EXPLAINING LOW ADOPTION RATES OF CONTACT TRACING APPS

An Interdisciplinary Analysis

This paper will look at the question how to explain the low adoption rates of Contact Tracing Apps. It will be argued that the low adoption rates of Contact Tracing Apps can be explained through a collective action problem. Displaying that Contact Tracing Apps contains a conflict of interest between the individual and the collective. The liberal-communitarian debate gives us an insight into whose interests can be considered more decisive. However, privacy as will be argued in the paper can also be viewed as a collective good in the context of CTAs. This exemplifies that potentially two collective goods have been competing each other in the context of Contact Tracing Apps. Indicating a further aspect in the obstruction of the public adoption of CTAs.

Antonia Maria Bulfon

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6489702 | Bachelor of Science Thesis | PPE+H | Utrecht University

Supervisors | Jonathan Benson | Merve Benzologuglo

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Introduction

"No contact tracing, no lockdown lifting" said the French Health Minister on the 6th of May 2020 in the French Senate (Rowe 2020, 1). During this time the first lockdown from the COVID-19 disease was coming to an end and new solutions were proposed to make living relatively normal again, despite the proceeding virus. One prominent idea was to deploy Contact Tracing Apps. These applications should help authorities and society to achieve the goal of controlling the virus, and thus reviving the ordinary life. Nevertheless, within this one year in which the Contact Tracing Apps have been operating, there have been three more lockdowns. Thus, it seems like these applications have not been as successful in pursuing their goal. This is not really surprising as one main reason for this can be retraced to the low public adoption rates of CTAs (Kostka and Habich-Sobiegalla 2020).

Thus, the research question is: How can we explain the low public adoption rates of Contact Tracing Apps? This question is defined in a broader manner, because it allows us to view the concepts of the individual and the collective in a more dynamic way. However, this dynamic research question also comes with its downfalls, as there is not one clear way to answer this question. Hence, the research in itself will be limited in the explanations it can provide.

This research question, especially due to its range, exceeds to not only the disciplines of politics, philosophy, economics and history, but it reaches into the realms of sociology and also into the technical aspects of CTAs. This, however, is not problematic because, within my research I am looking upon a social phenomenon that cannot be simply explained through one discipline and likewise cannot be restricted to a certain discipline. Nevertheless, the main focus of this paper will be in the disciplines of philosophy and economics. Both of these disciplines complement the understanding of the low adoption problem. Economics allows us to make an action-theoretic analysis of this question. An action theoretic analysis is a bottom up explanation to understand large-scale social phenomena (Heath 2020). Hence, the economic assumption of the rational self-interested individual can help explaining why the individual has chosen to not download the app and how this influenced the public adoption CTAs. Philosophy on the other hand, looks upon the normative assumptions are embedded in this social phenomenon regarding the dichotomy between the individual and the collective.

Both of these disciplines together will eventually at the end of this paper lead to a new explanation of the low public adoption of CTAs.

The paper will be structured in the following way. Firstly, the occurrence of CTAs will be discussed and their relevance in regard to COVID-19 will be exemplified. Secondly, the issue of the low public adoption of CTAs will be highlighted and looked upon through the collective action problem, which offers a way to explain individual behavior and contextualize it in a collective setting. This will be then complemented with the liberal-communitarian debate which exemplifies the contrast between views on the values of the individual interest and the common interest. This philosophical debate will influence the view on privacy and how this individual perceived concept gains a common value in a datafied society of which CTAs are part of. Hence, it is concluded that potentially there is not only a dichotomy between the individual and the collective, but moreover in the CTA context two common goods operate as vices to each other.

COVID-19 and Contact Tracing Apps

This section will introduce the topic of Contact Tracing Apps. A Contact Tracing App is an application on the smartphone that allows contact tracing. The app notifies the users in case they were in close contact (so the virus might have been transmitted) with an individual with a positive COVID-19 case confirmation. Depending on the technology, these applications keep a provisional record of proximity between individuals, which allows the app to alert recent close contacts of detected cases and urge them to quarantine (Ferretti, et al. 2020, 4). Due to the COVID-19 pandemic many different health apps emerged, such as raising awareness apps and apps that provide health monitoring. However, CTAs are apps that aim to manage the spread of COVID-19 by informing potentially infected people timely, so they do not infect others. On this basis, special attention needs to be paid to CTAs -- separately from other COVID-19 health apps (Almalki and Giannicchi 2021). The following sub-sections aim to give an overview of CTAs, the distinct technologies upon which they operate, and the implication one can draw from the technological characteristics of each app. Firstly, this paper will discuss CTAs in the context of the COVID-19 pandemic and how CTAs emerged

as a consequence thereof. Secondly, it will be reviewed how CTA's work and what technology they use.

COVID-19, Contact Tracing & Smartphones

The goal of the subsequent paragraphs is to outline three factors that have contributed to the existence of Contact Tracing Apps. These factors are, firstly the spread of COVID-19, secondly the method of contact tracing as pandemic response measure, and lastly the technological progress of the last decades.

The first factor which explains the emergence of Contact Tracing Apps is the spread of COVID-19. COVID-19 is a disease that is caused by a virus called Severe Acute Respiratory Syndrome Coronavirus-2 also referred to as SARS-CoV-2. It is believed that the virus SARS-CoV-2 has transmitted from animals to humans in China in the late December of 2019 (RIVM 2021). From there on humans have transmitted the virus amongst each other via respiratory droplets and aerosols (European Centre for Disease Prevention and Control 2021). The human-to-human infection of COVID-19 can be mainly traced back to near proximity between people. Coughing, sneezing, speaking or breathing of an infected person can lead to a contamination of an uninfected person, once these droplets or particles come into contact with the uninfected persons nose, eyes, or mouth (Centers for Disease Control and Prevention 2021). Therefore, proximity, but also mobility of people are main contributors of spreading the virus (Cartenì, Di Francesco and Martino 2020, 8-9). Currently, one of the central goals on political agendas around the world is to contain the SARS-CoV-2 virus because it spreads fast, has high mortality rates, severe disease progression and potential negative health effects (European Centre for Disease Prevention and Control 2021).

