

Secret erosion of the “lockdown”? Patterns in daily activities during the SARS-Cov2 pandemics around the world

Heimliche Erosion des „Lockdown“? Muster im alltäglichen Verhalten während der SARS-Cov2 Pandemie weltweit.

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April 27, 2020

Abstract in German / Deutsche Kurzzusammenfassung

Wir messen Veränderungen in den Aktivitätsmustern während des „Lockdown“ der COVID-19-Pandemien mit Hilfe des Apple Maps Mobility Trends Report, der Google COVID-19 Community Mobility Reports und Daten aus einer weltweiten Online-Umfrage mit mehr als 100 000 Teilnehmern. Wir konzentrieren uns auf die Monate März und April 2020, d.h. einen Zeitraum, in dem in den meisten Ländern ein „Lockdown“ stattfand, der soziale Interaktionen und tägliche Aktivitäten einschränkte. Während die Daten von Apple Maps Informationen zu geplanten Reisen liefern, liefern die Google-Daten Ortsinformationen, und die Umfrage ergänzt beide mit Daten zur Motivation von Aktivitäten.

Wir konzentrieren uns auf einige wenige Länder mit besonders guter Datenverfügbarkeit: Frankreich, Deutschland, Großbritannien und die USA. Unser Hauptergebnis ist, dass in den meisten dieser Länder in diesem Zeitraum bereits eine deutliche Wiederaufnahme von Aktivitäten zu beobachten war. Die Zunahme der Aktivitäten lässt sich nicht mit gelockerten Vorschriften in den untersuchten Ländern erklären. Während einige dieser Aktivitäten sicherlich unvermeidlich sind, haben wir auch eine Zunahme weniger notwendiger Aktivitäten gemessen, die bei der Diskussion von Maßnahmen zur Eindämmung der Pandemien berücksichtigt werden sollten.

Wir stellen auch starke Unterschiede in der relativen Bedeutung der verschiedenen Aktivitäten in den einzelnen Ländern fest. Dies kann politischen Entscheidungsträgern wertvolle Informationen darüber liefern, welche Art von Aktivitäten für die Eindämmung der Pandemien am relevantesten sind.

Abstract

We measure trends in activity patterns during the “lockdown” of the COVID-19 pandemics, using the Apple Maps Mobility Trends Report, the Google COVID-19 Community Mobility Reports and data from a worldwide online survey with more than 100 000 participants. We focus on the months of March and April 2020, i.e. a period where in most countries a “lockdown” took place that restricted social interactions and daily activities. While the Apple Maps data gives high quality data on planned trips, Google data gives high quality location data, and the survey supplements both with data on activity intention.

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We focus on a few countries with particularly good data coverage: France, Germany, UK and the US. Our key finding is that during this period in most of these countries already a significant re-increase of activities was visible. The increase in activity cannot be explained by relaxed regulations in the countries under study. While some of these activities are certainly unavoidable, we also measured an increase in less necessary activities which should be taken into account when discussing policies for the containment of the pandemics.

We also find strong differences in the relative importance of various activities across countries. This may provide policy makers with valuable information about what type of activities are most relevant to reduce for curtailing the pandemics.

1 Introduction

After initial attempts to contain the SARS-Cov2 pandemics failed in most countries, the most favoured response is currently to reduce social interactions in order to decrease the replication rate of the virus. This means that in most countries not only large events (like congresses or the Olympic games) had to be cancelled, but also small-scale contacts (school, parties, visiting friends) had to be reduced substantially. Most developed countries introduced such restrictions in March. While the first countries were starting to relax these constraints during April, most have them still implemented at present.

Rules, however, are one thing, the compliance with them another. Also, even within the prescribed rules, there is still freedom, and people might use (or abuse) it or not. In any case, it seems to be pivotal to get an overview about patterns of activities and how they change over time.

In this paper, we will achieve exactly this. We use three large-scale datasets: Google mobility data (Google LLC, 2020), Apple Maps Mobility Trends Report (Apple, 2020) and a survey by an international group of researchers (Fetzer et al., 2020). Additionally, we use data on policy stringency (Petherick et al, 2020).

