May I Have Your Attention, Please? – Building a Dystopian Attention Economy

Sven Helmer
Free University of Bozen-Bolzano
Bolzano, Italy
shelmer@inf.unibz.it

ABSTRACT

We analyze the scenario depicted in the "Black Mirror" episode "Fifteen Million Merits" from an economic point of view, focusing on treating the attention of a user or consumer as a commodity. We continue by sketching the technological requirements for building such an economic framework, looking at advertisement platforms, payment schemes, and surveillance technology. As we show, a lot of the technology already exists and we expect the gaps to be filled in the very near future. Additionally, we briefly discuss the impact on social and work environments. While we believe that a scenario as extreme as shown in the episode is unlikely, we think that certain facets of it could find their way into our society.

CCS CONCEPTS

• **Security and privacy** → **Social aspects of security and privacy**; *Information accountability and usage control*; • **Social and professional topics** → Computing / technology policy;

KEYWORDS

attention economy; black mirror

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1 INTRODUCTION

In today's society, many entities try to attract and keep our attention, often by offering us something in return. For instance, when watching videos on YouTube, we do not have to spend any money, instead our attention is directed towards advertisements, and advertiser money pays for the infrastructure of YouTube. This leads to the notions of *attention economy* and *attention economics*. An attention economy treats user attention as a commodity and tries to monetize it by (digital) advertisement. Studying the economic principles behind this kind of market is called attention economics [4, 5].

The second episode of the first season of "Black Mirror", called "Fifteen Million Merits", takes the attention economy one step further. Bing, the protagonist, does not get anything in return for watching advertisements; instead, he has to pay to skip them. When he does not have the money (merits) to do so, he is forced to watch the advertisement. In a sense, the advertiser no longer has to buy the attention: they already own it, and the consumer has to buy it back from them.

After analyzing the episode we show how close we already are in terms of being able to implement such an attention economy, sketching suitable platforms and frameworks. In summary, we make the following contributions:

In this paper,

- We show that large parts of the advertising and payment system are technologically feasible today.
- We refer briefly to surveillance technology to implement a system for tracking the user.
- We discuss whether it is plausible for today's advertising ecosystem to develop towards the scenario in the show.

The remainder of the paper is structured as follows. We first analyze the situation in the "Black Mirror" episode, then discuss which parts could potentially already be implemented today, and conclude with a summary and an outlook.

2 ANALYSIS

In the following, we analyze the episode from four different angles, comparing each to the current situation in our own (Western) society. First, we look at the mechanisms used by advertisers to compete for the attention of consumers. Second, we investigate the way that credits are managed and transferred. Third, we scrutinize the way consumers are tracked and surveilled. Finally, we consider (briefly) what the social and work environment in the episode might look like, and how ours could develop towards it.

2.1 Attracting Attention

People already allow themselves to be distracted on a voluntary basis, e.g. by subscribing to news channels or services, checking social network alerts, updates, and notifications, or simply by clicking on click-bait links. The use of smart phones amplifies this effect, as the information can be received anywhere and anytime.

The "Black Mirror" episode goes a step further. While a smart phone user can opt to go offline for certain periods of time, in "Fifteen Million Merits" there is no escape from being bombarded by distracting shows, games, and advertisements. The walls of the cells in which people live consist entirely of screens; when pedaling on exercise bikes, everyone is facing a screen. At the beginning of the episode, Bing is trying to resist but the best he can do while pedaling is to opt for a simple animation depicting a

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virtual landscape scrolling past instead of watching a distracting show.

Another interesting point is that the advertisements shown in this episode are often intrusive and obnoxious. Intuitively, one would expect that annoying the customer would be counterproductive if the intention of the advertisers is to get the consumer to spend credits on their products. Then again, we already see this happening in practice. It seems that some advertisers try to attract our attention by any means: better to annoy or insult than not to get attention at all. Manson argues that "advertisements get zanier and more nonsensical – like the Geico gecko or the Old Spice guy – because the goal of advertisements is no longer information but simply attention" [15].

2.2 Payment Schemes

When it comes to payment schemes, many of today's smart phone apps (and other services) offer a paid ad-free option. The 'free' option shows advertisements.