Contact tracing is the second important factor that led to the existence of CTAs. Keeping track of contacts, with recently infected people, is viewed as one dominant strategy to contain infectious viruses (Browne, Gulbudak and Webb 2015, 33, Garnett and Anderson 1993). It is an established approach in combating any form of virus, to cut off infection chains by identifying potential new positive cases and putting them in isolation before they can infect others (Eames and Keeling 2003). Since the virus SARS-CoV-2 spreads through human

proximity and thus also with human mobility, contact tracing can be an important strategy for containing COVID-19[1] by cutting of infection chains. Initially, contact tracing has been conducted manually. Yet the exponential rise of COVID-19 cases and the spread of the disease on a global scale, manual contact tracing turned out to be overburdened and an inefficient mean to cut off infection chains (Ferretti, et al. 2020). Many factors complicated matters: few and slow testing capacities, little transnational cooperation regarding contact tracing, and a high intensity of global mobility. Put visually, infected person A travels from Wuhan to Paris in a fully occupied aircraft, uses public transport to visit the Eiffel tower, the Louvre and Versailles. Until person A develops symptoms it will take five days, until he will get tested it will take two days and until he will receive the results it will take another two days. To manually identify and inform all the potentially infected people on the flight, on public transport and on the touristic sights is a challenge for just one positive, the more so when one deals with many cases simultaneously. Moreover, given this bureaucratic challenge manual contact tracing is time-consuming. This is problematic because contact tracing, as a virus containment tool, is only a promising approach if potentially newly infected people are informed rapidly, so they do not infect others (Kretzschmar, et al. 2020). The longer the process takes to detect positive cases and to retrace their contacts, the less effective contact tracing will be as a containment strategy.

Contemporary technologies, the third important factor, could be a way to increase the efficiency of contact tracing and thus the effectiveness of contact tracing as a virus containment strategy. The smartphone was thought as one technological device that could be a major asset in contact tracing of COVID-19. The usage of smartphones by a large share of the population and the possibility of smartphones to connect with Big Data, made this a promising tool to approach contact tracing on a more efficient and effective manner than the traditional contact tracing. Concerning the first point it can stated that the smartphone owners have increased (Pew Research Center 2021). Not only have their owners increased, but they are also being more incorporated in different facets of human life (Min, et al. 2013, 1, Wang, Xiang and Fesenmaier 2016). In most society's, smartphones are so integral to human life that

1 It is important for the reader to note that within this paper contact tracing is viewed as a virus containment tool and not used for other purposes.

they are always in touch with the smartphone holder. Secondly, smartphones do not operate independently, but they are connected with Big Data (Ansharia and Alas 2015, 182). Big Data is a multifaceted concept, but in its core, it describes the process of collecting, sorting, evaluating, storing, and retrieving huge volumes and different varieties of data in high velocity. Thus, smartphones are not only accessors of Big Data, but they are producers of data and therefore contributors to Big Data. This signifies that a smartphone user can be put into relation with other smartphone users, depending on the type of data and the technology. This in turn, allows connecting different smartphone devices to each other, based on proximity or GPS location. Clearly the connection between devices on basis of proximity is dependent on regulation, but it is technically feasible. Based on this interplay between the human-smartphone relationship and the connectivity of the smartphone to Big Data, the smartphone is a powerful technical device to contact trace, which appears to be advantageous over traditional contact tracing.

This section outlined the reasons for the emergence of Contact Tracing Apps as a response to the COVID-19 epidemic by looking at the spread of SARS-CoV-2, the strategy of contact tracing for virus containment, and smartphones as a new tool for more efficient contact tracing. The following subsection will delve into how the technologies behind different CTAs work and how they are employed.

Provision of and accessibility to CTAs

This paragraph will look at the providers of and the accessibility to CTAs. There are roughly 120 different CTAs available in 71 different countries (Woodhams 2021). Contact Tracing Apps were mainly commissioned by governments (Ramakrishnan, et al. 2020, 4). They were developed through a collaboration between different technology companies, interest groups and governmental departments. There are not only governmental CTAs, but also privately provided CTAs and local approaches (Du, Raposo and Meng 2020, 2). Nevertheless, this paper will focus on the governmental commissioned apps. This is because many countries only have one prominent CTA, commissioned by the respective government (European Commission n.d.). CTAs are mostly accessible free of charge, which make them accessible to everyone independent of budget constraints. Nevertheless, there are other constraints that

restrict accessibility to CTAs. For example, one prerequisite is to own a smartphone and depending on the app, a recent model of a smartphone or a specific operating system is required to download the free app. Moreover, in some cases constraints in the registration can appear, as some apps require local phone numbers or national identification codes for a registration (Ramakrishnan, et al. 2020). Consequentially, although the most prominent CTAs are government commissioned and free of charge, there are still barriers to access.

Technology of Contact Tracing

This subsection intends to give an overview on how CTAs work. To achieve this, the following three paragraphs will highlight how CTAs are provided, on which technology the apps operate and lastly how the data is saved. It is important to note that this section cannot cover every possible aspect of CTAs. This section will therefore only frame the key discussion points of the technologies on which CTAs operate.

Automatic contact tracing apps are based on gathering and processing information about people that are close to each other at certain points in time. There are two main technological tools to achieve this: Either the app records the absolute location with time stamps of all app users and compares the devices' proximity, or the app documents the relative location among smartphone devices. The former is known as location-based contact tracing which is mainly conducted based on GPS technology. The latter, proximity-based contact tracing, is based on Bluetooth Low Technology (Legendre, et al. 2020, 6).

Both technologies allow a different approach to contact tracing. The GPS technology is a reliable outdoor tracker, nevertheless, the technology is less accurate in three-dimensional spaces (Bay, et al. 2020, 5). As a result, the GPS technology is not recommended for multi-floor buildings and subway-systems. Making the GPS technology less effective for retracing contacts. Nevertheless, this technology, which is used in China, can be an effective tool to crowd-map the spread of the virus (Li and Guo 2020, 1). The disadvantage is that there is a high chance of individuals being wrongly notified about a positive contact (Wang, Ding and Xiong 2020, 3). The Bluetooth Low Technology, on the other hand, allows devices to share information between each other and store it. This exchange is reached through an effective

physical proximity between the devices. In contrast to the GPS technology, one would not be notified about a contact in case someone was on the same location as oneself but one floor up in the same building. This is the key advantage of the Bluetooth Low Technology over the GPS technology. Hence, Bluetooth Low Technology is more precise in linking specific contacts in three-dimensional spaces, making it the favored technological approach for epidemiological tracing (Rivest, et al. 2020, 3).