Analysing the activity pattern for a number of countries, we find indeed a slight, but steady *increase* in activities in most of them during April. Such a slight increase is already visible based on data from navigation requests in Apple Maps. The location data by Google (2020) gives additional evidence to that, and the survey data shows also the different motivations for this increase. While some of these motivations seem to be rather harmless (physical exercise, e.g., since single joggers or hikers in sparsely populated areas are unlikely to spread the disease), others are more worrisome (meeting friends, e.g.).

We also see strong regional differences in the relative importance of activities in the current situation that may provide useful hints to policy makers about some key risks.

In the following Section 2 we describe our methodology, in Section 3 we present the results. Finally, we derive policy implications from the study in the concluding Section 4.

2 Methodology

The study is based on data from navigation requests (Apple, 2020), location data (Google LLC, 2020), data on policy stringency (Petherick et al., 2020), and a large-scale online survey (Fetzer et al., 2020).

The navigation requests from Apple Maps (Apple, 2020) are available for a large number of countries and also for larger cities. They are sorted by means of transportation (driving, public transportation, walking).

The location data from Google LLC (2020) measures the number of people close to certain types of locations (like shops) with respect to a “normal” amount.

The online survey by Fetzer et al. (2020) was initially advertised worldwide on Twitter and reached by now more than 100 000 participants from more than 170 countries. The survey data used in our study encompasses the time period from March 20, 2020 to April 22, 2020. The participation number was highest in the first week, but subsequent participation was still large enough for our purpose in the countries studied below. Our sample was composed of N=23 210 subjects (all subjects from France, Germany, UK and US³), out of which 53.1% were female. Average age was 41.3 years, 63.7% were married or living with a partner.

3 Results

3.1 General mobility

A first indication for the activity patterns is given by the Apple Maps data (Fig. 1). Ignoring the obvious weekday pattern, we see that in France, Germany, UK and US the basic pattern is very similar: after a steep decline at the onset of the crisis, caused by voluntary reduction of activities and a lockdown, we observe a subsequent slow re-increase. This re-increase started early in France and Germany (where a lockdown took place on March 17 and March 22, respectively, with restrictions in place already before), a bit later in the UK (lockdown on March 23) and later in the US (where the lockdown occurred depending on the state between March 19 and April 6). The re-increase, however, was not the same for all means of transportation: only in Germany a substantial re-increase of public transportation inquiries could be noticed, in France the increase was weak whereas driving and walking inquiries increased in all four countries.

Estimating Pearson correlation of these variables with the date (starting on March 21) confirms the significant increase in all activities for Germany and France. In UK and the US, the picture is mixed with some activities increasing, others still decreasing. When starting a week later, on March 28, however, in these two countries also a uniform and statistically significant increase is observable (Table A.1 in the Appendix).

Of course, inquiring about trips does not mean that the trips are actually made. It also does not mean that these trips would be harmful: jogging or hiking, e.g., can be done alone with obviously little to none infection risk, provided that the population density is low. Walking, however, can also mean to meet friends. The same applies to driving which might be simply necessary (and some of it might have been postponed during the first weeks of the lockdown), but it can also lead to meetings and infection risk. Public transportation is in any case to be seen critically, as it poses an infection risk by itself. The increase of its use in France and in particular in Germany is therefore a worrisome sign in itself, although an obligation to wear face masks might reduce this risk again.

³ The distribution of countries was (as to be expected of an online survey) very unbalanced, with very few people from small countries and only 419 subjects from China (where Twitter is blocked) participating. For this reason, we decided to focus on four countries with a large number of subjects that are also different in handling the crisis, but culturally and economically similar.

