COVID-19 Conspiracy Beliefs among Students in China and Germany – Causes and Effects

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Abstract

Based on survey data collected during the COVID-19 pandemic in Germany and in China (N=959), we study how widespread conspiracy theories are, what personal and political factors influence the tendency to believe in them, and what consequences the belief in conspiracy theories has on the attitudes towards protective measures. We focus on university students to enable comparability between China and Germany. We find that the belief in "neutral" conspiracy theories is very similar between Germans and Chinese living in Germany, but "anti-China" theories are much more common among Germans, while "anti-US" theories are much more common among Chinese. In China, we find that the conspiracy theory about a US-origin of COVID-19 has already turned into a "mainstream" belief that is shared by the *majority* of students. We find that in all samples, patriotism is positively correlated with conspiracy beliefs, but for Chinese, it plays a distinctive role because it impacts the kind of theories they believe in. Conspiracy theories lead to a lower degree of acceptance of social distancing rules, masks and vaccines. Interestingly, the belief in conspiracy theories does not affect opinions regarding the protective effects of masks.

Keywords: SARS-Cov-2, COVID-19, conspiracy theories, conspiracy myths, uncritical patriotism, disease prevention, social distancing, face masks, vaccination.
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1 Introduction

The COVID-19 pandemic has impacted the lives of people worldwide in a way that no other pandemic has in the last hundred years. In absence of an efficient treatment or a vaccine against the disease, we can only rely on measures that minimize the spread of the pandemic, like social distancing or wearing masks. The behavior of every individual in the society plays a crucial role in managing the crisis. Unfortunately, there are numerous factors that negatively affect compliance. One such factor that has been widely discussed in the past months is the belief in conspiracy theories. It is, therefore, important to assess how far-reaching these beliefs are, how they originated, and how they affect the prevention of the spread of the pandemic.

In this article, we will discuss all the mentioned aspects and we will particularly focus on questions that cannot be easily answered on the basis of the existing literature on conspiracy theories.

First, we will study the population of university students to see whether conspiracy beliefs are widespread among better educated young persons (Section 5).

Second, there is a strong *national* aspect in COVID-19, as its outbreak in China coincided with increasing political tensions between China and the US and an increase in nationalism, especially in China, but also elsewhere. We will focus on this special feature in Section 7 of this article by comparing conspiracy beliefs that are widespread among Germans, Chinese living in Germany, and Chinese living in China.

Third, we will study the effect conspiracy theories have on the preventive actions taken by people. In particular, their effect on wearing masks has not been thoroughly studied yet, and we aim to fill in this gap with our survey data (Section 8).

This paper is structured as follows: we start with discussing previous literature on this topic (Section 2), in particular regarding the history of conspiracy theories, factors influencing beliefs, and their effects on health prevention. In Section 3, we give an overview on the occurrence and spread of COVID-19-related conspiracy theories, present some interesting, albeit mostly qualitative, results regarding the special situation in China, and finally derive a set of hypotheses (Section 3.2) based on previous literature. In Section 4, we describe our survey methodology, in particular the survey items and the sample structure. Afterwards, we discuss results regarding

influencing factors of susceptibility to COVID-19 conspiracy theories (Section 6) and the special role of patriotism, in particular among Chinese (Section 7). We finally look at effects of conspiracy beliefs on health prevention (Section 8), before we briefly discuss limitations and possible extensions in a concluding section.
Before closing this section, we would like to remark that research in the times of a pandemic requires fairly quick adjustments to keep up with the current developments. Not everything can be planned well in advance, and we cannot travel back in time to give answers to questions that became interesting only later on. We believe that an important advantage of our data collection process on conspiracy beliefs is that it began already in March 2020, at a fairly early stage of the spread of the virus when the lockdown in Germany was just imposed.
Due to the relevance of the topic, we also refrain from "streamlining" our paper towards one or two interesting and new findings, but will also report findings that merely support previous evidence, since such replications can be useful in assessing the validity of the results of previous studies in the context of the COVID-19 pandemic.

2 Literature

2.1 Historical remarks

Conspiracy theories are an old phenomenon – one that has always been associated with politics. Examples include conspiracy theories about Illuminati, Catholics or Communists that played a role in election campaigns throughout the American history (Hofstadter 1966). Anti-semitic conspiracies became state-doctrine in Nazi Germany, and wars were always a fertile ground for conspiracy theories (Van Prooijen 2018).
The extent of beliefs in such theories was already large before the widespread use of the internet: for example, Goertzel (1994) found that 41% of US Americans believed that the US air force intentionally withheld information regarding the existence of flying saucers. A later overview over the extent of beliefs in the US by Oliver & Wood (2014*b*) also finds a high number of people believing in conspiracy theories: more than half of the Americans believe in at least one of the mentioned conspiracy theories.

Given the long history of conspiracy theories, it is no surprise that there is also a rich literature on parameters that are related to the belief in conspiracy theories which will be reviewed below.

2.2 General results on conspiracy beliefs

The so-called case-consequence matching was found by psychologists to be an important factor leading to these beliefs (Leman & Cinnirella 2007, LeBoeuf & Norton 2011): people tend to believe that "big" events need to have "big" causes and cannot just be the result of pure chance. COVID-19 is, of course, a big event, thus it could be expected that numerous conspiracy theories about its origins would be made up.

Another factor that strengthens the belief in conspiracy theories is a sense of lack of control. The belief enables persons to regain some of this control by at least "knowing" a culprit for fateful events that otherwise could only be attributed to bad luck (Whitson & Galinsky 2008).

Cacioppo, Petty & Morris (1983) showed that the need for cognition enables persons to rely more on the quality of arguments when forming opinions, thus "people who are low in need for cognition may find it easier to accept conspiracy theories" (Abalakina-Paap, Stephan, Craig & Gregory 1999). This relates to studies on the effects of cognitive abilities. Here, the conclusions are not as clear as one might a priori assume: conspiracy theories are not only a topic for people with low cognitive abilities. Nevertheless, there are some studies that point to a negative correlation between cognitive abilities and the belief in conspiracy theories (Stieger, Gumhalter, Tran, Voracek & Swami 2013), particularly regarding crystallized intelligence (Swami, Coles, Stieger, Pietschnig, Furnham, Rehim & Voracek 2011), although others find no such relation (Mikušková 2018), and emotional intelligence does not seem to have an influence on the tendency to believe in conspiracy theories (Brotherton, French & Pickering 2013).

While an effect of intelligence seems likely but cannot be proven with high certainty, there is ample evidence on the effects of education (van Prooijen, Krouwel & Pollet 2015, Douglas, Chapin & Nolan 2016, van Prooijen 2017): more education correlates with lower beliefs in conspiracies where the precise mechanisms of this are not fully understood yet.

It is also important to note that conspiracy beliefs tend to strongly intercorrelate: in other words, a person who believes in a flat earth is more likely to believe in chemtrails. This allows to define the concept of a "conspiracy mentality" (Moscovici 1987, Imhoff & Bruder 2014). The intercorrelation is so strong that sometimes even beliefs in contradicting conspiracy theories correlate positively, as Wood, Douglas & Sutton (2012) demonstrated.

2.3 Cultural factors

In our study, we will discuss differences in COVID-19 related conspiracy beliefs between China and Germany, thus we would like to highlight previous findings on the effect of cultural dimensions. Imhoff & Lamberty (2017) and Biddlestone, Green & Douglas (2020) show that individualism (IDV), a cultural dimension found by Hofstede (2001), positively affects the belief in conspiracy theories. The reasons for that can be summarized as follows: individualistic societies encourage the need for uniqueness. Conspiracy theories provide people with the possibility to feel unique by believing in them and not in the "mainstream" opinion (Biddlestone et al. 2020).

Another cultural dimension that has been found to be related to conspiracy beliefs is analytic thinking. The concept of holistic and analytic thinking styles was pioneered by Nisbett (2004) and Peng & Nisbett (1999). A lower degree of analytic thinking style has been shown to increase beliefs in conspiracy theories (Swami, Voracek, Stieger, Tran & Furnham 2014).

Notwithstanding particular cultural differences, minorities tend to believe in conspiracy theories more easily (Goreis & Voracek 2019, Wilson & Rose 2014). This can also be caused by the aforementioned factor of perceived lack of control. Thus, the status of such minority groups within their host country should play an important role here as well.

2.4 Effects on health prevention

COVID-19 is not the first disease which brings along conspiracy theories (Oliver & Wood 2014*a*). Such theories are particularly frequent and damaging in health prevention. Vaccines are a frequent topic (Jolley & Douglas 2014, Kata 2012), and such theories have also been shown to be problematic in AIDS prevention (Herek &

Glunt 1991, Herek & Capitanio 1994), or recently in the prevention of the spread of Zika (Klofstad, Uscinski, Connolly & West 2019) and Ebola (Vinck, Pham, Bindu, Bedford & Nilles 2019).

In case of COVID-19, where the number of preventive measures is limited, we focus on measures such as social distancing, masks, and vaccinations (given that the latter are available).

For social distancing, several studies have already shown a negative impact of conspiracy beliefs (Allington, Duffy, Wessely, Dhavan & Rubin 2020, Biddlestone et al. 2020, Miller 2020, Imhoff & Lamberty 2020). On the macro level, the lack of compliance with social distancing rules has also been documented (Rieger & Wang 2020*a*, Rieger 2020*a*) and its connection with civic culture studied (Durante, Gulino & Guiso 2020). Conspiracy theories have also been shown to be a decisive factor in the judgement of the restrictions imposed by the government (Rieger & Wang 2020*b*).

There is also some research on vaccination that shows that the willingness to get vaccinated upon availability of a vaccine is not high in many European and North American countries (Neumann-Böhme, Elsem Varghese, Pita Barros, Brouwer, van Exel, Schreyögg & Stargardt 2020, Thunstrom, Ashworth, Finnoff & Newbold 2020, Rieger 2020*c*).

Another tool to minimize the spread of COVID-19 are face masks. The willingness to wear a mask is so low in some groups of people, for example in Germany, large protests were organized against the obligation to wear masks *while shopping*.[1] Conspiracy theories seem to play a large role in the mobilization of demonstrators (Deutsche Welle 2020). The reasons for the unwillingness to wear masks have been studied briefly in Rieger (2020*b*), but otherwise many questions are left open that we aim to answer with this study.