As the Bluetooth Low Technology is the most widely employed technology in CTAs, the following discussion will focus on aspects of this technology specifically. In end, the Bluetooth Low Technology is the most crucial when reviewing CTAs (Reichert, Brack and Scheuermann 2021, 2). Bluetooth is initially a technology that allows data exchange between devices within close range. The Bluetooth Low Technology is simply an advanced Bluetooth version that preforms the Bluetooth task with a lower energy consumption. Even though the initial task of Bluetooth is not to measure distances between two devices the Received Strength Signal Indication (RSSI) of Bluetooth can to some extent infer the distance between two devices (Gao 2015). This makes the Bluetooth technology handy for proximity-based contact tracing. Most of the CTAs, using Bluetooth technology, work in the following way: When two CTA users are in close proximity to each other, the apps automatically interchange randomly generated pseudonyms that document the contact within the applicable proximity range. The altering and anonymized pseudonyms represent the user, which are then used to store the information about the duration of the contact, and the distance among the devices (Zhao, et al. 2020). This is how the proximity and duration of the proximity is exchanged between users of CTA running on Bluetooth technology. All CTAs running on Bluetooth technology, document contacts this way. However, the architecture of different CTAs differs in respect to how contact tracing is carried out after a positive case of a CTA user is determined.

There are two distinctive architectural approaches to notify users with a COVID-19 exposure. The centralized and the decentralized approach. It is important to note that also within the central and decentral approach there can be differences among those categories, depending on the protocol used (Reichert, Brack and Scheuermann 2021, 8-18). This paragraph will, however, review both approaches in general terms.

The centralized approach implies that both the infected user's pseudonym and the contacts pseudonyms that were exchanged are transmitted to a centralized database. Such a centralized server assesses the risk of infection based on the contact information transmitted. It identifies the relevant contacts and then notifies the applicable users. The decentral architecture, although, is more client-based meaning that the analysis of data does not take place on a centralized server. Instead, the infected CTA user only transmits his pseudonym to the database and all devices with the CTA will periodically check the database to assess the risk of an exposure. Thus, in this case, it is the mobile devices which accesses the central database and carries out the data analysis (Zhao, et al. 2020, 3). There is a common misconception that central and decentral refer to a central or decentral servers. In fact, both architectural approaches use a central server. The actual difference is where the risk assessment is conducted; on the main server (central) or on the user's mobile device (decentral).

Both architectural approaches of designing a CTA have different implications when it comes to the matter of privacy. One key difference is that the centralized architectures partially need to register the app-user's identity on the main server, this is for example not the case for the CTAs with a decentral architecture (Vaudenay 2020, 9-10). The differences in degrees of privacy invasion the two architectural approaches pose will be not discussed in further detail. What is most relevant for this thesis' analysis is that each of the two architectural approaches of CTAs invades into the user's privacy.

Limitations of Contact Tracing Apps

In the previous subsections, the advantages the technology of CTAs bring in contrast to traditional contact tracing became evident. Within this subsection, however, three limitations such CTAs face, will be discussed: one, technological limitations; two, degree of adaptation; and three, and privacy limitations. It will be argued that those limitations are essential to how successful CTAs can be in detaining the virus. Please note that these limitations refer exclusively to CTAs as a functioning tool to contact trace.

The first limitation of CTAs is the technology. A precise contact tracing technology is a key feature for the CTA to fulfill the purpose of accurate contact tracing. Hence, if the technologies are not reliable, the effectiveness of the CTAs will be limited. As stated above the Bluetooth Low technology is the favored technical approach of CTAs. Nevertheless, measurement errors still occur as the RSSI (Received Strength Signal Indication) of the Bluetooth technology is dependent on the referring environment and on the transmitting phone (Maccari and Cagno 2021, 13). This indicates that the accuracy of CTAs based on the Bluetooth technology varies depending on the hardware and on the location, the app is used.

The second limitation is that the effectiveness of CTAs is reliant upon public adoption. Many CTAs are supplied by the government on a voluntary basis. Thus, only individuals that download the CTA will eventually contribute to automated contact tracing, while non-users will not. This poses a problem because the effectiveness of CTAs as a tool for epidemic control is heavily reliant on a high adoption rathe of the population. A study conducted by University of Oxford suggests that for CTAs to be an effective corona control tool, at least 60% of the population must use the app (Fraser, et al. 2020, 3). This is further shown by another study which has shown that there is a positive relationship between app adoption rates and the transmission rates[2] of the SARS-CoV-2 virus (Cencetti, et al. 2020, 11). It is important to note that within these studies more factors have played into the model such as testing capacities, mobile phone access, infectiousness, and isolation strategies. Nevertheless, it demonstrates that the success of CTAs as an effective tool for COVID-19 containment is subject to the app adoption rates. This is currently one main issue of the deployed CTAs (Chan and Saqib 2021, 1). They are lacking the necessary number of downloads among the population, for the CTA to be considered as an effective tool.

The third limitation is privacy. As stated before, contact tracing will always be invasive to privacy. The inherent nature of contact tracing is to detect the movement of a person and their close contacts. The fact that the contact tracing process takes place automatically, systematically, and fairly accurately highlights the dimension of the privacy issue which CTAs entail (Kleinman and Merkel 2020, 654). Undoubtedly, the extend of the privacy issue

[2] How many people are on average are infected by one person.

is dependent on the technical design of CTAs and on the legal and ethical frameworks operating in the respective country. Nevertheless, it is inevitable that for CTAs to serve their purpose there needs to be a sacrifice of privacy. Of course, it depends on how the data that is shared is protected, but the app needs access to private data to serve its purpose no matter what (Cho, Ippolito and Yu 2020).

Technology, public adoption, and privacy are thus the three dominant constraints CTAs face. For this paper, however, the most noteworthy limitations of CTAs are privacy and public adoption. This is because both privacy and public adoption stand in a strong relationship to each other. Public adoption inevitably entails a privacy loss and vice versa. Therefore, this paper focuses on the trade-off between privacy and public adoption. It is assumed that CTAs are effective in their purpose of contact tracing and thus containing the virus, once privacy is disclosed and public adoption is high.

Concluding, this section has introduced factors that led to the existence of CTAs, discussed the operating technologies of CTAs and the limitations of CTAs as a virus containment tool. The next sections will discuss the pay-off between public adoption and privacy in more detail.

The Collective Action Problem of CTAs

The last section has revealed that two main limitations for effective functioning of CTAs are privacy and public adoption. This section aims to highlight their relationship and how the concept of privacy affects the adoption rates of CTAs. Considering the empirical evidence of low CTA adoption rates, the question arises, how these low adaptation rates can be explained. It will be argued that the phenomenon of low CTA adoption rates is well captured by the collective action problem. Subsequentially, the collective action problem will be discussed and then applied to the case of CTAs and their respective low adoption rates.