From here it is only a small conceptual step to the situation depicted in "Fifteen Million Merits", where users decide to go ad-free for individual advertisements. The system there is fully automated and the balance of user accounts is updated in near real time. For instance, when an advertisement starts and a user tries to skip it, the system deducts credits from the user's account if possible, otherwise it prevents the skipping. If a user tries to bypass an advertisement by closing their eyes, the system starts blaring at them. Additionally, the system supports both very small and very large transaction amounts, e.g. getting toothpaste from a dispenser for four credits or registering for the talent show "Hot Shots" for fifteen million merits. A lot of different parties seem to have access to an account: consumers to their own accounts, consumers paying something on behalf of someone else, and service providers and advertisers to the accounts of customers.

While the transition from today's environment to the one in the episode is a small conceptual step for the user, it is non-trivial technically. For instance, on mobile devices a free Spotify account does not allow the streaming of specific songs on demand and a user is only allowed to skip a track up to six times per hour. The idea of increasing the number of skips by paying proposed by a user was not picked up by Spotify in 2016. However, this was not due to technical reasons, but because the idea did not receive enough positive feedback (kudos) from the user community [9].

2.3 Surveillance

Many states are already surveilling their citizens: for example, according to a study of the British Security Industry Association (BSIA) there are between 4 million and 5.9 million CCTV cameras in operation in the United Kingdom [19]. The main purpose of these installations is to reduce the crime rate and the number of terrorist or similar attacks.

In contrast, the surveillance used in "Fifteen Million Merits" seems to check whether a person is paying attention to advertisements, but does not seem to analyze their general behavior. For instance, when Bing tries to avoid looking at an advertisement (after he fails to skip it due to insufficient funds) by turning around, it follows his gaze by switching to a different set of screens. When he covers his eyes, an alarm goes off with a very uncomfortable high-pitched sound telling him to resume viewing. Finally, when he tries to leave his room, he cannot do so because the door is locked during the advertisement. However, when he starts punching the monitors and even breaks a screen, nobody seems to intervene.

2.4 Social and Work Environment

We already see traditional labor markets in many advanced economies failing. There are people who are unable to support themselves through paid employment because the jobs that they are qualified to perform are not paid highly enough for them to live a decent life. On the other hand, there seem to be jobs that do not contribute so society in a meaningful way. Graeber argues that more and more people work in made-up jobs performing tasks that are basically pointless [11].

The society in "Fifteen Million Merits" appears to have gone a different route: there is not even the pretense that the task people are performing (pedaling on exercise bikes) is meaningful. The energy output obtained from an exercise bike, although usable to partially power some of the infrastructure, is hardly worthwhile. Pedaling for half an hour generates about 0.1 kilowatt-hours of electricity (for comparison: the daily energy footprint of an average American is about 200 kWh) [8]. Consequently, the real motivation for this work scheme seems to be to keep people occupied. Someone has thoughtfully set up the make-work to be healthy and exhausting, keeping down healthcare costs and suppressing rebellious behavior.

3 IMPLEMENTATION

In this section we investigate what kind of technology or other resources are needed to implement the scenario described in the episode. We do so from four different angles.

3.1 Attracting Attention

On-demand video streaming is already a reality (see Youtube, Netflix, and Amazon Prime Video). By upgrading current networks to optic fiber, and taking advantage of caching opportunities for popular videos, it is possible to broadcast millions of different videos to individual customers at the same time. Even though the capacity of optical fiber networks is not infinite, in recent years, improvements in areas such as wavelength division multiplexing, advanced modulation formats, digital signal processing, and amplifying techniques have increased the capacity of fiber optic networks significantly [2]. Bayvel et al. report a transmission rate of 102.3 TBit per second on a single fiber core over a distance of 240 kilometers [2].

Equipping exercise bikes with individual screens is certainly affordable with today's technology: we estimate the size of the screens used in the episode to be about 50 inches (across the diagonal). Depending on the quality and make, these kinds of screens can be purchased for less than US$300. Furnishing entire rooms with video walls spanning several meters is another topic, though. While the technology is available, the important question is the cost. Prices can range a lot, depending on factors such as physical size, the number of pixels per square inch, and the quality of the components. Doing a quick check on the web revealed that LED video walls are available from around US$400 up to well over US$1000 per square meter [1]. We estimate that one wall in Bing's

room measures about four and a half square meters, which would come in at eighteen square meters in total, meaning a (minimum) price of around US$7200. Assuming that prices will still keep falling in the future and receiving a discount for ordering screens in bulk, furnishing small rooms with video walls is not out of reach.