3 COVID-19 related conspiracy theories

3.1 Spread of conspiracy theories

Conspiracy theories about the origins of COVID-19 were propagating fast, especially through social media (Gruzd & Mai 2020, Ferrara 2020, Alshaabi, Minot,

[1] In Germany, it was never prescribed to wear masks on the street.

Arnold, Adams, Dewhurst, Reagan, Muhamad, Danforth & Dodds 2020, Pennycook, McPhetres, Zhang, Lu & Rand 2020, Molter & Webster 2020). Already in February, warnings about their negative impact were published (Depoux, Martin, Karafillakis, Preet, Wilder-Smith & Larson 2020).

The spread of conspiracy theories can in some instances be traced back to particular activities in social networks that used conspiracy theories for political purposes where bots (automatized posting programs) played a major role (Ferrara 2020, Gruzd & Mai 2020). Conspiracy theories also caused widespread incidents of Sinophobia, especially during the onset of the crisis outside China (Schild, Ling, Blackburn, Stringhini, Zhang & Zannettou 2020, Bieber 2020).

In China, the situation was different due to the fact that the virus originated there, thus the COVID-19 related conspiracy theories in China deserve a closer look. The spread of these theories was, indeed, very fast: already on January 2 there was a video in Chinese posted on Youtube that dismissed such theories (which implies that they must have already existed by that time) (Molter & Webster 2020). It is likely that such theories reflected ideas from previous pandemics, in particular SARS, and then added the idea of a virus that was genetically targeted only towards Chinese (maybe adapted from the highly popular Chinese science fiction novel "The dark forest" by Liu Cixin from 2008). – When cases of COVID-19 grew exponentially outside China and even in the US, the theory was accordingly "patched" (see an example below).

The most popular version of the anti-US theory is that the CIA developed the virus and spread it during the Seventh World Military Games in Wuhan in October 2019 through the US participants. As supporting evidence it is often mentioned that some of the US participants were located close to the Huanan Seafood Market (the first place where mass infections were noticed) and that the US participants did not win a single gold medal at the games (raising suspicion that not real athletes but agents had been sent). The obvious gaps in the theory (why use such a public event to spread a virus when most Americans could easily travel to China; how come the outbreak at the Huanan Seafood Market started only two months after the games; the performance of the US athletes was, in fact, as mediocre as in the previous years) did not seem to reduce its attractiveness enough to prevent its further spread. As a result, during January and February, Chinese state agencies were not only fighting the spread of the virus, but also the spread of conspiracy theories. Here are

two examples: the Beijing News called the anti-US conspiracy theory in an article from January 21 a "mere speculation" [2] and the author of a video advocating the theory was even sentenced to a ten-day detention[3], but this did not stop the spread of various versions of this conspiracy theory.

The situation changed slightly in March: worldwide media coverage caused the high state official Zhao Lijian, deputy director-general of the Chinese Foreign Ministry's Information Department, on 12 March 2020 when he spread these anti-US conspiracy theories via Twitter[4], obviously to fight back the anti-Chinese conspiracy theories propagated by the US president Donald Trump (Molter & Webster 2020). Although this did not become the official party line and the Chinese Communist Party did not publicly support such conspiracy theories, there was also no public distancing from that statement. Chinese media, however, do still report that a fabrication of the virus by the US (or anybody else) contradicts scientific evidence,[5] so it seems unlikely that such statements are actively censored.[6]

The origins of the propaganda of anti-US conspiracy theories on social media are unclear. Its amount, however, was huge, especially on the Chinese social media network WeChat. It often worked also with active manipulation: an example was the (most likely intentional) mistranslation of a statement by Robert Gary, Professor at the medical department of Tulane University, and one of the authors of a study that demonstrated the natural origin of SARS-Cov-2 (Andersen, Rambaut, Lipkin, Holmes & Garry 2020). He simply stated that the first cases must not have been the ones at the Huanan Seafood Market (but occurred earlier), but this was mistranslated into him saying that the first cases were "definitely not in Wuhan".

It is bitter irony that in the same interview, Professor Gary stated "I'm sorry for the conspiracy theorists. The conclusion of the study is: COVID-19 was 'not made at a laboratory'." Their paper had debunked one conspiracy theory, but his mistrans-

[2] Beijing News, "The first time I've ever seen SARS, I've never seen it before. Don't let the 'conspiracy theories' get in the way.", still accessible online on August 9, 2020.

[3] "Inner Mongolia man who fabricated 'new coronavirus is U.S. genetic weapon' was detained for ten days." Online Observer, guancha.cn, February 8, 2020, still online on August 9, 2020.

[4] Ironically, Twitter is blocked in China and its use forbidden.

[5] QQ News, e.g., wrote in an article on July 30, 2020 that the virus was "not manipulated or man-made", https://new.qq.com/omn/20200730/20200730A0IYKO00.html

[6] Statements that the virus most likely originated in China also seem to be missing from current news articles which, however, can be explained with the zero news content of this information.

lated interview gave fuel to another, demonstrating the Sisyphus-style work that scientists sometimes face when dealing with conspiracy theories.

Another mistranslation on WeChat started with a CNN report stating: "CDC confirms first coronavirus case of 'unknown' origin in US", i.e. about the first COVID-19 case in the US that was not "imported" from abroad. This ended up on Chinese social media as the "CDC confirms first coronavirus case originated in US", thus allegedly confirming the conspiracy theory that the virus originated in the US.[7]

A further fuel for the conspiracy theory was provided by a Youtube channel of a US-based Chinese person on the speech given by Andrew M. Cuomo, Governor of New York, on March 31, 2020, at a press conference, where he said: "We've been behind this virus from day one. The virus was in China. We knew it was in China. *Unless we assume there's some immune system variation with Asian people*, it was coming here and we have been behind it from day one since it got here and we've been playing catch-up."[8] The part highlighted in italics was then cut out and mistranslated into Chinese as: "we thought this variation only attacks Asian immune system" which was then used as proof of the conspiracy theory and found wide acceptance on Chinese social media.[9]

In general, we can see a pattern here: snippets of sentences are being taken out of context and mistranslated to fit the conspiracy story. Providing the original video snippet with a content that at least vaguely resembles the statement made, gives credibility to the theory, especially to many Chinese people whose English is good enough to notice the rough similarity, but not good enough to notice the difference. It is difficult to believe that these mistranslations were not done intentionally. We should, however, be careful to suspect a joint "conspiracy" effort behind the propagators of the conspiracy theory, and in particular not a coordinated governmental effort: in some cases, such channels were blocked by the Chinese censorship, e.g. the WeChat channel Sushangguanzhong (a typical source for conspiracy theories where single posts could receive more than 10,000 likes) was closed down during the first half of April.

[7] Both stories are analyzed in details in a text on the Chinese social media platform WeChat, see https://tinyurl.com/y5bjjx3n (retrieved on August 7, 2020).

[8] Video and transcription are available at https://www.governor.ny.gov/news/video-audio-photos-rush-transcript-amid-ongoing-covid-19-pandemic-governor-cuomo-announces-new

[9] See, e.g., the repost on QQ at https://xw.qq.com/cmsid/20200404A0EOTJ00

3.2 Theory

The extent to which people believe in COVID-19 related conspiracy theories seems to be huge, at least in the US and UK (Miller 2020, Freeman, Waite, Rosebrock, Petit, Causier, East, Jenner, Teale, Carr, Mulhall, Bold & Lambe 2020). This can be readily explained by the aforementioned case-consequence matching, the feeling of lack of control that was caused by a virus of which initially so little was known, and the overwhelming multiplier effect of social media.[10]

As regards the overall spread of conspiracy theories, we expect similar numbers in Germany as in the US and the UK. Given the somewhat lower levels of individualism in Germany (that have been confirmed by recent data), the numbers might be slightly lower. For university students we expect lower levels, since the tendency to believe in conspiracy theories is negatively correlated with education.

Given the aforementioned special situation of the pandemic, China is obviously a much more interesting case to study: Can we expect conspiracy theories to have high or low acceptance rates in China? There are numerous potentially relevant factors to consider, especially such of cultural and political nature. As regards cultural differences, there are particularly two dimensions that have been shown to be related to the tendency to believe in conspiracy theories and that are traditionally assumed to demonstrate significant differences in East Asia (in this case China) and the West (Germany): individualism/collectivism and analytic/holistic thinking style.

We have seen that existing literature (Imhoff & Lamberty 2017, Biddlestone et al. 2020) finds that individualism (IDV), a cultural dimension found by Hofstede (2001), results in higher tendency to believe in conspiracy theories. Given that China is considered to be a country with low IDV, we would expect a lower tendency of Chinese to believe in conspiracy theories.

There is, however, a problem: it is not clear whether the traditionally low levels of IDV in China still hold, particularly among young people. Even though IDV values measured among university students are known to be a lot higher than those

[10]There is, however, some criticism on the elicitation methods in Freeman et al. (2020) by Sutton & Douglas (2020) that boil down to the question of "little agreement" to a conspiracy theory could be just a polite form of disagreement. His replication study that used different scales, however, also showed substantial amounts of conspiracy beliefs, in particular when taking the "neither agree nor disagree" category and the extreme content of the theories presented into account.

originally measured among IBM employees (Hofstede 2001), there seems to be an additional effect that accelerates the convergence between China and the West in this cultural dimension. This can be seen, for example, when comparing the classical values measured by Hofstede (China: 20, Germany: 68) that are very far apart when compared with more recent data (collected around 2008) for university students from the INTRA study Rieger, Wang & Hens (2015) where the gap has entirely closed: China and Germany both score 80 on the IDV scale and other East Asian countries catch up with Germany or even overtake it (Japan: 80, South Korea: 80, Hong Kong: 85, Vietnam: 98, Taiwan: 103). Given this apparent development, we do not expect that differences in IDV will lead to a reduced tendency to believe in conspiracy theories among Chinese university students as compared to Germans.

Another factor, holistic versus analytic thinking style (Nisbett 2004, Peng & Nisbett 1999), has also been shown to affect the tendency to believe in conspiracy theories: a more analytic thinking style helps to prevent such beliefs (Swami et al. 2014). The traditionally assumed differences between East Asia and the West have been confirmed in a recent study (data from 2018): Phan & Rieger (2020) find that Vietnamese as well as Taiwanese university students score lower on analytic thinking than Germans. It is, therefore, natural to assume that the difference also persists for Chinese which leads us to the hypothesis that Chinese will, on average, be *more* prone to believe in conspiracy theories than Germans.