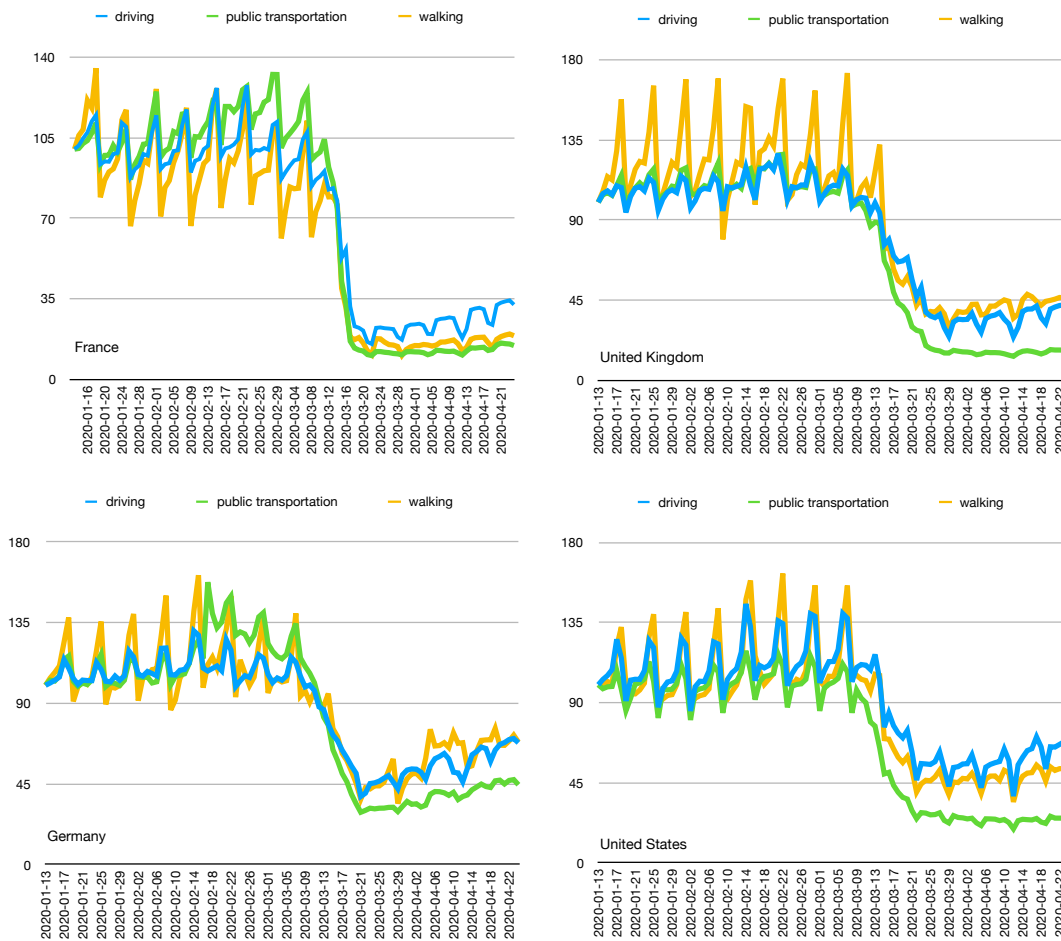


Fig. 1: Mobility proxied by Apple Maps requests: we see a steep decrease at the onset of crisis, but later also a clear upward trend in all countries regarding driving and walking, but in Germany and France also an upwards trend in public transportation.