Low Adoption Rates in CTAs

One crucial factor for CTAs to fulfill their purpose of containing the spread of COVID-19 is to have adoption rates of at least 60% (Fraser, et al. 2020, 3). However, current evidence

suggests that the public adoption rates vary between countries (Seto, Challa and Ware 2021). China for example after making the app mandatory has unsurprisingly reached an adoption rate above 60%. Western democracies, on the other hand, have not been able to reach this threshold and remain at public adoption rates under 20% (Kostka and Habich-Sobiegalla 2020). This is striking because a cross-national study conducted at the beginning of the pandemic has revealed that 74.8% of their respondents indicated that they would probably and certainly download the respective CTA if available on a voluntary basis (Altmann, et al. 2020). Interestingly, there seems to have been a strong voluntary public support for CTAs which however has not translated into action. This seems counterintuitive at first because CTAs are freely available to people with smartphones. Furthermore, if the contact tracing technology is effective and reliable in containing the virus this would lead to a situation in which all are better off. Not only with regards to direct health effects but also with respect to liberty and economic stability, given that lockdowns and other resections could be relaxed sooner. The following will review this more closely by discussing why especially voluntary approaches to CTAs, that are mainly present in Western Democracies such as the European Union and the United States, resulted so far in low adoption rates (European Commission 2020, Art. 14). It is argued that the collective action problem is an appropriate analytical tool to understand the counterintuitive evidence of low adoption rates despite the societal interest to contain the virus.

Applicability of the Collective Action Problem

This section will argue that one way to understand low public adoption rates of CTAs can be understood in terms of the collective action problem. The collective action problem describes the following problem. The model starts off with the assumption that agents are motivated to act upon things that are more valuable than costly to them individually. This in turn, must mean, are motivated to act upon things they are at the same time more costly than valuable towards society (Jagers, et al. 2020, 1283). This creates a significant risk that collective goods -- goods which cannot be produced by the individual alone -- are not offered in a society (Baldassarri 2009, 392). Social sciences have attempted to approach and explain this social phenomenon with concepts which are strongly connected to the collective action problem. Those include prominently the free-rider problem and the prisoner’s dilemma (R. Hardin

1982, 7). Essentially the collective action problem, prisoner's dilemma and free-rider problem deal with cases in which tensions between the individual and a wider society arise. All concepts have in common that each individual benefits privately from being selfish, however, collectively all individuals would benefit even more when acting upon a selfless, community-oriented attitude.

Before delving into the details of the collective action problem with respect to CTAs, the following will briefly outline why the collective action problem is applicable to CTAs and how it can complement our understanding of low public adoption rates.

The collective action problem is applicable to the adoption rates of CTAs, because voluntary CTAs require the individual user to download the app. However, as frequently mentioned, the effectiveness of the app is reliant on the adoption rates of large share of the population. Without reaching the minimum adoption rate of 60%, there to the functioning of CTAs is very limited. In turn, the desirable effect contributing to restraining the COVID-19 disease through the means of CTAs are unlikely to unfold. Containing COVID-19 is a collective good because, as highlighted by Delia Baldassarri (2009, 392), it is a good which cannot be produced by individuals alone. The SARS-CoV-2 virus mainly spreads through human contact; therefore, the spreading of the virus can never occur on basis of individual efforts but must be brought about by a collective effort. Moreover, once the virus is contained also those individuals who have not downloaded the app will benefit from the contained virus.

What are the obstacles for this collective good to be achieved? It is the individual which is in control of the act of downloading a CTA. So, what personal interests could stand in opposition to the collective good -- preventing the latter to be achieved? One potential candidate for an explanation is the non-willingness to allow access and processing of one's private data. Another candidate for an explanation is the non-willingness to invest one's personal time to download the app and register accordingly.

The interplay of individual and collective dimension, which come with the choice to download CTAs or not, is a strong indication that an approach via the collective action problem can shed light on low adoption rates. This is because, the individual might value, on

an individual level, their personal data or time investment more than they value the benefit the app can bring to them individually. Moreover, it is uncertain for the individual if societal benefits of a CTA unfold, as for that a high adoption rate is required. The consideration of downloading the app involves a risk outweighing then. One could invest one's time and give up some of one's privacy without reaching the point where the benefits of CTAs unfolding if not enough people download the app too. The rationale behind this will be reviewed more closely in the subsequent section by reviewing Mancur Olson's famous account of *The Logic of Collective Action.* However, the aim of this previous paragraphs was to highlight that there is an individual and collective dimension to CTAs, which makes it applicable to the collective action problem.

The Logic of Collective Action

The Logic of Collective Action (1971) by Mancur Olson is one of the most well-known accounts of operationalizing the collective action problem. As revealed above the collective action problem, put simply, describes the problem of the individual not acting to promote the collective interest. Preceding the publication of *The Logic of Collective Action* (1971) it was frequently assumed in the social sciences that an individual will intrinsically pursue the common interest (Oliver 1993, 273). Nevertheless, Olson's book evinced that it is irrational for self-interested individuals to take part in collective action given specific circumstances. The subsequent paragraphs will explain why this is the case and the concluding paragraph will give a justification of why Olson's account of the collective action problem was used as an approach.

Olson reasons that rational individuals will not participate in collective action to obtain non-excludable goods (1971, 2). Two elements are critical here. One, the assumption of a rational individual and two, the concept of a non-excludable good. A rational self-interested individual is an assumption that is prominent in classical and neo-classical economics. This concept views the individual as a free and autonomous decision maker who acts upon own selfish interests (Flam 1990, 39-40). A non-excludable good is a good which upon provision can be accessed by a certain group or collective. This means that if the individual is part of the group or the collective, the individual cannot be excluded from accessing the respective group's or

collective's good, irrespective of the individual's contribution to the group's or collective's good. These two concepts are the main pillars to understand the occurrence of the collective action problem.

Having highlighted these two fundamental concepts it is important to underline what collective action is in Olson's view. Collective action is the act of an individual to engage in any form of collective effort. Once the collective succeeds in pursuing its shared interest, the collective good is available. This good can be either excludable or non-excludable. Excludable goods are those which are accessible only to an identifiable group of people. Non-excludable goods are accessible to all those who want to access it, no matter if they engaged in pursuing the respective collective's common interest or not. Hence, it is possible for the whole population to access such a non-excludable good (Olson 1971, 5-14).

The collective action problem occurs, if there is no incentive for a rational individual to join collective action, because they know that once collective action succeeds, the beneficial good is provided, is accessible to them independent of their own contribution. Thus, the rational individual will prefer not to invest its own individual cost associated with pursuing the common interest. This, however, only applies to non-excludable goods. Fundamentally, this gives the rational individual an incentive to "free ride" upon collective efforts of others, and the possibility to enjoy the good, in case collective action is successful despite the absence of one's own contribution. In Olson's words:

> Though all of the members of the group therefore have a common interest in obtaining this collective benefit, they have no common interest in paying the cost of providing that collective good. Each would prefer that the others pay the entire cost, and ordinarily would get any benefit provided whether he had borne part of the cost or not.
>
> (Olson 1971, 21)

This displays that based on the rationality of the individual and the premise that the common interest regards a non-excludable good, the collective action problem will emerge and the collectively aspired good will not be provided at all. If all give in to their rational incentive to free ride, collective action will not take place despite a common interest in achieving this goal.