There is another potential factor that could lead to this effect: Knobloch, Kroll, Mattil & Rieger (2020) show that political freedom (especially free media) might affect the ability to differentiate fake news from real news. In their experiments they show that the Chinese score lower on this type of critical thinking than Germans and attribute this to the differences in the degree of political freedom. This effect could also lead to more willingness to believe in conspiracy theories among Chinese.

For Chinese people living in Germany, another factor might be relevant, as minorities are more prone to believe in conspiracy theories (Goreis & Voracek 2019, Wilson & Rose 2014), especially if they feel discriminated. Whether this is a relevant factor for Chinese living in Germany (of whom many have a relatively high social status) needs to be seen.

Finally, we also expect some differences between the various types of conspiracy

theories that originated during the COVID-19 pandemic: the virus is most likely to have emerged in China. This simple fact might be less relevant (pandemics can emerge in any country and this has always been the case; high population, indeed, increases the chances of emergence of a virus), but can, of course, give rise to negative psychological, social and political processes: Chinese people worldwide have been bullied because of the outbreak and even incidents of violence against Chinese minorities were reported (Schild et al. 2020, Bieber 2020). From the psychological point of view, this can also result in a feeling of shame or collective guilt among Chinese, and, finally, all of these factors can be exploited for political agenda by various interest groups (anti-Chinese, Chinese nationalists etc.). In view of this, it is very natural that anti-Chinese conspiracy theories would not gain popularity among Chinese, while any theory shifting the felt responsibility for the pandemic away from China (i.e. anti-US conspiracy theories) would easily spread. This might be intensified by the state-controlled traditional and social media in China, but so far there is little evidence for this, as we have seen.

In any case, we hypothesize that the tendency among Chinese to believe in anti-US conspiracy theories is higher than the tendency to believe in anti-China conspiracies. If media played a substantial role, we would further expect that this difference is larger in China than among Chinese living abroad (in this case in Germany). We would also expect patriotism to be a driving force for this difference between conspiracies.

Not everybody had heard about the conspiracy theories that we presented in our study. We measured this for our German subjects. The question arises whether people are less likely to believe in a conspiracy theory when they hear it for the first time in a rather neutral way (as in our experiment). We hypothesize that this will be the case if a person cannot easily relate to the conspiracy theory, either on a personal level or driven by other known beliefs.

In our case, the 5G theory is probably the easiest to relate to: there is a widespread belief in negative health effects caused by cell phone radiation, so to associate this with the threat posed to health by COVID-19 makes sense (in a holistic way) at first sight. The Bill Gates conspiracy is also easy to relate to: Bill Gates is a famous rich person, everybody has used Microsoft products, so a person can easily associate the perceived power of Bill Gates with the evil conspiracy theory and find it plausible, and this effect will be intensified especially if the person does not

view Bill Gates in a positive light for some reason. The other three subjects of conspiracy theories, including secret services, weapon programs or virus research in China are not directly relatable for an average German. In particular, China is a distant country and the general knowledge about China is limited as opposed to the US with its famous movies which frequently involve the CIA. We, therefore, hypothesize that the difference between the tendency to believe in a conspiracy theory – after having heard about it or not having heard about it – is highest for China-related conspiracy theories, followed by the US-related ones, Bill-Gates-related conspiracy theories rank third, followed by the 5G-related ones.

We admit, of course, that it is difficult to predict the availability (Tversky & Kahneman 1973) of these conspiracy theories for an average German in a systematic way, but we think that the above arguments are at least plausible.

Finally, we will study how conspiracy theories affect preventive actions taken by people to fight COVID-19. Based on the existing literature on other diseases and partially also on COVID-19, we expect these theories will negatively affect attitudes toward social distancing, wearing masks and the willingness to get vaccinated. As regards wearing masks, we will also study whether conspiracy theories influence the beliefs in the capability of masks to reduce the spread of the disease.

In summary, this article will study a number of issues related to the causes and effects of conspiracy theories regarding COVID-19, considering some important differences between China and Germany (see Fig. 1).

4 Methodology

4.1 Survey

We conducted a series of five survey waves in the period between March 2020 and June 2020 in Germany and China. Waves 1–3 were advertised at German universities (Trier and Magdeburg) and were conducted in German and, since the number of foreign students at both universities is fairly low, we can assume that the majority of the participants were Germans.[11] For each of these waves, a reward of 50 Euro was announced as an incentive to participate in the survey. Most participants

[11] We will, for simplicity, denote the subjects from these waves as "Germans".

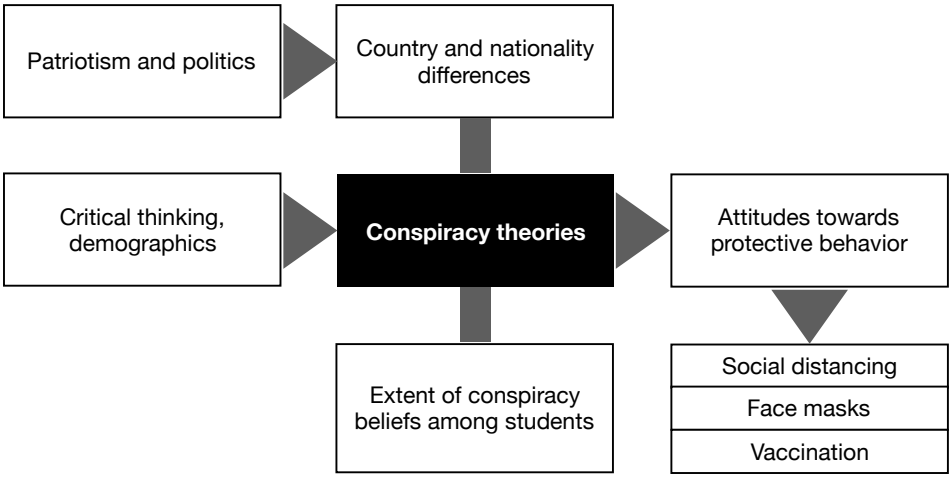

Figure 1: Overview on the research agenda of this article.

were students. Wave 4 was conducted among students at a Chinese university.[12] Wave 5 was advertised on WeChat in the community of Chinese living in Germany.[13] Questions of the survey waves slightly varied, as will be specified later. An overview of the demographics of the participants is provided in Table 1.

We included questions in the survey to measure variables such as the tendency to believe in conspiracy theories, attitudes and behavior regarding protective measures, critical thinking, and a number of other control variables. Given that some of the first results of our study had already been published during data collection for these survey waves, we asked participants whether they were familiar with these results. Since a non-negligible number (N=48) did, we tested whether the conspiracy related items differed significantly for them, but did not find any difference (t-tests, all p-values above 0.4).

In the following, we give an overview of the variable elicitation and definitions.

4.2 Conspiracy theories

We elicited general attitudes towards conspiracy theories with the first questions (items 1 and 2 were also included in the first survey wave of March 2020 and were

[12] Due to the current political situation in China, we do not disclose the name of the university.

[13] We did not prove for nationality here, so we use the word "Chinese" as a simpler term for "people born in China or their children".

Table 1: Demographics of the different subject groups

	—— Germans ——		———— Chinese ————		
	Germany (students)	Germany (all)	Germany (students)	Germany (all)	China (students)
Age av.	23.9	26.7	24.1	33.8	21.5
Median	23	24	24	30	21
Std.error	0.2	0.3	0.7	1.3	0.2
Female (%)	68.3	64.0	62.1	71.6	73.0
Students (%)	100	76.5	100	37.2	100
Bachelor degree (%)	39.6	48.2	79.3	82.4	20.7
Total N	581	759	29	78	122

also posed to the students in China):

1. The media try to hide information about the Coronavirus from us.
2. The hype about the Coronavirus was caused by pharmaceutical companies and other groups that benefit from it.
3. The virus is just an excuse for our politicians to trample on our fundamental human rights.

Each item had four answer options: disagree / somewhat agree / mostly agree / fully agree, coded with the numbers 1 to 4.
In the third and fifth survey waves (May/June), we added item 3 from the above list, and also questions about beliefs in the following popular conspiracy theories:[14]

4. The first patient was an employee of a virus laboratory in Wuhan who got infected by accident.[15]

[14] In March, these theories had either not emerged yet, or they were still too obscure.

[15] This item is the only one that is not considered to be scientifically impossible (although there is also no evidence in favor of this theory). Therefore, we repeated all following analysis without this item, but this did not lead to significantly different results.

5. The US Secret Agency developed the virus and imported it into Wuhan to damage China.
6. The virus was developed by China at a laboratory for biological weapons and spread due to an accident.
7. The spread of COVID-19 is related to the rollout of 5G networks.
8. Pharmaceutical companies and Bill Gates spread the virus to make money from their patented vaccine.

All items provided a five-point Likert scale (very unlikely / unlikely / average probability / likely / very likely), coded with the numbers 1 to 5.
We defined a composite score ("conspiracies score") as the sum of the answers to all of these items, and the following three subscores:

- "Neutral conspiracies": sum of items 1, 2, 3 and 7 (minimum theoretical value 4, maximum theoretical value 19).
- Anti-China conspiracies: sum of items 4 and 6 (2 to 10).
- Anti-US conspiracies: sum of items 5 and 8 (2 to 10).

In between these items, we elicited agreement with statements that reflect the current scientific consensus:

- The virus originated in animals (bats or pangolins) and spread to humans.
- The virus emanated in Wuhan (China).

We defined a consensus score by adding the numerically coded answers to these items (same 5-point-Likert scale as above).
The indices we constructed were tested on reliability: all of them had a Cronbach's Alpha above 0.6. (Consensus: 0.61 (N=398), neutral conspiracies: 0.63 (N=398), anti-US conspiracies 0.63 (N=398), anti-China conspiracies: 0.70 (N=398), (total) conspiracies score: 0.79 (N=370).)
In China, we could only ask items 1–3. Instead, we asked where subjects thought the virus originated from. We gave three answer options: China, USA, and elsewhere. Subjects could state for each option the likelihood on a Likert scale (yes / rather likely / rather unlikely / no), where "yes" was coded as 4 and "no" as 1.