3.2 Locations associated with specific activities

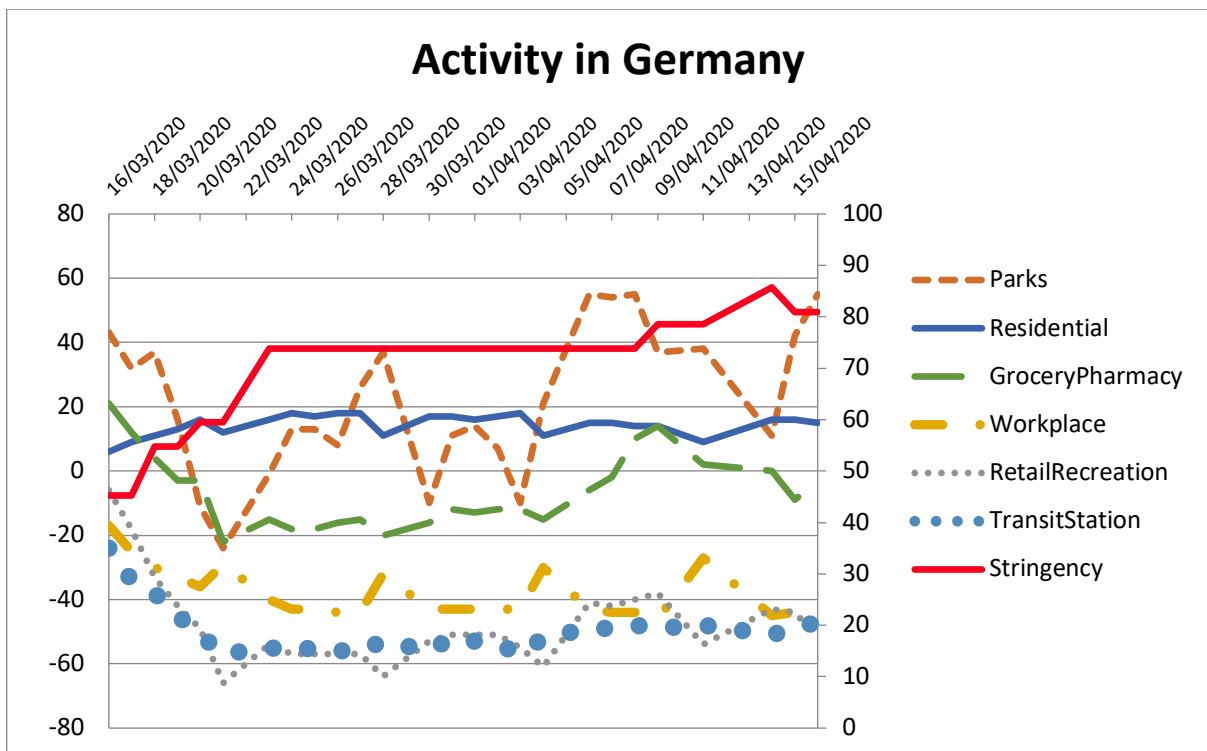
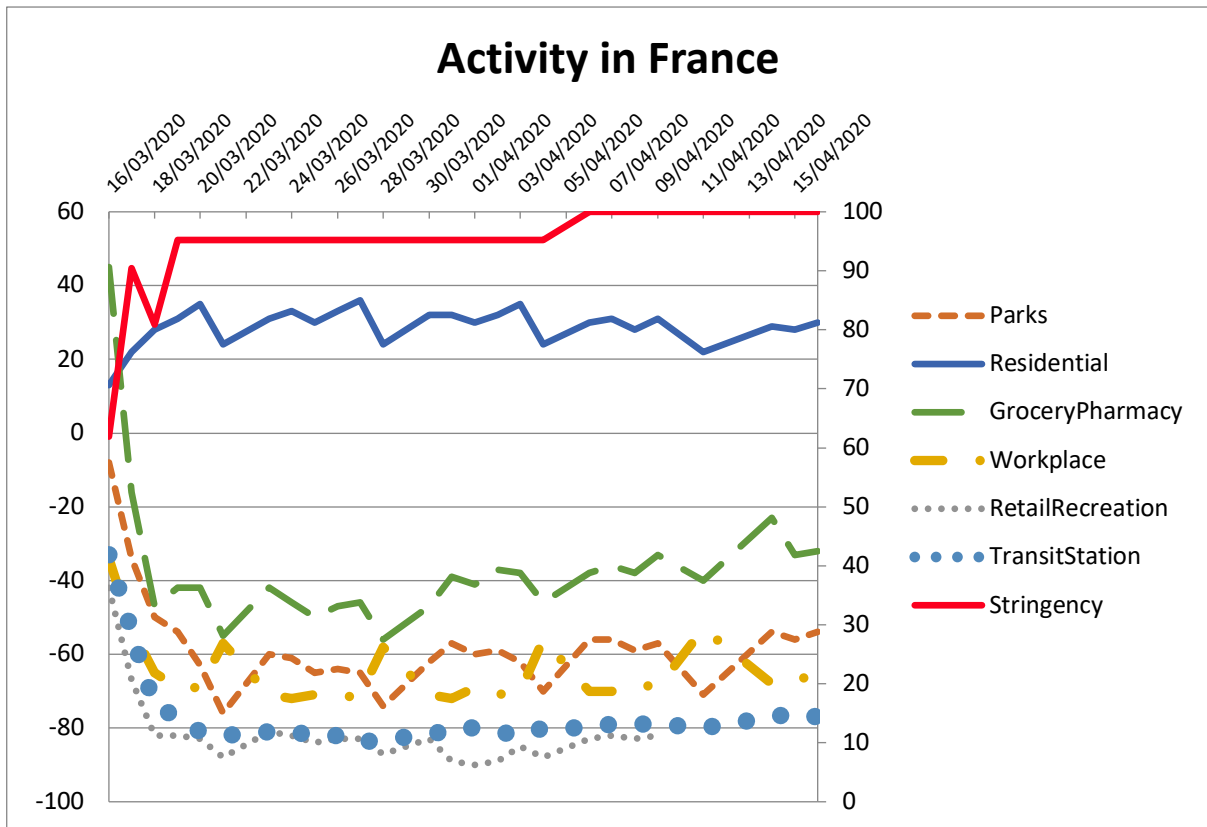
Although the Apple Maps data discussed in the previous section gives interesting results, more precise data that could tell us where all these trips might go to would be helpful to understand the activity patterns better. This is what the Google data set provides to us.