While today user profiling and recommender systems making use of the gathered data in order to target advertisements is a hot topic and implemented in many systems, in this "Black Mirror" episode it seems to play no role. A user skipping advertisements would give direct feedback showing that they dislike certain advertisements. However, Bing has become so used to swiping away advertisements that he performs this gesture almost automatically: at one point he forgets that he does not have enough funds to skip advertisements, but still goes through the motions. This seems to indicate that the advertisements are not well-targeted, as Bing seems to dislike a very large proportion of them.

3.2 Payment Schemes

If we tried to build a scheme using today's electronic payment systems, we would probably use systems along the lines of PayPal, Google Wallet, Apple Pay, or TWINT. However, we need some additional features that those systems do not provide:

- very secure authentication (adequate for fifteen million credits)
- very fast transfer, even for large sums
- smooth integration with daily activities

From what is observable in the show, the authentication does not follow typical mechanisms used today, such as passwords, personal identification numbers (PINs), generated transaction numbers (TANs), or two-factor authentication. We think one way to implement the payment method used in the show is via chip implants that store a private key or similar authentication data.

Assuming a giant monopoly running everything, i.e, banks, merchants, and advertisers all belonging to the same entity (corporate or state-owned), fast money transfers are much easier to implement, as we do not need clearing houses or contractual agreements between different participants. However, we think that it is more plausible that we still have multiple corporations and banks. One method of handling a multi-party scenario without trusted third parties is the application of a decentralized processing paradigm, such as a distributed ledger or blockchain. Currently, one drawback of this technology is the relatively low transaction throughput. Mechanisms for reaching distributed consensus in public blockchains, such as proof-of-work (which is used in Bitcoin), are too slow to achieve real-time behavior. Consequently, we think that a permissioned blockchain would be more appropriate than a public one, as it restricts who can validate transactions and who may participate, allowing much faster verification methods such as proof-of-stake, which is the one applied in Casper [3]. Hyperledger Fabric, using a Byzantine-Fault-Tolerance (BFT) protocol, can achieve transaction rates of several 10,000 per second [13], Assuming one advertisement every ten minutes for every user and everyone watching video streams for sixteen hours a day, would give us 96 advertisements per person per day. Furthermore, on the assumption that half of these are skipped, this would result in 48 transactions per day per person. A throughput of 10,000 transactions per second would allow us to process the ad-skipping of 18 million users. So, a payment system like Hyperledger Fabric would not scale to a whole country yet, but we expect the transaction rates of blockchains to improve in the near future.

For smooth integration with daily activities, one technique that is used today are micro-payments. A customer has an account with a service provider, e.g. an online newspaper, tops up the account with a small amount of money, e.g. US$ 5, and the system subtracts a few cents every time a customer accesses an article. In the "Black Mirror" episode, there is no intermediate account, everything is booked directly against the consumer's main account. Employing blockchain technology with smart contracts as used, for example, in Ethereum, interactions that require payments, e.g. skipping an advertisement, can be automated and integrated into the blockchain. A smart contract is a function, represented by a piece of code, that resides on the blockchain and can be executed by the nodes of the peer-to-peer network. The distributed consensus protocol enforces the correct execution of the code: each node runs the function locally and checks that it gets the same results as the other nodes before validating it. For instance, a smart contract could check that certain conditions are met before going ahead with a monetary transfer, basically acting as an escrow service.

3.3 Surveillance

While we do not follow every single gesture of people yet, there is already a lot of tracking technology around. When we navigate the web, many sites leave cookies on our system to track us. When we use location-based services, we disclose our position to various entities (cell phone network operators are able to track our phones regardless of any options we choose). While we do not have cameras in our homes yet, an ever increasing number of households deploys smart speaker systems [14], such as Amazon Echo, Apple HomePod, and Google Home, which are used to collect data for creating user profiles.

Gaze tracking implementations available today distinguish between intrusive and non-intrusive techniques [12]. Intrusive systems require the user to wear some device, such as contact lenses or a head-mounted system [7], while non-intrusive ones do not [20]. The advantages of intrusive systems are greater accuracy, robustness against sudden and sweeping head movements, and ease of calibration. Non-intrusive systems, on the other hand, are more comfortable for the user.