The previous paragraphs have highlighted the two main factors for the occurrence of the collective action problem -- in Olson's account. Additionally, Olson emphasized the importance of group size and selective incentives on overcoming the collective action problem (Olson 2008, 6). These two aspects, however, will not be reviewed further in this thesis, since they play a diminishing role for analyzing CTAs. One, the group size at stake when discussing CTAs is the whole population, thus small group size does not apply as a countering factor to make collective action more probable. Two, selective incentives such as, e.g., cash payments for individual contribution do not apply for CTAs either. Moreover, this thesis is not concerned with explaining what factors can lead to an amplification of the respective collective action problem. Instead, the collective action problem aims to explain the low adoption rates by conceptualizing the dichotomy between the individual benefits and the collective non-excludable good.

This aspect is the most interesting for the question: why individuals have not downloaded CTAs even though it leads to the collective good of containing the SARS-CoV-2 virus. This outline therefore is limited to a similar scope taken in T*he Logic of Collective Action (*1971) because Olson's emphasis on non-excludable goods is more applicable to the case of CTAs than other collective action accounts such as Ostrom (1990) or Hardin (1982). This does not imply that there are no other valuable and reasonable accounts of collective action. However, the applicability of Olson's account was convincing to select it as an approach to understand low adoption rates of CTAs. How Olson's *Logic of Collective Action (*1971) plays out when applied to CTAs will be laid out in the following section.

Collective Action and Containing the Virus

This subsection will utilize Olson's collective action problem to explain the occurrence of low adoption rates of CTAs among populations in Europe and the US. According to the underlying assumption of a self-interested individual, it is irrational to download the CTA in order to contain the virus. This is mainly because of two factors. Firstly, there is an individual cost involved in downloading the app and secondly, containing the virus is a non-excludable good.

Regarding the individual cost involved in downloading the app, as already mentioned merely the time and effort put into downloading the app represents a commitment, for which the individual does not directly receive a tangible benefit. However, more substantially, for most individuals is the fact that by downloading the app they are effectively consenting that their personal data will be accessed and will be processed.

This means that depending on which data one has consented to be processed "any information relating to an identified or identifiable natural person" (General Data Protection Regulation 2016, Art. 2(1)) can be subject to "collection, recording, organisation, structuring, storage, adaptation or alteration, retrieval, consultation, use, disclosure by transmission, dissemination or otherwise making available, alignment or combination, restriction, erasure or destruction" (General Data Protection Regulation 2016, Art. 2(2)). There are of course legal safeguards put in place by the General Data Protection Regulation, such as the purpose limitation principle, which attempts to restrict the processing of personal data to the purpose it tries to fulfill (General Data Protection Regulation 2016, Art. 4(1h)). This however does not diminish the risks for individual privacy when data is processed for the purpose of the CTA. Since the fundamental nature and goal of the app is to limit the spread of the disease. The app traces the number of people a singular person was in contact with. While there may be a degree of anonymity present through the pseudonyms the technology gives to each device, the fact that ultimately the app also has to contact each person. This shows how easy it could be to potentially break this anonymity. At the end of the day, even if each phone has a pseudonym for the purposes of the app, it has this pseudonym for the entire time (which is necessary to track contacts over a given period), thus making an identification of the pseudonym with a particular phone and subsequently a particular person possible. Furthermore, even if this anonymity is upheld, information regarding how many people one has encountered how closely at what times for how long, can also represent a serious undermining of personal privacy, and reveal a lot of the activities one has done.

This privacy cost and risk applies to both, central and decentral CTA architectures, as both process personal data and can be subject to different forms of privacy breaches (Cho, Ippolito and Yu 2020, Vaudenay 2020). This shows that the individual downloading the CTA indulges

in the personal cost of the processing of their respective personal data, plus the potential cost of an uncertain risk from a data breach.

The second reason for the rational individual to refrain from downloading the CTA can be based in the non-excludability of the CTA good provision. The primary reason why CTAs were built can be grounded in the idea of efficient contact tracing to enable the containment of the COVID-19 disease. Containing the COVID-19 disease is dependent on a collective action, since the COVID-19 disease spreads through human contact. Nevertheless, once the containment of the virus is obtained nobody can be excluded from the benefits the collective effort has produced. Everyone has the possibility to benefit from the decreased health risks, the relaxation of lock down regulation or other constraints which came along the COVID-19 pandemic. Thus, independent of whether people downloaded the CTA they will be able to benefit from the containment of the virus once it has been achieved. While an individual may receive also benefits privately from the app (e.g., opportunity to protect his own family and friends), the individual will mostly receive public benefits from a decreased spread of COVID-19 in the society independent of whether he personally downloaded the app or not. It is benefits of these kinds that make it viable to apply Olson's collective action problem to CTAs. The extent to which an individual privately receives benefit from CTAs is ultimately irrelevant, it is still society as a whole that profits more from CTAs being used widely and cannot exclude those that do not have the app from benefits of these kinds. Even the individual benefit of increased preparation in light of a likely infection may not be enough to motivate individuals privately to download the app, who however might greatly profit from the non-excludable public benefits of living in a society with decreased COVID-19 infections, partially attributable to an increased adoption rate of CTAs.

Concluding, downloading CTAs as a mean to contain the COVID-19 virus, can be presented as a collective action problem. There is an individual cost and risk involved in downloading the app, while the benefits of the app, mainly after the virus is indeed contained, are accessible to everyone independent of their participation. This shows, that for a rational self-interested individual it is more reasonable to refrain from downloading the app and to free ride of the non-excludable good provision of the virus containment. Hence, one possible

explanation for why voluntary CTAs have not exceeded the 60% threshold is the occurrence of a collective action problem in Olson's terms.

Philosophical Views on Collective Action

The Collective action problem, as described by Olson, can also be seen as being part of the wider political-philosophical debate between communitarian and liberalists. Collective action fundamentally deals with situations of tension between the individual good understood privately and the collective good. The question thus is related with considerations on which of the two should have primacy.