4.3 Critical thinking

We elicited critical thinking with two different scales. First, with these two items, each with a five-point Likert scale (strongly disagree / somewhat disagree / neither agree nor disagree / somewhat agree / strongly agree):

- While searching for new information on a specific topic, I am normally satisfied with one single source.
- While searching for new information, I search both for information that supports my opinion as well as for information that contradicts my opinion and I weigh the arguments against one another.

This scale was taken from Rieger, Wang, Massloch & Reinhardt (2020), adapted from European Commission (2013). We summed the answers to both questions to obtain the variable "critical thinking (2)".
Second, we used the scale from Giancarlo, Blohm & Urdan (2004) with the items:

- It is not very important to insist on trying to solve a difficult problem.
- I search for arguments that support my point of view and not for arguments that contradict it.
- Analyzing the arguments of other people is a waste of time.
- I am aware of my own opinions, why should I pretend to be considering other options?
- Taking into account the opinions of other people means that you are not able to have your own.

We calculated the average of all answers to these questions (on a 4-point Likert scale) to construct the variable "critical thinking (5)".
The Cronbach's Alpha of the two scales were not impressive, but sufficient (0.58/0.56, with N=241/N=369).
As has been pointed out in Knobloch et al. (2020), all of these scales share a common problem: self-assessing critical thinking assumes that a person can think critically about his own deficits when it comes to critical thinking – a self-contradiction. In the context of conspiracy theories it can well be that people who believe in the

most unconvincing theories think of themselves as being particularly *good* at critical thinking abilities, because they are able to "question the mainstream beliefs". Nevertheless, we decided to elicit these variables as control for our study.

4.4 Social distancing

Actual behavior regarding social distancing is very difficult to measure in a standardized survey, since a strong experimenter effect may be present (Rosenthal 1976): social distancing is an expected pro-social behavior, since it reduces the spread of the pandemic. We therefore utilized the theory of planned behavior (Ajzen 1985) as described in Rieger (2020*d*) and we measure antecedents of intention and behavior, namely attitudes and subjective norms. To this end, we use a number of brief hypothetical "scenarios" with the participation of university students. The scenarios were the following:

1. A student celebrates his birthday with his friends on the university campus. None of the friends is in a Coronavirus high-risk group.

2. A student meets his friends for a soccer game. None of them is showing any cold symptoms.

3. Despite having a cold, a student visits his grandmother in a nursing home because she is feeling lonely.

4. A student meets his friends for a jog and does not greet them by hugging as usual and insists that they keep distance, even though his friends tell him that they are not feeling sick.

5. A student tells her friend that it is irresponsible of him to continue to meet his friends, knowing that it may hurt his feelings.

The scenarios were presented in randomized order and evaluated on a Likert scale from 1 to 4, corresponding to "totally okay", "not optimal but understandable", "rather bad", "unacceptable". We define "positive attitudes towards social distancing" by subtracting the average value of the items 4–5 from the average of the items 1–3.

The scale had a Cronbach's Alpha of 0.67 (N=441). The items were measured among Germans in waves 1 (March) and 3 (May).

4.5 Attitudes toward masks and vaccination

We elicited several items on wearing face masks (see Rieger (2020*b*)), in particular how much wearing masks can help to avoid infecting others, not to get infected, and in which situations the participants would wear face masks:

1. How well do you think wearing a face mask protects one from getting infected with the new Coronavirus? (Not at all / little / somewhat / well / very well)

2. How well do you think wearing a face mask prevents one from infecting others with the new Coronavirus? (Not at all / little / somewhat / well / very well)

3. Would you wear a face mask in the following situations (assuming you had one)?

   (a) On the bus

   (b) At the university

   (c) On the street

   (No / probably no / probably yes / yes)

We used the sum of items 1 and 2 as a proxy for the belief in protection by masks, and the sum of the items 3(a)–(c) as the willingness to wear a mask.
We also elicited the (hypothetical) willingness to get a vaccinated against SARS-Cov-2 once it is available on a 4-point Likert scale (no, definitely not / probably no / probably yes / yes, definitely).

4.6 Other variables

We measured distrust of media with the statement: The media try to hide information about the Coronavirus from us. (4-point Likert scale: strongly disagree / mostly disagree / mostly agree / strongly agree)
In case of Chinese in Germany, we asked this question separately for German and Chinese media.
Specifically for Chinese living in Germany we also elicited their media consumption, in particular whether they use the Chinese social network WeChat or the

American platform Facebook. We also asked them to state whether they agreed or disagreed with the following statements:

- Western society would love to see China fall.
- I do not think it is appropriate to publicly discuss the dark sides of society.

In all cases, there was a 4-point Likert scale (strongly disagree / somewhat disagree / somewhat agree / strongly agree). We refer to these questions in the survey as "perceived anti-Chinese sentiment", "hiding dark sides".
To measure the effect that patriotism can have on the tendency to believe in conspiracy theories, we included two different questions into the survey, following, for example, Schatz, Staub & Lavine (1999) and Kahne & Middaugh (2006) who distinguish between blind/uncritical and constructive/critical patriotism:

- We all should be willing to fight for our country whether it is right or wrong. Do you agree or disagree with this statement? (4-point Likert scale: strongly disagree / mostly disagree / mostly agree / mostly agree)
- Are you proud to be German/Chinese? (4-point Likert scale: very proud / rather proud / rather not proud / not proud)

We refer to the answers in the following as "uncritical patriotism" and "patriotism".
We elicited trust in official information about COVID-19 asking to state whether the participants agree or disagree with the following statement: I trust official information about the virus in Germany/China. (4-point Likert scale: Disagree / somewhat agree / mostly agree / fully agree)
We elicited worries about the COVID-19 with the following question: How worried are you personally about the consequences of the Coronavirus? (5-point Likert scale: very little / little/ somewhat / quite a bit / a great deal)
We measured risk aversion with respect to health on a scale introduced by the German socio-economic panel (SOEP) (see Richter, Metzing, Weinhardt & Schupp (2013) and references therein): How would assess your willingness to take risks in situations related to your health? (Likert scale from 0 to 10, with 0=not prepared to take risks, 10=fully prepared to take risks)
We also asked participants how many people aged 70 or above they know personally, considering that older people make up the high-risk group for COVID-19.

We finally elicited standard demographic variables: age, gender, occupation (coded as student (yes/no) and working (yes/no)), highest education degree (coded as bachelor degree (yes/no)).
Descriptive results for the core variables of interest will be presented in the results sections. Descriptive statistics for all other variables in form of a summary table can be found in the appendix.

5 How widespread are conspiracy theories about COVID-19 among students?

In this section, we want to study the spread of conspiracy theories and, in particular, whether there are systematic differences between countries in this respect. As we have seen, this could be expected, especially in case of China. Taking Chinese students in China as well as Chinese in Germany into our sample helps to disentangle to some extent the effects of political and media surrounding and the inherent (patriotic) motivations on the tendency to believe (or not to believe) in certain conspiracy theories.
Descriptive statistics of the consensus belief and the three conspiracy dimensions that we defined in Section 4 reveal, at first glance, that there is a surprisingly large number of students (Chinese and Germans alike) that do not reject conspiracy theories entirely – although the majority of students are also not strong proponents of these theories (Fig. 4, the bars show the distribution of students according to their attitudes toward each item, colored green (students rejecting conspiracy theories), yellow and red (neutral), and black (strong belief in conspiracy theories)). We also see a substantial number of students doubting the plausibility of conspiracy theories.
When looking at individual conspiracy theories (Fig. 2), we find an alarmingly large rate of (at least partial) support. This corresponds to the aforementioned findings for the US (Miller 2020) and the UK (Freeman et al. 2020). Given the methodological critique by Sutton & Douglas (2020), we present both optimistic as well as conservative estimates of the proportion of students believing in the theories. The numbers are in general a bit lower than for the US and the UK, but this might be also due to the fact that we limited the survey to university students.

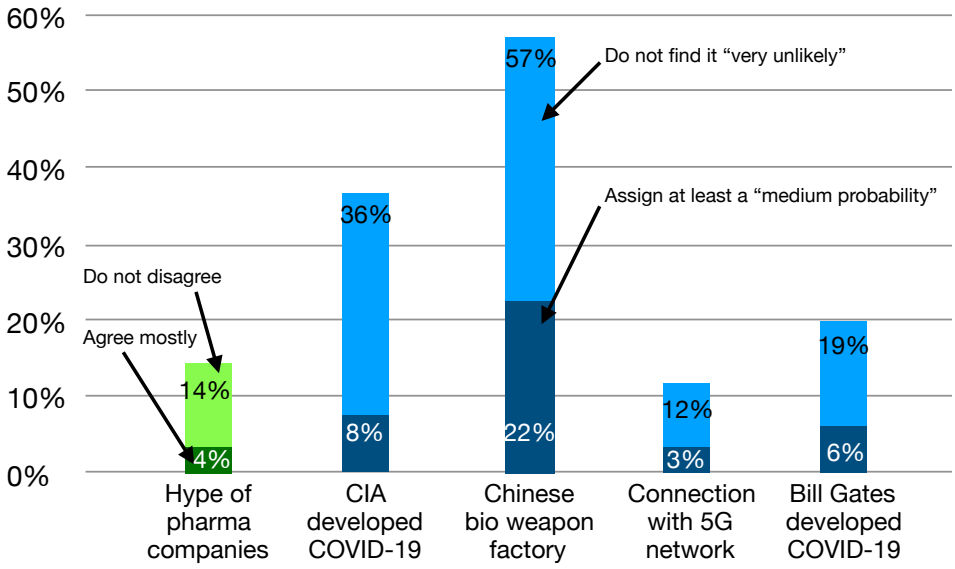

Figure 2: Proportion of German university students believing in five widespread conspiracy theories.

As regards the differences between Germans and Chinese (both in Germany and in China), there seem to be significant differences with respect to anti-Chinese and anti-US conspiracy theories, but with regard to neutral conspiracies we find only a small difference, if at all. The statistical analysis confirms this first impression (Table 2), where we conduct not only t-tests, but also Mann-Whitney U tests since the distributions are highly skewed.

