensively use social media platforms to advertise their apps, just like normal apps. They use social media platforms like *YouTube*, *Instagram*, *TikTok* and *Facebook*. Besides that, we've also seen fleeceware promotions through *Google Play* search ads and internal app promotions.

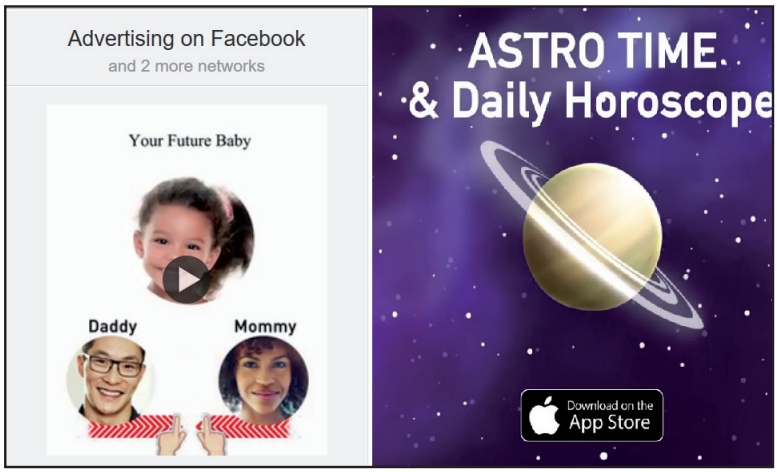

Figure 21: Social media advertising.

In the app store reviews we can see users writing about how they ended up having downloaded and installed fleeceware apps.

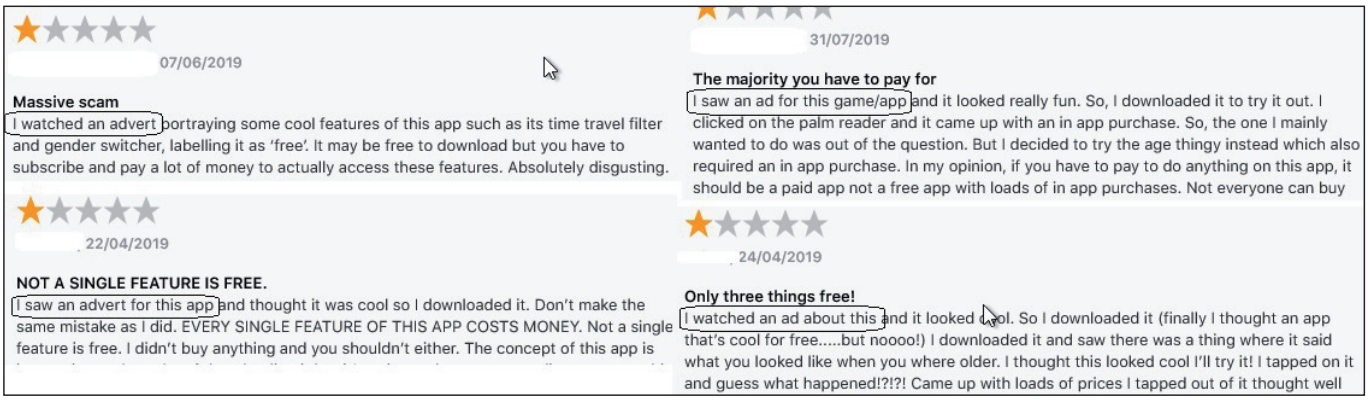

Figure 22: Users have written in the app store reviews about having ended up with fleeceware apps.

FAKE REVIEWS AND PAY-PER-INSTALLS

In addition to the *iOS App Store* apps with high install counts that we listed in the top grossing charts section, Table 3 lists some apps from the *Google Play Store* that have a high installation count. Several of these apps have an install count of over 100 million. Many developers of legitimate apps dream of reaching these kinds of installation numbers.