The data set measures how often people are in locations from one of these categories:

- Grocery & pharmacy
- Workplaces
- Parks
- Transit stations
- Retail and recreation
- Residential

Obviously, it is not always easy to relate locations clearly to these categories, and Google does not reveal their methodology in details. The data is also quite noisy and shows (as to be expected) an even more pronounced weekday pattern than the Apple Maps data. We therefore analyse only working days during the period from March 16 to April 16, 2020. Fig.2 shows the corresponding results for France, Germany, UK and US. We see in all countries an initial decrease everywhere, but in residential areas, suggesting that people essentially tried

to stay at home as much as possible. Later, however, we see again a slow upward trend in most of the other places, at least for France, Germany and UK. The data in the US is not as clear and also ends a week earlier for unknown reasons.



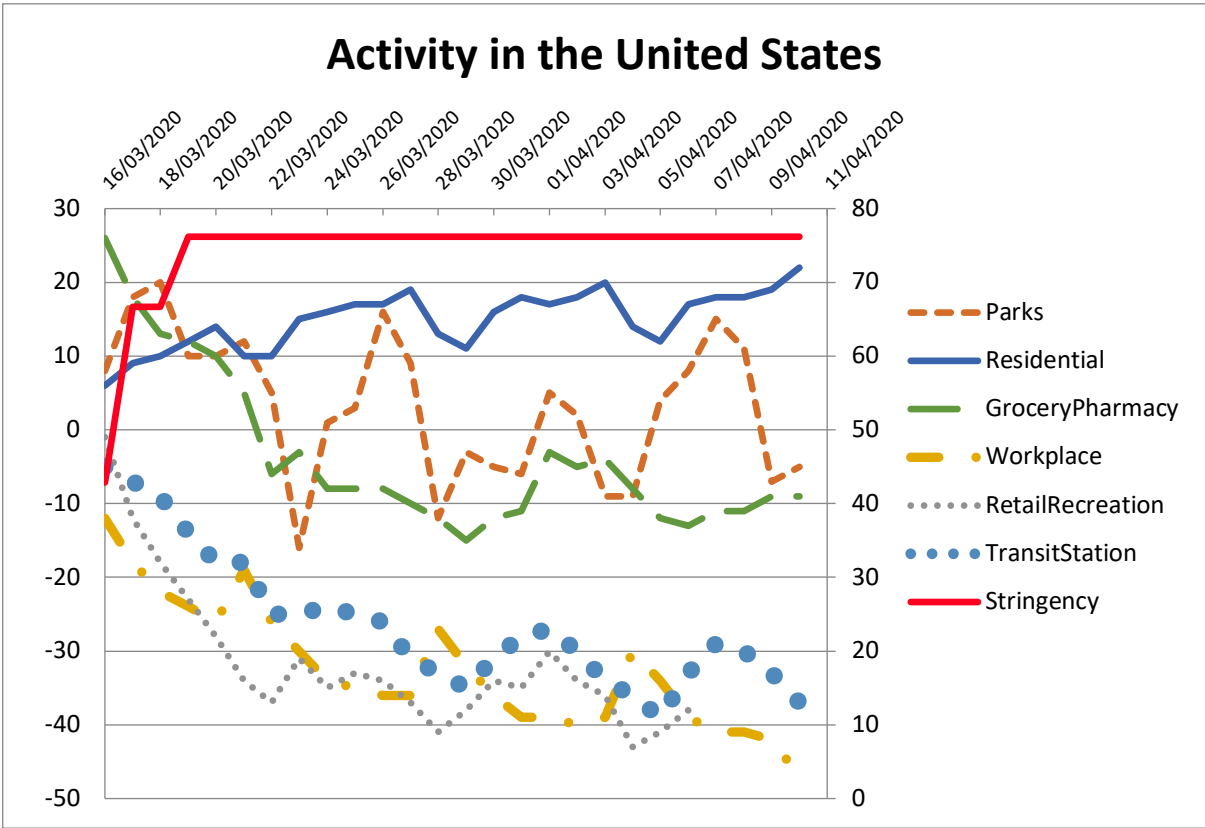
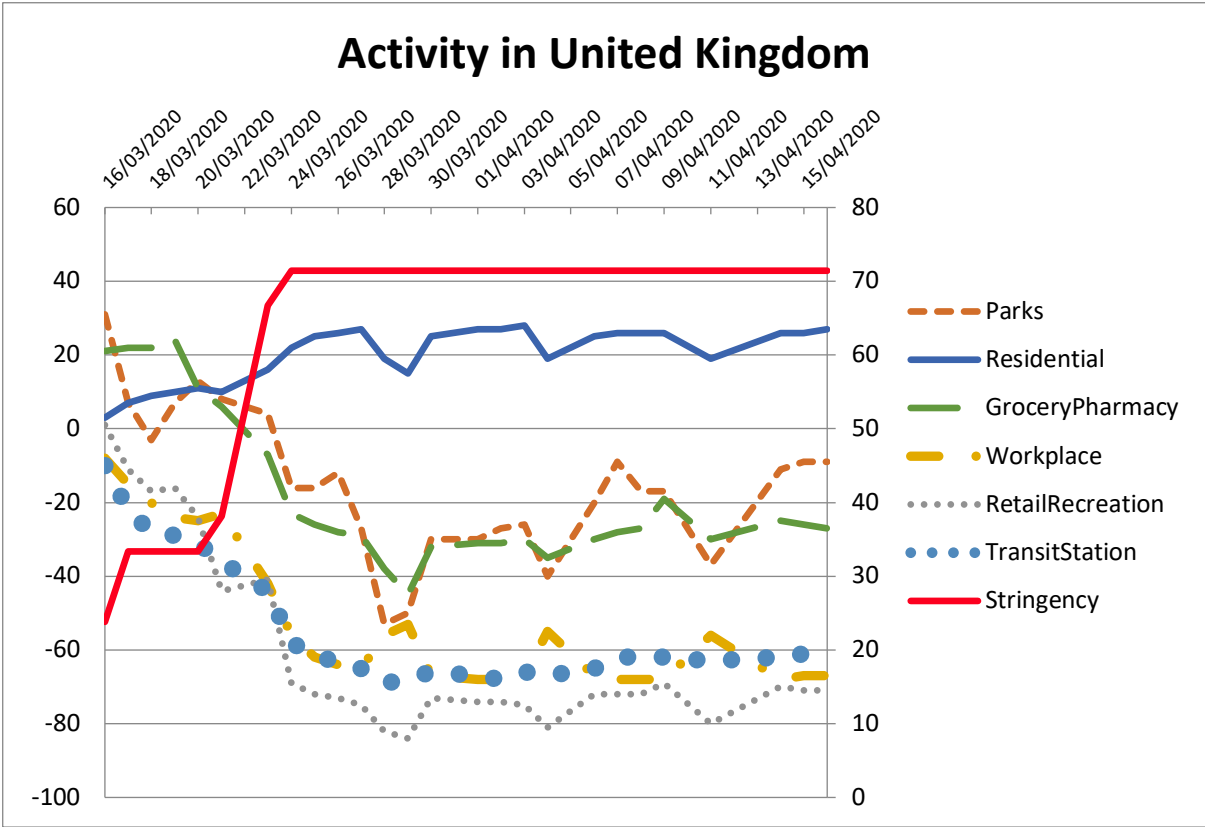


Fig. 2: Google location data shows a dramatic initial decrease in areas associated with activities like shopping, recreation or public transportation, often followed by a slow increase.

To give our analysis more substance, we estimate the Pearson correlation between these locations data and the date, starting on March 21, 2020 (Table 1). The statistical analysis confirms that there is indeed an increase in most locations for Germany and France, but still a decrease in UK and the US.