Liberalism, a school of thought pioneered already in the 17th century under thinkers such as Locke and Hobbes, advocates the primacy of individual rights in contrast to some form of the collective goods. For these thinkers, the primary goal of political institutions should be to protect the private rights of each individual (Gaus 1996). All forms of responsibilities the individual might have or be perceived to have to society are secondary to his own individual rights. In the context of CTAs a liberalist, would thus argue that the individual right for privacy stands over the collective good for public health, and that therefore the individual cannot be made responsible to download the app.

An extreme liberalist might even go so far as to argue that the app itself should not be allowed, as even if the act of downloading it is voluntary, societal pressure might coerce individuals into downloading it, thus subverting their private right to privacy. If it is the responsibility of the political organization to protect the rights of individuals, the polity should also remove all ways in which those rights might be subverted. However, to completely outlaw such an app might conflict with other private rights and can thus lead to conflicts even within the liberalist conception. One of the greatest individual rights according to liberalists is the right of ordering one's own life in the way one pleases and being free to think and talk what one wishes to think to think and talk (Gaus 1996). Freedom of thought and expression are important individual rights, which as human rights are also strictly protected in western democracies. Choice and active human agency are therefore considered to be of paramount importance by liberalist thinkers. Each man can and should be able to

pursue his own best interest and knows best what his own interest consists of. Directly outlawing the app in the first place would therefore restrict the extent of human choice, as many might privately want to help the common good by downloading the app. Even if it helps protect the individual right of privacy, outlawing the app can undermine other rights and freedoms. Therefore, for the liberalist, and most western countries nowadays, the app must be purely voluntary, but cannot be outlawed.

Communitarianism is at first glance a modern response to liberalism, articulated in the 1980s. At this time the Anglo-Saxon world was led under political figures such as Thatcher and Reagan, whose political policies very much advocated the primacy of individual rights, and tried to limit the reach of the state, and the responsibilities an individual could be perceived to have to the common good (Jaede 2017, 2). Communitarianism however is not a completely modern phenomenon, but also picks up strands of thought from ancient philosophy, most notably Aristotle (Rapp 1994). For communitarian thinkers the individual needs a society and therefore also has responsibilities towards society. They accuse liberalist of falsely separating the individual from his societal context and looking at each man on his own, an atom without contact to wider society. Because of this criticism, communitarian thinkers are fond of calling liberalist atomists.

The key communitarian thinker Taylor in his chapter devoted to atomism, in his book *Philosophy and the Human Sciences* (Taylor 1985), argues that the primacy of rights can only be upheld in particular social and political systems, and therefore the individual has a responsibility to those societies. Paradoxically, to guarantee freedom of thought, expression, and all the other individual rights, the rights of the individual according to Taylor must to a certain extent be limited when they endanger the society, that guarantees the flourishing of these rights. Taylor argues that in acknowledging the primacy of these rights, liberalists acknowledge value in the way of life that enables one to use these rights. We are not concerned with giving the right to freedom of thought or expression to animals, because in our view they do not live in a way that requires this right. By giving those rights to humans, according to Taylor, we acknowledge the reflective, contemplative and varied lifestyle humans are capable of. This lifestyle, however, is only possible in certain political communities. If a political community imposes one particular lifestyle, ideologically,

forcefully, or based on economic necessity on the individual he cannot make use of his private rights, even if he has them. Thus, the individual according to Taylor must be seen in his societal context. He copies the famous statement of the ancient philosopher Aristotle in the 4th Century BC, that man is by nature a political animal (Bell 2001).

In the case of CTAs the communitarian might thus argue that public health is important enough for the society as a whole to function and to ensure the sustenance of a lifestyle that makes use of individual rights to the fullest, which liberalists value so highly. Therefore, it would be the responsibility of the individual to download the app. Each individual has an obligation to society, which is just as important as the obligation the society has in protecting the private rights of each individual. Therefore, the communitarian might argue that the usage of this app should be made mandatory, as is the case in China at the moment. Indeed, Hixon argues that the "right to privacy is a societal bequeathal, not an individual possession" (Hixson 1987, xiv). The individual right to privacy therefore does not trump the community interest.

The liberalist would accuse the communitarian of creating a pervasive state that assumes to know what the good of each individual is. A frequent point of criticism by the liberals is that the communitarians what to enforce a particular way of life for different people and restrict them in their freedoms by enforcing responsibility towards the community. Central to communitarian thinking is the belief that there is a particular conception of a community based common good for all people. By arguing for responsibilities to society, the communitarian essentially enforces a particular way of life on the individual, which he himself may not choose. The question becomes how unique all individuals are. If there is a form of life that can vaguely be perceived as commonly good, even if that lifestyle itself might be very varied, as active, deliberate, autonomous choices in that form of life are important, then the communitarian can justify assigning responsibilities to the individual to protect that way of life. If such a vague common good way of life does not exist however, and the good is very different for each individual, then liberalism with its focus on individual choice as opposed to communal action takes precedence.

In the case of the collective action problem and CTAs it is also a matter of assessing the importance of the public good that can be achieved through the CTAs. In a communitarian perspective individual rights are still important but have to be balanced with the public good. If the CTAs had a very limited effect on public health, but represented a big transgression into personal privacy, even the communitarian might acknowledge that CTAs should be voluntary. In the communitarian assumption the public good after all is inseparable from the goods of the individuals in the society. Thus, excessively reducing the individual good, expressed through privacy, for a small increase in public health might actually overall still decrease the public good.

Similarly, within the liberalist conception the rights of one individual end where the rights of another begin. If the liberalist deems the spread of Coronavirus to be an active endangerment to other people, he might also pursue actions that would penalize infecting another, much like Accidental Bodily Injury. But he would do so on an individual level and would not enforce the usage of a CTA whose effectiveness can only be guaranteed when enough people have downloaded the CTA.

So far, I have argued how for both the communitarian and the liberalist the CTAs might represent a point of tension between the private individual and the common good. In the next section I will, however, argue that privacy is paradoxically a common good as well. In this way the debate becomes less about the importance and primacy between the individual and society but the importance and primacy between two common goods namely public health and collective privacy.

Privacy as a Common Good

Up to this point in the thesis, privacy was mainly treated as good which concerns the individual and its own interests and does exclusively so. This is a common conception, as Solove points out, “privacy is often cast as an individual right and balanced against the greater social good” (2008, 78). Is not also possible to perceive privacy as a common good? One which does not merely affect us on a private plane but also on a societal and common plane? The following paragraphs will highlight that this view is tenable. Especially in the highly

connected and global world, we live in, privacy should not be limited to the conception of operating on the individual sphere. Privacy is gradually gaining relevance in the collective sphere and thus also becomes a value in a collective sense. CTAs operate in this inter-connected world too and therefore it is important to highlight that the debate regarding CTAs is not one which should be limited to a tension between the individual and the collective, but rather as a tension between two counteracting common goods, (a) containing the virus on a societal plane and (b) preserving privacy on a societal plane.