Package name	Install count	Costs
faceapp.facemystery.learnmoreaboutyourself	10,000,000+	$119.99/year
com.funcamerastudio.videomaker	50,000,000+	$9.99/week
com.jb.emoji.gokeyboard	100,000,000+	$59.98/year
screenrecorder.recorder.editor	10,000,000+	$79.99/year

Table 3: Install count of fleeceware apps in the Google Play Store.

From past research [18, 19], we know that there are many services available to inflate app store install counts and also to purchase five-star reviews. These services boast about bypassing app store security checks by mimicking real-world scenarios. There is an ongoing cat-and-mouse game between app stores and the crooks offering these services. Based on this, we could probably say that many of the high fleeceware app install counts and two-to-three word five-star reviews could have been achieved using such payment-based services.

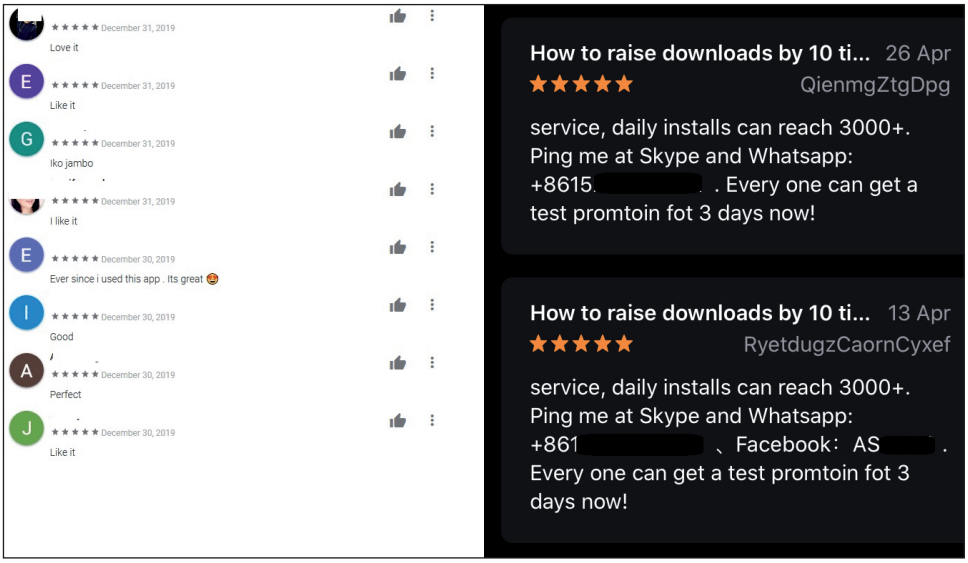

Figure 23: We know that there are many services available to inflate app store install counts and that it is possible to purchase five-star reviews.

The reason for having high install counts and good reviews is to boost app store search rankings, and to attract more potential 'customers'. Having better install counts and reviews will also influence how app store search results return specific apps. For instance, the *Google Play Store* search 'factors in the overall experience of [the] app based on user behavior and feedback. Apps are ranked based on a combination of ratings, reviews, downloads, and other factors.' [20]

VULNERABLE USERS FALLING FOR FLEECEWARE

If you look beyond the glowing fake reviews, you will also notice many one-star reviews written by affected users. Many users are upset that they have lost money. In some cases, these apps affect people's budgets and day-to-day lives because of unwanted subscriptions. This is particularly the case for vulnerable users like children/teens, the elderly and people with disabilities or mental health issues. Vulnerable users are less likely to read fine print or to realize that the subscription is an ongoing payment that they should cancel, and may be less tech savvy, finding it harder to navigate through menus, unsubscribe from app subscriptions and to ask for refunds.

In one review we saw (Figure 24), a user complained about having been charged $64.79 twice – apparently money that the user had set aside for their rent – and had trouble getting any refunds. In another case, a parent reported their child having an app subscription that charged £148 'unknowingly' at a cost of £7.99/week. These fleeceware apps affect real users and can have a significant detrimental impact on people's lives. We need to take this threat type seriously and nip it in the bud.