	France		Germany		UK from 3/21		UK from 3/28		USA	
	correl.	p-value	correl.	p-value	correl.	p-value	correl.	p-value	correl.	p-value
Retail/Recreation	0.39	0.03	0.67	0.01	-0.36	0.03	0.59	0.04	-0.45	0.02
Grocery/Pharmacy	0.82	0.00	0.75	0.00	-0.29	0.03	0.71	0.02	-0.26	0.04
Parks	0.54	0.02	0.64	0.01	-0.03	0.04	0.77	0.01	0.06	0.04
Transit Stations	0.84	0.00	0.85	0.00	-0.37	0.03	0.90	0.00	-0.65	0.01
Workplace	0.15	0.04	-0.18	0.04	-0.58	0.01	-0.36	0.08	-0.72	0.01
Residential	-0.20	0.04	-0.24	0.04	0.47	0.02	0.37	0.07	0.48	0.02

Table 1: Google location data suggests an increase in all locations related to activities in France and to most in Germany during the time period from March 21 to April 16, 2020. In UK and the US, the overall trend was still reversed, but in UK it increased from March 28 on.

3.3 Changes in activity motivations

While knowing that many people visit a certain location (e.g. grocery shops and pharmacies) suggests something about their motivation, there is still much space for interpretation: it is, e.g., very unlikely that many persons will enjoy a shopping trip to a pharmacy. More likely, they simply need medicine. Going for grocery shopping, however, can also be the result of boredom, when other entertaining activities (like cinemas, theatres etc.) are closed. Disentangling both from location data is difficult (as in the US, e.g., pharmacies are often inside supermarkets).

The survey data from Fetzer et al. (2020) is therefore useful to access these patterns further. It contains the following items that were relevant to our research question:

Do you need to leave your home in the next 5 days? (Yes / No)

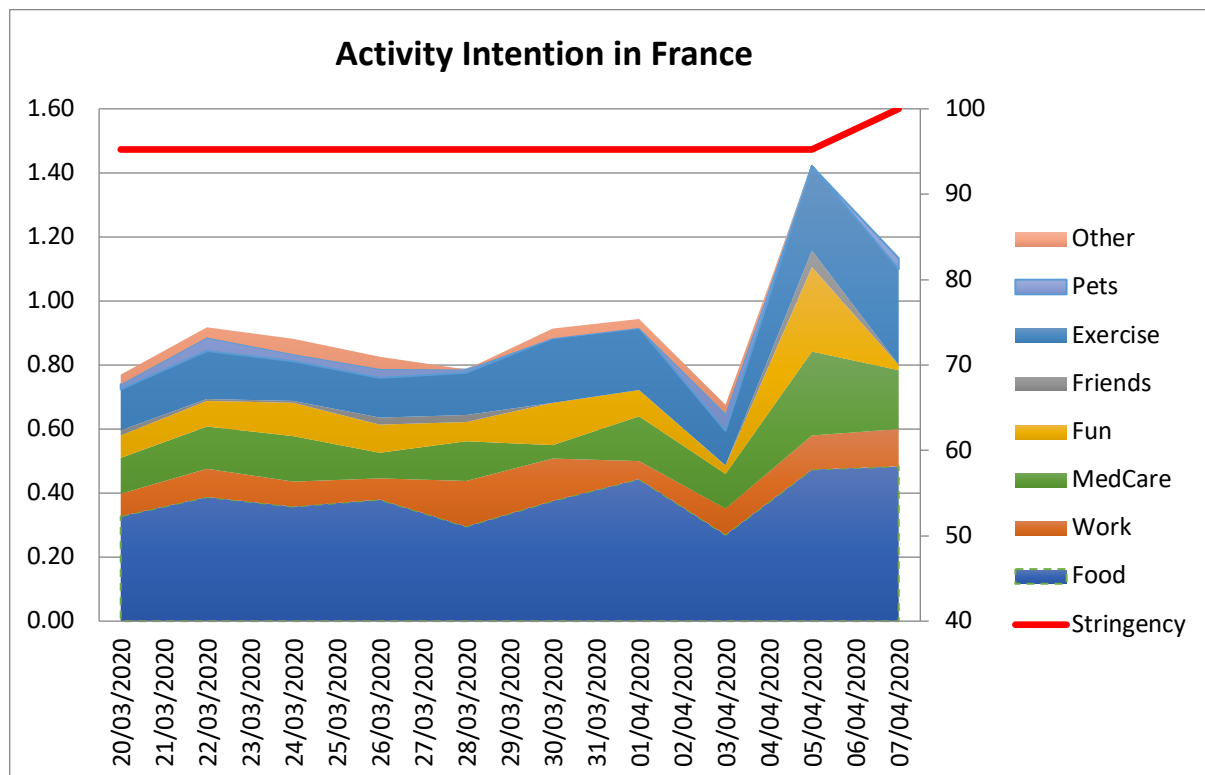
What are the reasons for you to leave your home (check all that apply)? Please try to be as honest as possible. Your answers will be kept confidential.