Clearly, the system used in the "Black Mirror" episode is a non-intrusive one. The method proposed by Yoo and Chung in [20] uses five infrared light-emitting diodes (LEDs) and two cameras and is based on the reflection of light. The authors claim that their setup, in which four LEDs are attached to the corners of a monitor and a fifth to one of the cameras, is able to cope with large head movements. This setup covers only one direction, though; here we would require multiple setups, one for each wall. While we expect the accuracy of the system to suffer when configured in this way, we only need to know whether the eyes are closed or not and a rough estimate of the direction of the gaze. In order to synchronize the advertisements with the eye movements of the user, there needs to be some data transmission from the room. A full feed from the cameras would result in a considerable data volume.

However, we assume that a large part of the processing can be done locally, applying edge cloud or fog computing architectures [10].

3.4 Social and Work Environment

When we speak of implementation in the context of the social and work environment, this is less about technology and more about how we structure our society. Appeasing people and keeping them occupied by distractions is not a new concept: in the Roman Empire we find "bread and games" [17]. Poorer sections of society were supplied with cheap (or even) free grain and entertained with circus games. There are similarities to our own society: for instance, suggestions of a universal basic income (UBI)[6] so that paid work becomes optional and distracting shows and sports events.

Although there are some similarities with the society in "Fifteen Million Merits" (no shortage of food and plenty of entertainment shows), there are also some profound differences. Pedaling on an exercise bike is hardly entertaining in itself. It seems that being assigned to a bike carries a certain status with it. The cleaning personnel, dressed in yellow uniforms, is looked down upon by the bike riders. This seems to be similar to handing out important-sounding job titles and paying a higher salary as a way to make boring and pointless tasks more palatable.

4 CONCLUSION AND OUTLOOK

A lot of the technology to implement the scenario depicted in the "Black Mirror" episode "Fifteen Million Merits" already exists. We could build most of the infrastructure around the living quarters and exercise bikes, even if some of the components would still be on the expensive side, e.g. the video walls. We believe that the technology which is not quite fit for purpose yet, such as payment schemes based on blockchains and gaze tracking, can be advanced to a level that would make it suitable for this scenario.

Nevertheless, we find it rather unlikely that a situation as shown in "Fifteen Million Merits" will become reality in exactly this way in the near future. However, certain aspects could very well be integrated into our society and economy. For example, the reversal of the advertisement schemes, in which a consumer pays to skip an advertisement, could be implemented once micro-payments become ubiquitous, fast, and reliable. While being constantly monitored and fed video streams seems extreme from today's point of view, the proliferation of smart speaker system and other smart home devices could lead to much subtler forms of surveillance and attempts by advertisers trying to attract our attention. We may end up in a situation in which no force or coercion is required to steer us into an attention economy, as many people participate voluntarily, giving up privacy and allowing themselves to be distracted in return for a comfortable and convenient lifestyle.

This raises important questions on the impact of an attention economy on our lives and society in general. The system in "Fifteen Million Merits" does not offer any explanations to the participants and does not encourage them to ask questions, instead it reduces everyone to the role of a passive user. Even worse, there seems to be no way of opting out or protecting one's privacy. Although we are shown end-user license agreements (EULAs) when registering for a (digital) service in our own society, this usually means that we do not get access if we do not agree. McDonald and Cranor have looked at the amount of time that would be needed by an average American online user to actually read the privacy policies of the services they use and came up with a minimum estimate of 180 hours (even skimming the policies would still require around 80 hours) [16]. Consequently, many users do not read these policies and just click on the accept button.

Although there are steps in the right direction, e.g. a user can manage permissions for apps on Android or iOS devices in a more fine-grained manner and even revoke permissions again later on, it is doubtful that many users actually use this functionality. In essence, people accept being pushed into the role of a passive user and give up a lot of their privacy. There is a real danger that we will see a further erosion of privacy with potentially harmful consequences. When interviewed for The Guardian, Josh Cohen said "Privacy [] provides a shelter for imaginative freedom, curiosity, and self-reflection. So to defend the private self is to defend the very possibility of creative and meaningful life" [18].

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