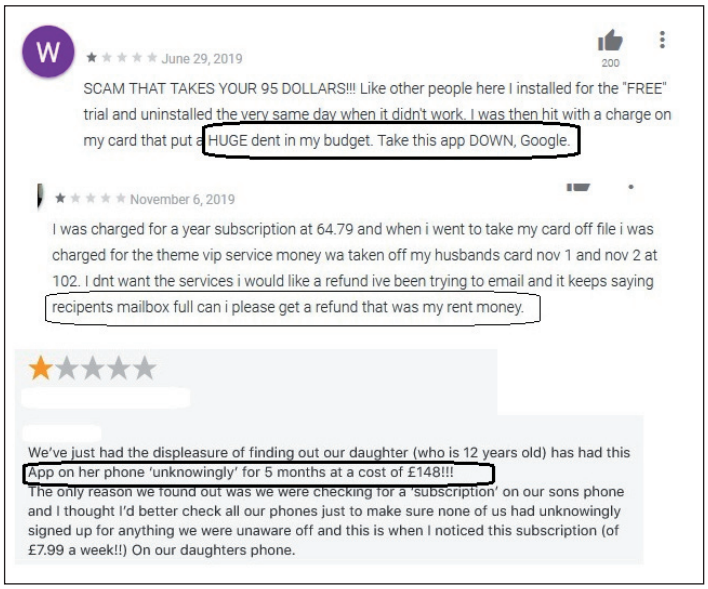

Figure 24: There are many one-star reviews from affected users.

FLEECEWARE APP DEVELOPERS

Fleeceware apps have associated addresses and websites in different corners of the world. We can broadly classify them into two groups based on the details they divulge publicly on app stores and how on much they charge for subscription costs.

1. Fleeceware app developers like the one shown in Figure 25. This app is still [21] in the *Google Play Store* at the time of writing and charges a very high subscription rate of $89.99/week – the weekly subscription rate is greyed out and in a small font. Fleeceware apps like these do not list their address or have a website. They usually have one app per account. The apps are hard to use even once and lack any useful functionality. The app shown below gives you a subscription prompt when you start the app and then when you click on any feature, you either get another prompt for a trial subscription or you are forced to watch an advert. These apps are probably intended to make a quick buck before they are discovered and kicked out of the app store. They might return to app stores with a different flavour.

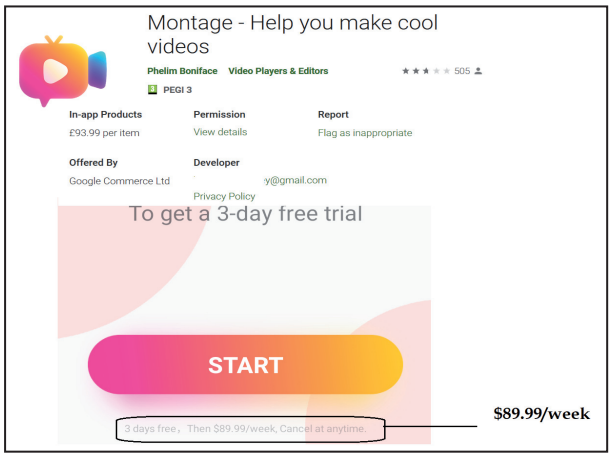

Figure 25: Fleeceware apps like these do not list their address or have a website.

2. These app developers have a basic website that gives some information about their apps. But they do not disclose much information about the company or its employees. They charge medium to high subscription rates. The apps have some basic functionalities. If they are removed from the app store, they change costs and/or trial periods and continue to thrive.

   One such app is called 'Fortunemirror'. This app charges approximately $89.99/week to provide your horoscope, read your palm or even perform a face scan. It has a standard website like the one shown in Figure 26 to help convince users.