As explained before, we could not pose the same questions in China, but we asked how likely the participants thought it was that the virus originated in China (scientific consensus), the US (according to the CIA conspiracy theory, widely popularized in Chinese social media) or elsewhere (Fig. 5). We were expecting that the number of participants believing that the virus originated in the US would be higher in China than in Germany, but we were still surprised by the exact numbers: the majority of students in China believe that it is more likely that the virus originated in the US rather than in China. Given that university students have likely more chances to expose themselves to foreign media content (by “jumping the wall”, i.e. circumventing the Chinese censorship) or simply consulting research papers on COVID-19 to which they have free access in China, this suggests that the belief in

anti-US conspiracy theories in the broad population might be even higher. Simply put: what we consider a rather obscure conspiracy theory, the average person in China considers to be the reality.

When comparing Chinese people in China with Germans in Germany based on the tendency to believe in "neutral" conspiracy theories, we also find a significant difference. Here, we have data only for item 2 of our list of conspiracy theories (see Section 4). The average answer in Germany was 1.18, but the average answer in China was 1.37. Both values are significantly different (t-test: $p = 0.002$). Chinese living in Germany are on this scale in-between (1.25, no significant difference to either of the other groups).

We would also like to mention that there was no significant difference in this item over time, although we have measured it three times among the German subjects (end of March, April and May).[16] This implies that the increase in the media coverage of conspiracy theories about COVID-19 starting in May (measured by the number of articles in the FAZ, the leading german quality newspaper, see Fig. 3) did not have any visible impact on this. This, however, corresponds to data from Google trends on search entries for "conspiracy", "Bill Gates" or "5G", all of which first increased already in the middle of March. Therefore, it seems likely that the media coverage just follows with some delay the spreading of these conspiracy theories.

Table 2: Differences in belief in conspiracy theories in Germans and Chinese living in Germany.

Belief in:	Germans	Chinese in Germany	t-test	Mann-Whitney U Test
Consensus (scale from 2 to 10)	8.3	6.5	<0.001	<0.001
"Neutral" conspiracies (4 to 19)	5.0	5.3	0.29	0.02
Anti-China conspiracies (2 to 10)	4.6	3.0	<0.001	<0.001
Anti-US conspiracies (2 to 10)	2.8	3.7	0.004	<0.001

[16] In a recent follow-up survey in July and August, there was again no significant difference.

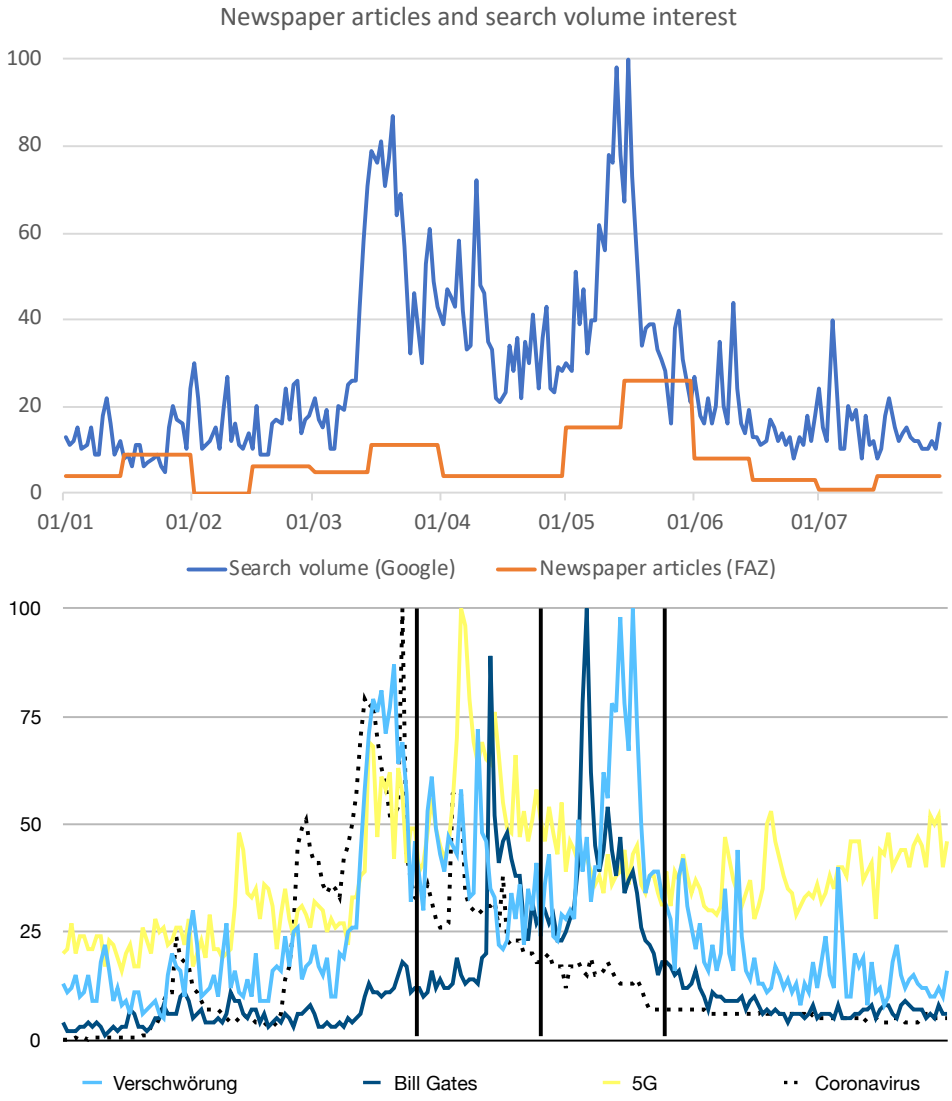

Figure 3: Top: Google search volume index and number of articles in the German FAZ for the item "conspiracy (theory)" (German: Verschwörung): the highest media interest occurred only in the second half of May, while search volume had its first large peak already in March. Bottom: Google search volume index in Germany for the words "conspiracy", "Bill Gates", "5G", and (for comparison) "Coronavirus". We see a clear increase of searches of conspiracy related topics already in mid-March. The approximate survey dates are marked with vertical lines.

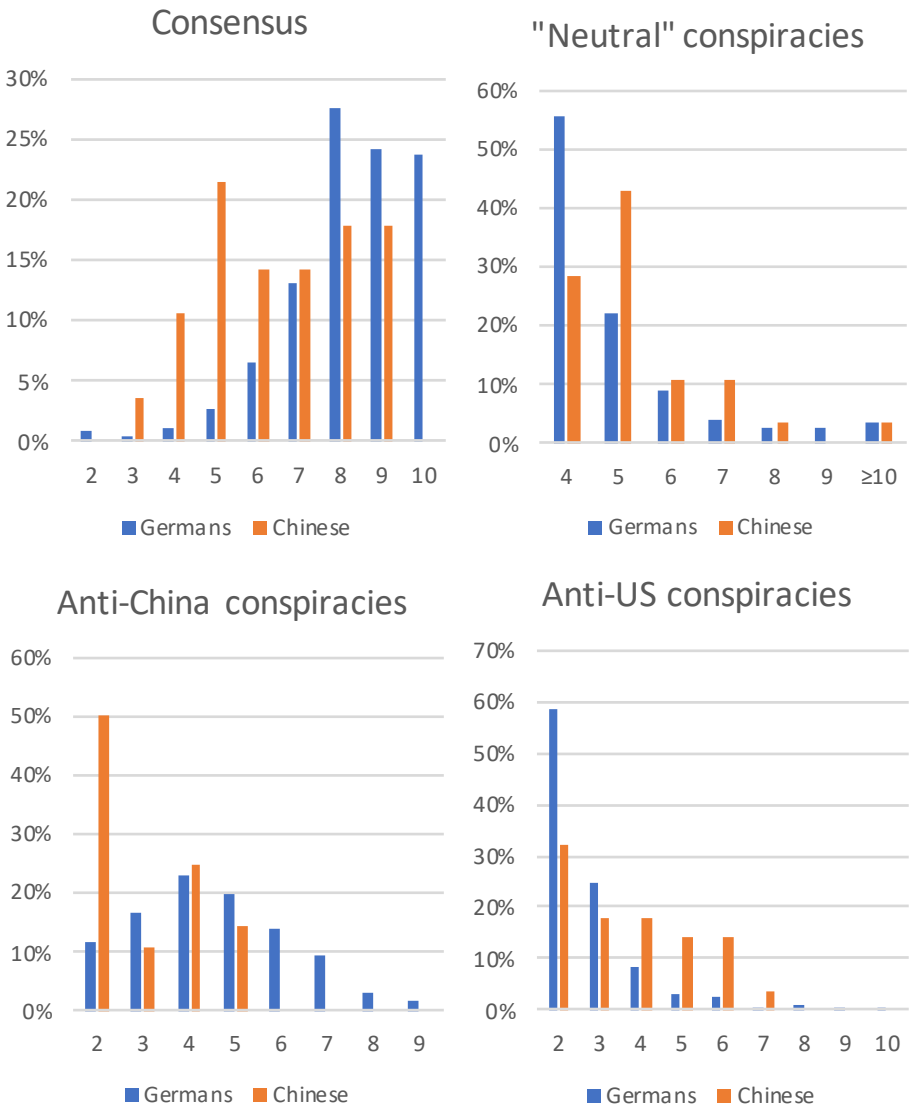

Figure 4: Distributions in belief in scientific consensus and various categories of conspiracy theories among Germans and Chinese living in Germany: 2 (or 4 for "Neutral" conspiracies)=lowest level of belief, 10=high level of belief.

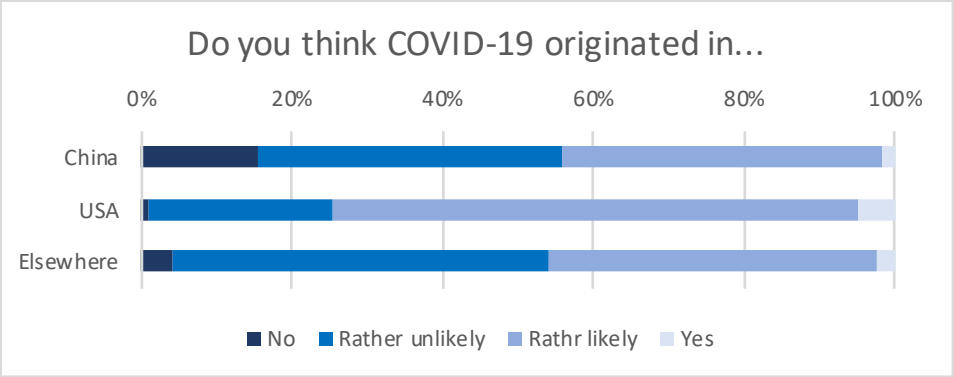

Figure 5: Belief in the origin of COVID-19 in China, an indirect way of measuring the extent of conspiracy theories: subjects think that it is most likely that the virus originated in the US, which corresponds to the conspiracy story supported by the Chinese government.