Within the contemporary world, privacy does no longer operate merely in the physical space, but it has moved into the sphere of cyber space (Regan 2002, 384-5). Privacy, in the physical sphere is more concerned with an identifiable individual being present in the physical world and in the location, they are currently at. Depending on the place where an individual finds itself, the individual can infer how private one is at a point in time and in the respective place. Hence, a person in his/her own bedroom can tell the difference to the privacy on a festival. However, in the cyber space, such clear inferences about differences in privacy do not exist. In cyber space it sometimes seems like complete anonymity, nevertheless, it is still necessary to consent to cookies when surfing on websites and one's unique IP address can be traced online for a respective computer (Regan 2002, 387). Furthermore, one cannot certainly say what information has been gathered, inferred, processed and deployed from the time spent online. The point is, to grasp a sense of one's privacy in the virtual world is more difficult than it is the case in the physical world.

The little sense of privacy in the cyber space is amplified through the fact that algorithms operate in this space. Algorithms in this paper are viewed as mathematical and statistical constructs that have the aim to create information output, from data input. Effectively these algorithms can gather data from all individuals and create certain relationships between groups and create profiles. The issue here is that it is not only the individual data that is processed on its own, but it is processed with many other people’s data. This is problematic since, firstly, the data gathered about the individual could be false or unrepresentative. Secondly, the processing of the personal data is brought into context with other people. This means that on the individual data is placed into a relationship with other people, that effectively did not exist previously, but which does now.

This is a grave problem to privacy, especially regarding the aspect of informational privacy, which describes the right[3] to control the information of oneself (DeCew 2018, Sec. 1.1 §1). Once the individual's data is processed with other data, the output that has been generated from that cannot be revoked. It is very difficult to control one's own information, if the personal information is automatically processed with other people's personal information. Hence, the problem is not that individual data is processed, but the fact that correlations are built between the individuals' data and the group. Every individual that operates and takes part in the online environment leaves a digital footprint. This is not necessarily problematic as such, as it might have been the individual's interest to give up one's own privacy. Nevertheless, the difficulty arises once the privacy of many individuals is processed and used to influence and infer things. This is called Big Data. Big Data can infer data about individuals, which the individual has not consented to be unveiled. This can have adverse effect on people's well-being in the real world. What this means is that in the cyber world, people have consented to give up certain aspects of their own privacy in order to pursue things that are important to them. However, the digital footprints they leave can allow things about individuals to be inferred that have they not consented to. This changes the character of privacy, so that it exceeds an individual value and enters the realm of the common good.

To illustrate this, let me give you an example. The person I will talk about lives in a community in which one's spiritual belief is considered your own private matter and there will be no interference of the community with your inner belief. However, in the respective community practicing the applicable belief with others (e.g., in ceremonies, etc.) is not socially accepted and discrimination against one is to be expected if the individual practices the applicable belief with others, nevertheless. Moreover, we assume that the community is embedded in a Big Data world, meaning that people have social media, do their shopping online and conduct financial transaction online. These and other digital activities generate data which can be stored, processed, and analyzed. The result is that Big Data, whoever is on possession and control of it, has several data points about the community's individuals. Using

[3] The term "right" in both of these concepts is very much open to discussion, nevertheless, this paper will not discuss this any further as this exceeds the scope.

these data points, Big Data can make inferences about peoples' preferences, activities, and attitudes (so even about data which was not indeed gathered).

How reliable and powerful such inferences can be, became evident in the prominent case of Cambridge Analytica. Here social media and neighborhood data (among others) were used to target undecided voters with personalized campaign and ideology content to swing their vote to one side. So, let us get back to the example of our person with the belief which is not accepted in the respective community to be practiced with others. Again, Big Data already has quite some data points about the person: friends the person is in regular contact with (e.g., via social media), the neighborhood of the individual (e.g., via online shopping) from which demographic data can be inferred and lastly maybe even some insight about the social class the person (e.g., via online banking where wage or income appears). However, the inference Big Data can make about whether the person practices its belief with others, is limited up to this point. Now let us go further and say that the referring individual has to make a choice whether to download a CTA or not. The individual decided not to download the app because the person is afraid that the CTA data could unveil whether she/he practices its belief with others, which she/he wants to prevent. Given the person's high standing in the community as a council member, she/he is aware of the public attention her/his belief practices get. As others who share the referring council member's belief are less affected by this, they download the app and consent to their data being gathered and processed, they want to contribute to containing the virus. The data, the CTA gathers, and processes of those people feeds Big Data with new data access points.

So, even if the referring council member has not downloaded the app, the proximity contacts the app has gathered, show that the group sharing their common belief, are in contact on a regular basis. Although there is no data which proves that the council member joins these gatherings, it is now know that these gatherings exist and that many of those, holding the respective belief join the gatherings. Thus, it can be inferred that the council member is probable to join or have joined those gatherings. Consequently, the council member might have to expect to be discriminated against due to her/his belief practices with others.

What this example intends to illustrate is that privacy is not merely a private matter, as not only private choices influence one's own and other's privacy. Individual efforts to protect one's own privacy are not sufficient to indeed protect one's own privacy in a world of Big Data. As discussed before, if a good cannot be achieved by an individual effort but if it requires a collective effort, we can speak of a common good. Thus, the example of the unaccepted belief practices has shown that Big Data creates a network via which the resulting data becomes more than the individual data points, which were indeed collected, and which the individuals indeed choose to share. If privacy is an interest, a community has in common, but if this interest cannot be achieved by individual efforts anymore, due to Bid Data, we must consider perceiving privacy as a common good. CTAs are not the cause for privacy to change its character from a private good to a common good, it is simply one new aspect that feeds into the process of privacy changing its character. CTAs contributes to this by feeding Big Data with new data points: close contacts with specific people at certain points in time.

Discussion

As I have shown, privacy can be considered collective good in the context of CTAs, because the more people download the app in the setting of Big Data, the more can be inferred from the data which is available. Individuals' choices (e.g., consent to share specific data and other data not) alone are not a sufficient determinant for the results of such data inferences. Thus, a collective effort is required to pursue the common interest of preserving privacy. Within the debate about low adoption rates of CTAs, containing the virus, therefore, appears to be not the only common good at stake. Potentially, the question about low adoption rates could reflect the undecided societal choice about how to balance two counteracting common goods.