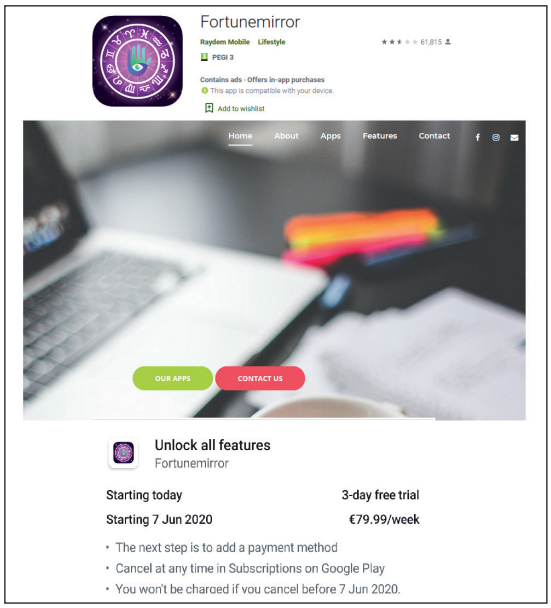

Figure 26: Fortunemirror charges EUR 79.99/week.

GOOGLE RESPONDS TO FLEECEWARE APPS CAMPAIGN – IS THAT ENOUGH?

We have been writing about fleeceware apps since last year [22]. Several users have also been complaining to app stores and asking them to contain this threat type. In a big win for both consumers and our campaign, in April this year *Google* published new policies on app subscriptions [23] to combat fleeceware apps.

Google suggests app developers consider best practices including:

1. Being explicit about subscription terms, such as:
   - Whether a subscription is required to use all or parts of the app. If a subscription is not required, users should be able to easily dismiss your subscription offer.
   - Cost of your subscription.
   - Frequency of your billing cycle.
2. If free trials and introductory offers are offered, clearly and accurately tell users:
   - The duration
   - The pricing
   - What is included with free trial or introductory offer
   - When a free trial will convert to a paid subscription
   - How a user can cancel if they do not want to convert to a paid subscription.

At the time of writing, fleeceware app developers have until 16 June 2020 to comply with the new rules [23]. Currently, we still see fleeceware apps on app stores that violate those rules.

Will these policies be enough?

There is no best practice and there are no guidelines as to the maximum amount an app can charge. We know it is difficult to set a price and value on the service the app provides. But what about the maximum an app can charge – should there be a limit? In our opinion it is not fair or ethical for an astrology or palm reading app to charge excessive amounts. As described earlier, the 'Fortunemirror' app charges approximately $89.99/week – that's more than high reputation, popular apps charge for their services. App stores should prevent fleeceware apps from exploiting this: at the time of app review the store can clearly see what an app is charging, and we believe that only fairly charged apps should be allowed in the stores. Furthermore, three-day trials are too brief for users to cancel a subscription and to make up their mind on app usage – apps should be encouraged to use longer trial periods.

CONCLUSION

Subscription-based services are becoming more popular, with an increasing number of traditional business-based services moving to subscription-based models because of the ease of cash flow. We can see this trend in app stores as well. There

are many legitimate developers that use this service in a benign way, but there are also an increasing number of fleeceware developers seeing an opportunity to cash on this.

On top of existing spend, consumers are seeing more burden on their wallets because of this. If fleeceware apps add an extra dent with their extortionate charges, users will start to feel suspicious about embracing this model. As the user mistrust grows, ultimately the ones that lose out will be legitimate app developers.

Mobile is a popular platform, with huge growth in developing nations. If app stores do not police the increase of fleeceware apps, this could affect millions of users in developing nations, many of whom do not speak English fluently. Besides them, vulnerable users like children, the elderly and those who don't bother to read fine print are also prime targets for fleeceware apps.

To effectively combat the fleeceware problem we need efforts from both consumers and app stores. Given the vast number of apps to choose from, consumers must be vigilant about the apps they are installing and the subscriptions they are signing up to. They should read the fine print carefully and avoid signing up to unwanted subscriptions. Meanwhile, app stores should monitor apps and prevent those without clear descriptions and with extortionate prices from appearing in the stores. A fair price table for different categories of apps should be introduced. If the user wants to unsubscribe from an app at the time of uninstall (exists in *iOS* but not in *Android*) then they should be given an option to do that instead of doing it separately.

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