6 Factors influencing the susceptibility to COVID-19 conspiracy theories

What factors increase the tendency of people to fall for conspiracy theories? As discussed in Section 3.2, we will study the role of demographic variables (since our sample consists of university students, we consider only gender and university degree), self-assessed critical thinking, and risk preferences. Finally, we will take a look at the intercorrelation between the beliefs in different conspiracy theories. As it will turn out, these factors differ across populations, so we will study them separately.

6.1 Germans in Germany

We conducted a number of linear regressions on the three conspiracy dimensions and the consensus score, also controlling for age. We refrain from providing all tables, but just summarize the (few) significant results that we find:

- Consensus is lower for females and for people that are more likely to take risks in health-related situations. All other factors are insignificant.
- Neutral and anti-China conspiracy theories are completely independent of

demographics. There is a small *positive* effect of the 2-item critical thinking scale, i.e. more (self-reported) critical thinking correlates positively with a higher belief in these conspiracy theories. The 5-items scale showed no effects.

- Anti-US conspiracy theories are also mostly independent of demographics; besides, students with a Bachelor's degree tend to believe in these theories slightly *more*. There was no effect of critical thinking.

All in all, these results once more underline that demographics have little to no influence on the tendency to believe in conspiracy theories. Moreover, we confirm that self-evaluated critical thinking is, indeed, a questionable measure, as it might be high exactly for persons who are having trouble to critically evaluate their beliefs. The higher tendency of students with a university degree to believe in anti-US conspiracy theories is, at first glance, puzzling, but it might be possible to explain this with a longer exposure to a usually slightly anti-capitalist and anti-US environment at German universities. This assumption, however, would need further investigations.

The intercorrelation between the various conspiracy dimensions is high (Fig. 3): one could say that if somebody believes in one conspiracy theory, he or she will tend to believe in all of them. At the same time, there is a strong *negative* correlation with trust in official information. The correlation between the consensus and the conspiracy theories is weak and not always significant: this might suggest that the belief in conspiracy theories is, to some extent, more a naive form of "openness" to all kind of opinions. This also explains why we even find a positive correlation between contradictory beliefs, for example that the CIA or the Chinese military had developed the virus, confirming previous results, e.g., by Wood et al. (2012).

We also analyzed the role of trust in media: when trust is high, people are usually more inclined to trust official information and disagree with all categories of conspiracy theories (all results are significant at 0.1% level, complete correlation table available upon request).

Finally, we measured how having heard of a conspiracy theory versus hearing it for the first time affected the likelihood of believing in conspiracy theories. The general result was that the differences were surprisingly small: in two cases (5G and

Bill Gates conspiracy), they even failed to be significant (see Table 6). The results confirm our initial hypothesis that theories that are more "available", i.e. easier to relate to, will simultaneously seem more plausible to people when encountered with them for the first time, while other theories in a more remote context (particularly the theories set in China) will need more time to be considered plausible.

Table 3: Intercorrelation between various conspiracy theories among Germans

	Trust offic. information	Consensus	Conspiracies score	"Neutral" conspiracies	Anti-China conspiracies	Anti-US conspiracies
Trust offic.	1	.198**	-.454**	-.459**	-.299**	-.336**
information		<0.001	<0.001	<0.001	<0.001	<0.001
Consensus	.198**	1	-.159**	-.162**	-.033	-.146**
	.000		.002	.002	.524	0.005
Conspiracies	-.454**	-.159**	1	.871**	.661**	.843**
score	<0.001	.002		<0.001	<0.001	<0.001
"Neutral"	-.459**	-.162**	.871**	1	.414**	.585**
conspiracies	<0.001	.002	<0.001		<0.001	<0.001
Anti-China	-.299**	-.033	.661**	.414**	1	.469**
conspiracies	<0.001	0.524	<0.001	<0.001		<0.001
Anti-US	-.336**	-.146**	.843**	.585**	.469**	1
conspiracies	<0.001	0.005	<0.001	<0.001	<0.001	
N	370	370	370	370	370	370

For all tables: *=significant on 5%, **=significant on 1%, ***=significant on 0.1%.

6.2 Chinese in Germany

In case of the Chinese living in Germany[17], demographic factors had no significant effect on any of the variables. More interesting is the pattern of intercorrelations that we find (Table 4): there is, as in case of Germans, a strong positive relation between trust in official information and consensus belief. There is also a strong negative correlation between neutral conspiracy theories and trust in official information, but contrary to the previous results for Germans, there is no significant correlation with other conspiracy items. Regarding the conspiracy dimensions,

[17]Due to the small student subsample, we used also non-students here, which can be justified by the observation that the results for German students and non-students regarding intercorrelations were very similar.

Table 4: Intercorrelation between various conspiracy theories among Chinese in Germany

	Trust offic. information	Consensus	Conspiracies score	"Neutral" conspiracies	Anti-China conspiracies	Anti-US conspiracies
Trust offic.	1	.496***	-0.207	-.331**	0.21	-0.168
information		<0.001	0.096	0.007	0.091	0.179
Consensus	.496**	1	-0.076	-0.105	.365**	-0.201
	<0.001		0.545	0.4	0.003	0.106
Conspiracies	-0.207	-0.076	1	.730***	.437***	.792***
score	0.096	0.545		<0.001	<0.001	<0.001
"Neutral"	-.331**	-0.105	.730***	1	0.114	.280*
conspiracies	0.007	0.4	<0.001		0.36	0.023
Anti-China	0.21	.365**	.437***	0.114	1	0.154
conspiracies	0.091	0.003	<0.001	0.36		0.216
Anti-US	-0.168	-0.201	.792***	.280*	0.154	1
conspiracies	0.179	0.106	<0.001	0.023	0.216	
N	66	66	66	66	66	66

Table 5: Intercorrelation on conspiracy beliefs among students in China

	Distrust media	"Neutral" conspiracy	——— Origin ——— China	USA	elsewhere
Distrust	1	.428**	0.117	-0.009	0.025
media		<0.001	0.201	0.921	0.781
"Neutral"	.428**	1	0.043	0.066	0.046
conspiracy	<0.001		0.639	0.469	0.615
Origin	0.117	0.043	1	-0.106	-0.168
China	0.201	0.639		0.246	0.065
Origin	-0.009	0.066	-0.106	1	.213*
USA	0.921	0.469	0.246		0.018
Origin	0.025	0.046	-0.168	.213*	1
elsewere	0.781	0.615	0.065	0.018	
N	122	122	122	122	122

Table 6: Having heard of conspiracies prior to our survey increased beliefs only in some cases.

	Have heard		Average likelihood		t-test	Correlation
	Percent	N	Had heard	Not heard	(p-value)	coefficient
Lab accident in Wuhan	0.51	187	2.87	2.50	<0.001***	-0.18***
CIA developed virus	0.51	187	1.56	1.38	0.02*	-0.11*
Chinese bio weapon	0.71	264	2.00	1.58	<0.001***	-0.20***
Connection to 5G	0.49	181	1.18	1.16	0.69	-0.02
Bill Gates conspiracy	0.65	241	1.32	1.24	0.25	-0.05

there is also a striking difference: while we do find strong positive correlations between most items (as we did for Germans), there is no significant correlation between anti-US and anti-China conspiracies. This might mean that Chinese living in Germany are more aware of the inherent contradiction between these theories, but it might also be that other factors, in particular patriotism contributed to this result. We will follow up on this in Section 7.

What role do Chinese and German media play for this group? We found strongly significant correlations of trust in German media with trust in official information, belief in consensus and belief in neutral conspiracies (all in expected direction and significant at least at 1% level). However, we did not find significant correlations with the anti-China or anti-US conspiracies. Trust in Chinese media decreased the belief in consensus and the belief in anti-China conspiracies (both significant at 0.1% level). However, it did not increase the belief in anti-US conspiracies.

6.3 Chinese in China

We tested the same demographic factors and the 5-item critical thinking scale for the students in China. In this case, the results were even more distinct: there was no significant effect of any of these variables on the conspiracy or consensus related items in the survey.

We also found a strong *positive* correlation between distrust in media and the neutral conspiracy item, similar to the other groups. Interestingly, we find no significant correlation between distrust in media and the "origin in the US" theory.

We find a significant correlation between the items "origin in the US" and "ori-

gin elsewhere". This suggests again that conspiracy theories tend to be positively correlated, even if they are to some extent mutually exclusive.
The relation between trust in (Chinese) media and the belief in an origin of the virus in China or the US are not significant. By the way: distrust in Chinese media was significantly higher, both for Chinese in China (average: 1.73 on the 4-point Likert scale from 1 to 4, see Section 4) and for Chinese in Germany (2.05) than the trust of the Germans in their media (1.44). Chinese living in Germany trusted German media as much as Germans (1.42), while they distrusted Chinese media significantly more than the Chinese in China did.

7 The patriotic side of COVID-19

Let us now take a closer look at the relation between patriotism and beliefs about COVID-19. While such relations are to be expected among Chinese, there are a priori no strong reasons to expect such effects among Germans. Nevertheless, there is a strong positive correlation between uncritical patriotism and all conspiracy beliefs (Table 7). However, only weak and insignificant correlations can be found with (critical) patriotism. These results may suggest that persons who are inclined to uncritical patriotism and persons who believe in conspiracy theories share some common psychological characteristics. It is interesting to see that patriotism itself (pride in one's country) is not connected to it. The relation confirms previous findings that proponents of far-right political ideologies are more inclined to believe in conspiracy theories than the proponents of centrist political ideologies (van Prooijen et al. 2015).[18]
Let us next take a look at the Chinese living in Germany (Table 8). Here, the picture is similar for the anti-US conspiracy theories and also for the neutral conspiracies (although not statistically significant), but we find a striking difference regarding the anti-China conspiracies: here we find a *negative* correlation between uncritical patriotism and belief in the conspiracies. It does not seem surprising that anti-Chinese conspiracies are considered to be anti-patriotic by Chinese and, thus, are considered to be less plausible, but we have to keep in mind that even beliefs in contradicting conspiracy theories are usually positively correlated. This demon-

[18]For the sake of completeness, van Prooijen et al. (2015) also find that this increased tendency to believe in conspiracy theories also exists among the proponents of far-left political ideologies.

strates that the influence of uncritical patriotism on these beliefs is, indeed, very strong. We observe this effect even more distinctly in the sample of Chinese students: here we find a strong and significant *negative* correlation between patriotism and the belief in the theory that the virus originated in China.