If this is true, this effectively shifts the debate away from the tension between individual interest and common interest. Instead, the question arises how to resolve a tension between two counteracting common goods. Reflecting with this insight on the libertarian-communitarian debate, one realized that two competing common values pose a challenge to the communitarian perspective. The rationale to overrule individuals' choices if a common good applies, reaches its limits when two common goods compete. Libertarians would not be surprised by this limitation, as they argued one cannot know what the common good is, just

by itself -- as the fact of two arising competing common goods highlight. They argue, only individual choices can reflect what society's path should be. However, as the collective action problem has illustrated sometimes individual choices do not get us -- as a society -- there, where we aspire to be.

So, with what insights are we left? This paper came to the realization that it comes down to the question how to make a choose a path of action if two, societally desirable common goods work in opposite directions. In the specific context of CTAs: How to reconcile collective privacy with the common good of containing the virus?

This question shows that a payoff must be made, to not end up in a deadlock situation. An increase of adoption rate, with the intention to contain the virus collectively, adversely affects the common good of collective privacy. The same logic applies vice versa. The discussion about the choice of which good should deserve primacy as guiding principle is one which exceeds the scope of this paper. The complexity and contestation this question would bring about, can be an indication for the following. The choice which of the good should deserve primacy, is so already so difficult to answer for oneself and even more so in general terms, one might be left with a deadlock situation. This deadlock situation could be one way to make sense of low adaptation rates of CTAs. This is because in the case of high doubt -- whether to pursue the good of virus containment or collective privacy -- people might have chosen inaction over action (in terms of downloading and using the app or not). Instead of making a choice in this contentious matter, the people might have relied on other virus containment rules for which an interference with another common good did not apply. Introducing regulations to wear face masks or distance rules would perhaps fall under this category. Clearly, it is not envisioned that this explanation is exclusively valid, it just outlines a further optional candidate for the question why there is little public adoption of CTAs.

Conclusion

This paper has attempted to explain the low adoption rates in Contac Tracing Apps (CTAs). The relevance of this question cannot be understated. CTAs are applications that have been deployed in nearly all parts of the global world to combat the COVID-19 virus. The COVID-

19 virus has influenced and altered the life of billions of people and the app was one of the most technological advanced approaches to combat a virus on a global level. With high CTA adoption rates, the technique of automatic contact tracing could have helped to break infection chains in a more effective manner. Furthermore, the test capacities could have been brought about a more significant effect if all contact of a positive case would have been informed timely and reliably. This crucial process was rare at the beginning of the COVID-19 pandemic. CTAs could have been a solution to this and could have contained the spread of the virus more effectively. Yet for this to be the case the premise that enough people would have downloaded the app, must apply. This however was not the case.

Especially in Western Democracies, the public adoption rates remained low, which is paradox, because these Apps could have maybe allowed society a more comfortable and secure living with the virus. A way that could have not resulted in the restriction of personal liberties, and likewise a way through which more human lives could have been saved. This cannot be overstated and yet the individuals in the society failed to reach above the public adoption of 60%.

This paper has found that one potential explanation to the low public adoption can be explained by conceptualizing the problem as a collective action problem. The collective action problem was applied, because it is perceived as the most applicable approach to highlight the tension between individual interest and the collective interest, which one can identify when looking at the download/usage decision of CTAs. The model predicts that the rational individual will not download the app and will free ride on the time and privacy investment of others in case collective action would succeed. As all individuals are assumed to act in this way, according to the model, collective action will fail. The result is that collective interest in containing the virus is not achieved.

It has been shown that the collective action problem can be applied and that one potential explanation to the low adoption rate is based on the non-excludability of the containment of the virus, which makes it likely for rational individuals to free ride as in case of success they cannot be excluded from the collective good.

This theory of collective action can be grounded in the economic assumptions, that a human is self-interested and utility maximizing. It is important to note that this theory was used, not because this individualistic assumption is shared, but it is an account to how we can grasp the individual in its relationship to the collective. This is the benefit of economics, in this case, it allows us to describe macro behavior on a micro level. Moreover, the predictions of the model apply to the empirical observation rates of CTAs. However, this does not imply a causation nor validity of the assumption behind the collective action theory.

As the collective action problem has highlighted the low adoption rates of CTAs can be understood as the manifestation of the tension between individual and collective interest. As the matter of this tension is a topic which philosophers contemplate about for a long time, two major streams of thought are reviewed to see whether a normative approach can shed light on the low adaptation rates of CTAs. This paper has focused in the liberal-communitarian debate. The liberalist-communitarian debate entails two opposing stances which provide a normative approach how to deal with the individual and collective interest tension. There is not one single for each of the streams of thought. Therefore, they were outlined along their most central arguments. The communitarians argue that it is necessary to override individual choices in cases in which a common interest prevails. Liberals, however, view the process of determining a common good as something politically laden. Instead, they defend that it is best if individuals can live according to their own preferences. The aggregate result of those individual preferences is not objectionable in their eyes.

The last section of this paper was concerned with introducing and arguing for the idea that privacy should not only be considered a private interest but as collective interest too. The main argument here was that, as we live in a world in which Big Data is employed, privacy has changed it character from private interest to collective interest. Since Big Data can make inferences about (private) data which was neither gathered nor consented to be dealt with. In this sense, our individual choices about protecting our privacy are undermined by the fact that we can give up parts of our privacy involuntarily. Only a collective effort can then preserve privacy of oneself and of others since an individual effort does not suffice to protect privacy.

Having established that privacy can and should be considered not only a private interest but as a collective interest, triggered to review the liberalist-communitarian debate in light of this new perspective. By recognizing the presence of two competing common goods, containing the virus and preserving collective privacy, the communitarian approach is faced with a challenge. They cannot provide an insight how to choose a path of action in case one is faced with two conflicting common goods. Even if society is willing to override individual choices the problem which of the two common goods to pursue remains. The liberalists would not be surprised by this challenge as they criticize the communitarian for the idea that a common goods exists per se and that this common good needs to be figured out. The presence of two competing common goods on the case of CTAs would be an illustration of this challenge.

In the end this paper recognized that either there as to be a payoff made between virus containment or collective privacy, or otherwise a deadlock situation occurs. The deadlock situation is the more likely scenario, because the difficulty deciding upon a payoff between the two is already delicate for oneself, even more so in a general way on a societal place. This deadlock situation could be one way to make sense of low adaptation rates of CTAs. People could face of high doubt whether to pursue the good of virus containment or collective privacy, when deciding to download the app or not. Here, people might have chosen inaction over action (in terms of downloading and using the app or not). Instead of making a choice on this contentious matter, the people might have relied on other virus containment rules for which an interference with another common good did not apply. It is not intended that this explanation is exclusively valid. Rather, the intention is highlight that it might be a candidate for a set of explanation for low adoption rates of CTAs.

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