Finally, we combine the data for Germans and Chinese living in Germany and test the effects of uncritical patriotism and its interaction with nationality on beliefs in the three dimensions on conspiracy theories (Table 10). At first, for the combined dataset we find that uncritical patriotism is positively related to all types of conspiracy beliefs. Chinese, however, are less likely to believe in anti-China theories and more likely to believe in anti-US theories. As expected, we do not find any nationality effect on the "neutral" conspiracies. Next, we take interaction effects into account (where we consider only the two dimensions with national differences). Due to the small number of Chinese students in our sample, we have to enlarge the sample here by adding non-students. We compute for each population the individual difference to the average level of uncritical patriotism and denote this difference by "deviation uncritical patriotism". Then we test the model with the interaction term "Chinese$\times$deviation uncritical patriotism". It turns out that this factor is strongly significantly negative for anti-China theories, i.e. uncritical patriotism plays a significantly larger role on this for Chinese than for Germans. However, we do not find any significant difference for anti-US theories. It seems that uncritical patriotism does, indeed, lead to a more strongly pronounced rejection of anti-China conspiracy theories, but, at the same time, it does not automatically lead to a higher degree of acceptance of anti-US theories – at least not more so than it does for Germans.

Which other factors can explain the fact that the Chinese living in Germany perceive conspiracy theories about COVID-19 differently than Germans? We tested correlations with the following factors: use of social media (WeChat and Facebook), the idea that one should hide bad things and a perceived anti-Chinese sentiment (all as specified in Section 4). The results are summarized in Table 11: social media consumption increased the belief in anti-US conspiracies, regardless of the fact whether Chinese (WeChat) or American (Facebook) apps were used. More importantly, the idea that one should hide bad things increased the belief in neutral conspiracies and reduced the belief in consensus, but decreased the belief in anti-China conspiracies. The latter effect could probably mean that anti-China conspir-

acies are considered to be something bad to talk about China which these persons would agree one should not do. A perceived anti-Chinese sentiment increased anti-US conspiracy beliefs and strongly decreased the belief in the scientific consensus, so this perception seems to support all beliefs that are directed against foreigners (as they are seen as opponents).[19]

In conclusion, we find strong evidence for the hypothesis that conspiracy theory beliefs are, on average, more widespread in China, as we expected given the cultural and political differences. Chinese living in Germany are placed between both groups. There are different possible interpretations for these findings: it might be that the difference in media freedom enables the Chinese living in Germany to improve their critical thinking, or it could be that cultural adaption or self-selection mechanisms blur the cultural differences in holistic/analytic thinking style. – Most likely, it will be a mix of these factors.

The differences between Germans and the Chinese living in Germany, however, become larger when we compare the belief in different types of conspiracy theories: Chinese are generally less likely to believe in anti-China conspiracies and are more likely to believe in anti-US conspiracies than Germans. This difference can be partly explained by (uncritical) patriotism, where for belief in anti-Chinese conspiracies, uncritical patriotism indeed acts differently for Chinese and Germans: it affects only the Chinese. For anti-US conspiracies, we do not find different effects of uncritical patriotism. It just correlates positively with belief in *any* kind of conspiracies (except for anti-China conspiracy theories).

There is further evidence in favor of the hypothesis that the differences regarding the beliefs are self-motivated: agreement to the necessity of "hiding dark sides" decreases anti-China conspiracies, but not anti-US conspiracies, while a perceived anti-China sentiment in Germany ("Westerners are happy to see China fall") strongly correlates with anti-US conspiracies and a decreased belief in consensus (but not with other types of conspiracies).

However, we do not find evidence that Chinese media would impact conspiracy beliefs differently than Western media: while the use of WeChat of Chinese in Germany did increase the likelihood of believing in anti-US conspiracies, the use of Facebook did so even more.

[19] We also tested for effects of Chinese versus German or English-language traditional media consumption (TV, newspapers), but did not find any significant effects.

We also did not find evidence supporting the idea that the status of Chinese in Germany as minority increased their overall beliefs in conspiracy theories, but a larger sample would be needed to answer this question.
All in all, the fact that the virus most probably originated in China is a kind of an "inconvenient truth" for many Chinese, even more so if they are very patriotic. This makes it easy for them to believe in conspiracy theories that offer alternative "theories" about the origin of the virus. On the other hand, similar reasons make it more difficult for them to believe in anti-China conspiracy theories.

Table 7: Correlation between patriotism, uncritical patriotism and various COVID-19 related beliefs among German students.

Correlation with	patriotism	uncritical patriotism
Consensus	.127*	0
	0.049	0.997
Conspiracies score	-0.016	0.228***
	0.799	<0.001
"Neutral" conspiracies	-0.037	.193***
	0.571	<0.001
Anti-China conspiracies	0.038	.173**
	0.561	0.001
Anti-US conspiracies	-0.013	.213***
	0.84	<0.001
	N=241	N=369

8 Effects on preventive actions: social distancing, face masks, and vaccination

We have now dissected various factors that are related to the beliefs in conspiracy theories about COVID-19. The final question is whether these beliefs are mere entertaining stories about humans gullibility or whether they have actual detrimental consequences. We have already argued – based on previous research findings on

Table 8: Relationship between uncritical patriotism and belief in various conspiracy theories among Chinese living in Germany.

	Uncritical patriotism
Consensus	-.336**
	0.007
Conspiracies score	0.177
	0.161
“Neutral” conspiracies	0.149
	0.239
Anti-China conspiracies	-.271*
	0.03
Anti-US conspiracies	.313*
	0.012
	N=64

Table 9: Relationship between patriotism and beliefs in the theory that COVID-19 originated in China.

	Patriotism
China	-0.273**
	0.002
USA	0.014
	0.877
Elsewhere	0.044
	0.632
	N=122

Table 10: Effect of uncritical patriotism on beliefs in conspiracy theories among Germans and Chinese living in Germany.

	"Neutral" conspiracies	Anti-China conspiracies	Anti-US conspiracies	Anti-China conspiracies	Anti-US conspiracies
age	0.094	0.072	0.013	0.046	0.048
	(1.634)	(1.276)	(0.229)	(0.881)	(0.93)
female	0.06	0.066	0.097*	0.052	0.101*
	(1.195)	(1.343)	(1.996)	(1.24)	(2.474)
student				0.051	-0.049
				(0.627)	(-0.608)
university	-0.019	-0.028	0.161**	-0.015	0.099*
degree	(-0.334)	(-0.516)	(2.974)	(-0.339)	(2.265)
working				-0.062	-0.105
				(-0.802)	(-1.376)
uncritical	0.178***	0.153**	0.21***		
patriotism	(3.482)	(3.067)	(4.271)		
dev. uncrit.				0.196***	0.253***
patriotism				(4.419)	(5.764)
Chinese	0.031	-0.247***	0.156**	-0.24***	0.208***
	(0.603)	(-4.89)	(3.147)	(-5.689)	(4.988)
Chinese×				-0.171***	0.043
dev. uncrit.				(-3.74)	(0.946)
patriotism					
Sample	students	students	students	all	all
N	396	396	396	555	555
adj. R^2	2.87%	6.90%	10.31%	8.14%	10.58%

Table 11: Additional factors affecting the belief in conspiracy theories among Chinese living in Germany.

	Consensus	"Neutral" conspiracies	Anti-China conspiracies	Anti-US conspiracies
WeChat	-0.114	0.162	0.007	0.250*
	0.368	0.201	0.954	0.046
Facebook	-0.049	0.159	0.053	0.317*
	0.703	0.21	0.675	0.011
Hiding dark	-0.388**	0.305*	-0.283*	0.221
sides	0.002	0.014	0.023	0.08
Perceived	-0.483***	0.159	-0.205	0.376**
anti-Chinese	<0.001	0.203	0.099	0.002
sentiment				
N	66	66	66	66

health related conspiracy theories – that the latter is likely. In this section, we will try to evaluate this negative impact empirically.

We focus here on attitudes toward three behavioral patterns that seem to be critical in the fight against the pandemic: social distancing, wearing masks and – eventually, after its successful development – a vaccine.[20]

Table 12 shows the results of the regression analysis for positive attitudes towards social distancing (as defined in Section 4) as dependent variable. We find that the effect of conspiracy theories is highly significant, even after controlling for worries about COVID-19, personal risk preferences regarding health, and the number of older people the participants personally know – variables that are all significant factors as well.[21] Further analysis (results available upon request), however, suggests that this is mostly caused by a lack of belief in consensus and official information.

As a robustness test, we repeated this analysis including the first survey wave and replacing the likelihood of believing in conspiracy theories by its second item

[20]For this analysis, we rely on data from the survey waves among German students.

[21]This is an extension of similar results by Rieger (2020*d*).

Table 12: Influence of belief in conspiracy theories on attitudes towards social distancing.

	Positive attitudes towards social distancing			
age	-0.018	0.000	0.002	-0.007
	(-0.251)	(-0.005)	(0.027)	(-0.109)
female	-0.064	-0.071	-0.014	-0.018
	(-0.966)	(-1.1)	(-0.245)	(-0.301)
university degree	0.04	0.056	0.022	0.025
	(0.551)	(0.787)	(0.345)	(0.389)
Conspiracies score		-0.212**	-0.17**	-0.195**
		(-3.301)	(-2.903)	(-3.285)
worries			0.337***	0.328***
			(5.705)	(5.578)
risk taking (health)			-0.208***	-0.202***
			(-3.518)	(-3.422)
known old persons				0.119*
				(2.014)
N	240	240	240	240
adj. R^2	-0.70%	3.35%	20.86%	21.89%

("hype about Corona"). Again, there is a significant negative correlation with attitudes toward social distancing (N=343). We also notice as side remark that these attitudes have substantially changed between the two survey waves (March and May): the social distancing variable declined from 8.6 (N=195) to 6.0 (N=246). The difference is significant at the 0.1% level (t-test). This difference is also significant for all single items (precise results available upon request).

What about face masks? In this case we have not only one but two variables: the belief in the protective effect of masks and the willingness to wear them.

Table 13 shows that conspiracy theories have little impact on how people perceive the protective effect of masks. The only factor that matters in this includes the worries about COVID-19: they correlate positively with the belief in the protective effects of masks. Again, an interesting side result as one might argue that the relation should be the other way around: if one believes that masks do not help prevent the spread of the pandemic, the he or she should be more worried about the pandemic.

Table 14 shows the regression results for the willingness to wear masks. Here, conspiracy theories have again a significant impact, even after controlling for worries, risk taking, and – most importantly – for belief in the protective effects of masks.

In summary, we find that for conspiracy theorists it does not matter whether masks protect them or not: they do not want to wear them, although they tend to trust masks as well as anybody else. If we see anti-mask demonstrators, it is, therefore, likely that they do not care about this protection for some reason. Since personal risk preferences also have no influence on the willingness to wear masks, the most likely explanation seems to be a certain lack of prosocial attitudes. Some may consider it more important to avoid being forced by the state to do certain things than to protect others.

As a robustness test, we included data from the first and second survey waves, replacing the conspiracy tendencies by the "hype about Corona" and the willingness to wear masks with 4-point Likert scale response options to the item "It is strange for someone to wear a mask in public." Again, this variable is significantly negatively correlated with attitudes towards mask wearing (N=580). On the positive side, there is a significant decrease in agreement to this statement when comparing the three survey waves. (All robustness results available upon request.)

Experts agree that the pandemic can most likely be ended by mass deployment

Table 13: The trust in the protective ability of face masks is not influenced by conspiracy beliefs.

	Belief in protection by masks		
age	-0.031	-0.027	-0.026
	(-0.425)	(-0.374)	(-0.371)
female	0.077	0.075	0.107
	(1.171)	(1.146)	(1.674)
university degree	0.042	0.046	0.022
	(0.587)	(0.629)	(0.309)
Conspiracies score		-0.042	-0.017
		(-0.645)	(-0.271)
worries			0.259***
			(-4.033)
risk taking (health)			-0.073
			(-1.137)
N	240	240	240
adj. R^2	-0.57%	-0.82%	6.31%

Table 14: The willingness to wear face masks is negatively affected by a belief in conspiracy theories.

	Willingness to wear face masks			
age	-0.037	-0.017	-0.016	-0.01
	(-0.506)	(-0.24)	(-0.231)	(-0.142)
female	0.06	0.052	0.082	0.056
	(0.915)	(0.811)	(1.307)	(0.908)
university degree	0.063	0.081	0.059	0.053
	(0.869)	(1.14)	(0.854)	(0.8)
Conspiracies score		-0.233***	-0.209***	-0.205***
		(-3.644)	(-3.365)	(-3.399)
worries			0.235***	0.171**
			(3.731)	(2.707)
risk taking (health)			-0.075	-0.057
			(-1.189)	(-0.929)
belief in protection by masks				0.246***
				(3.959)
N	240	240	240	240
adj. R^2	-0.63%	4.35%	10.28%	15.59%

of an effective vaccine. In open societies like Germany, this requires the willingness of people to get vaccinated. Do conspiracy beliefs reduce this willingness? Table 15 answers this question with a clear yes: there is a highly significant correlation between the willingness to get vaccinated and the score of belief in conspiracy theories, even after controlling for worries and risk preference. In fact, all three conspiracy dimensions are significant when added as separate items to the regression (complete results upon request).

We have, however, some positive news: Rieger (2020*c*) suggests three different information texts that were designed to increase the willingness to get vaccinated. When applying them as treatments in an experiment, they all increased the willingness to get vaccinated. We follow up on this and utilize the same three treatments in wave 3 to elicit whether they might work differently well on persons that are likely to believe in conspiracy theories. This does not seem to be the case: we find that they worked just as well for people that are likely to believe in conspiracy theories as for others. More precisely, we split the sample into two groups: one with a conspiracy score of 8 or less (49.2% of the total sample), one with 9 points or more. In both groups we used paired t-tests to compare the willingness to get vaccinated before and after the treatment. There was a significant increase in both groups (see Table 15). We repeated this with subjects with a score of 11 or higher (24.4% of the total sample) and again observed a significant increase. Finally, we also tested whether the three different treatments from Rieger (2020*c*) have different effects on persons with a moderate to high tendency to believe in conspiracy theories (9 or more), but we do not find such differences. In summary, it is not at all hopeless to convince someone who is likely to believe in conspiracy theories of the advantages of vaccination.

9 Conclusions

This article provides a first measurement of the extent of beliefs in COVID-19-related conspiracy theories among university students in Germany and China. We also test various factors that are related (or not related) with these beliefs, and measure the effect that conspiracy beliefs have on measures aimed at curbing the spread of the pandemic.

Table 15: The willingness to get vaccinated is negatively impacted by conspiracy beliefs.

	Willingness to get vaccinated		
age	-0.103	-0.068	-0.067
	(-1.422)	(-1.023)	(-1.034)
female	0.135*	0.12*	0.15*
	(2.074)	(2.029)	(2.56)
university degree	-0.025	0.007	-0.011
	(-0.345)	(0.102)	(-0.169)
Conspiracies score		-0.413***	-0.391***
		(-6.987)	(-6.757)
worries			0.175**
			(2.989)
risk taking (health)			-0.107
			(-1.82)
N	240	240	240
adj. R^2	1.50%	18.10%	22.30%

Table 16: Information treatments increase the willingness to get vaccinated for persons with conspiracy tendency just as well as for others.

	Proportion of	Average willingness to get vaccinated		
Conspiracy tendency	subjects	Before	After	paired t-test
Low ($\leq$8 points)	49.2%	2.63	2.93	$<$0.001
Medium to high ($\geq$9 points)	50.8%	2.32	2.54	$<$0.001
High ($\geq$11 points)	24.4%	2.25	2.46	0.001

The key results regarding our initial hypotheses can be summarized as follows:[22]

- As expected – considering cultural and political reasons – Chinese students on average are more likely to believe in COVID-19 related conspiracy theories than Germans.
- Chinese are, in general, more likely to believe in anti-US and less likely to believe in anti-China conspiracy theories as compared to Germans. A closer look at these differences (also taking into account the beliefs of Chinese living in Germany) supports the hypothesis that these are caused by a desire for self-assurance that the pandemic is not "China's" fault. It does not seem to be primarily caused by Chinese media, but is strongly related to (uncritical) patriotism.
- For subjects who had not heard of the conspiracy theories prior to the survey, we found evidence that the availability heuristic makes it easier for them to believe in conspiracy theories with more familiar contexts (5G, Bill Gates conspiracies) and less so for theories involving more abstract and foreign contexts (e.g., the theory that the virus was developed as a bio weapon by China).
- We find a negative effect of beliefs in conspiracy theories on attitudes towards various preventive actions (social distancing, wearing masks and vaccination).
- An important observation is that conspiracy beliefs did *not* (at least in our data) have a negative effect on the belief in the protective effects of masks, but on the willingness to wear them.

There are certainly a number of limitations to our study: it would have been nice to have a larger sample (which is of course true for basically all empirical studies), and using representative samples would also be interesting, but the speed that was needed in this fast-developing situation required a faster approach which led to the decision of using university samples. This obviously also had a number of other

[22] We had a number of other minor findings regarding relevant factors, national differences and effects of conspiracy beliefs that we do not summarize here.

advantages, particularly in that it enabled a better comparability of results between China and Germany.
Given the strong effect of conspiracies in the current crisis and the ongoing development, follow-up studies are certainly needed, and we plan to further extend our time series data.

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A Descriptive statistics

Table 17: Descriptive statistics of health prevention related variables

Positive attitudes about social distancing	-3	0.20%	Mask wearing	4	3.80%
	-1	0.20%		6	2.20%
	0	0.50%		7	2.40%
	1	1.80%		8	5.10%
	2	3.40%		9	5.40%
	3	2.00%		10	4.60%
	4	6.80%		11	8.90%
	5	8.20%		12	10.30%
	6	9.50%		13	22.20%
	7	16.10%		14	19.00%
	8	16.30%		15	8.10%
	9	15.90%		16	7.90%
	10	19.00%	Vaccination willingness before	1	7.80%
Masks seen as weird	1	45.50%		2	18.90%
	2	35.90%		3	33.70%
	3	12.70%		4	39.50%
	4	5.80%	Vaccination willingness after	1	8.20%
Masks seen as protective	2	1.60%		2	30.60%
	3	1.10%		3	46.30%
	4	8.70%		4	15.00%
	5	14.90%			
	6	36.00%			
	7	21.40%			
	8	13.60%			
	9	1.90%			
	10	0.80%			

Table 18: Descriptive statistics of various variables

worries	1	4.70%	patriotism	1	9.60%
	2	15.60%		2	12.90%
	3	38.90%		3	45.50%
	4	32.40%		4	32.00%
	5	8.20%	uncritical	1	46.90%
risk	1	3.80%	patriotism	2	31.70%
(health)	2	8.30%		3	15.60%
	3	19.20%		4	5.80%
	4	22.10%	perceived	1	10.30%
	5	12.50%	anti-China	2	31.00%
	6	12.50%	sentiment	3	51.70%
	7	9.60%		4	6.90%
	8	8.80%	Hide dark	1	17.90%
	9	1.70%	side	2	50.00%
	10	1.30%		3	32.10%
	11	0.40%	critical	6	1.90%
Distrust	1	46.40%	thinking	7	3.30%
media	2	50.00%	(5 items)	8	3.90%
Germany	3	3.60%		9	6.90%
Distrust	1	35.30%		10	9.90%
media	2	54.70%		11	4.10%
China	3	8.00%		12	2.50%
Trust	4	2.00%		13	1.90%
official	1	5.70%		14	5.50%
information	2	18.00%		15	5.80%
	3	42.00%		16	9.40%
Media	4	33.90%		17	10.50%
hide	1	63.00%		18	14.60%
information	2	30.30%		19	12.10%
	3	5.50%		20	7.70%
	4	0.90%	critical	-2	1.60%
known	mean	3.69	thinking	-1	3.50%
old people	stdev	4.61	(2 items)	0	9.20%
WeChat	0	21.40%		1	11.70%
use	1	78.60%		2	20.30%
Facebook	0	71.40%		3	23.80%
use	1	28.60%		4	29.80%