1. *Going to work*
2. *Walking a pet*
3. *Doing physical activity (e.g. exercising, jogging)*
4. *Procuring food for yourself or family*
5. *Going to the pharmacy*
6. *Going to the hospital / receiving medical treatments*
7. *Taking care of dependents*
8. *Meeting friends or relatives*
9. *Getting tired of being inside of the house*
10. *Getting bored*
11. *Getting some adrenaline (from breaking the law)*
12. *Exercising my freedom*

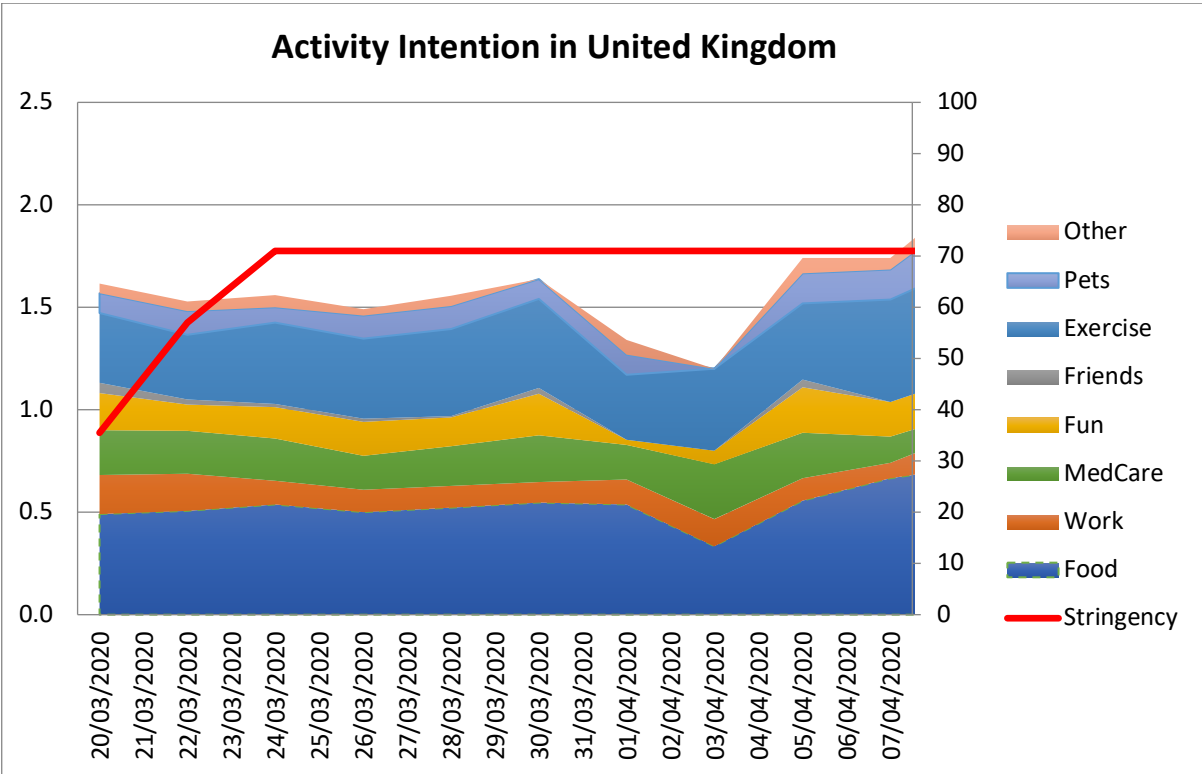
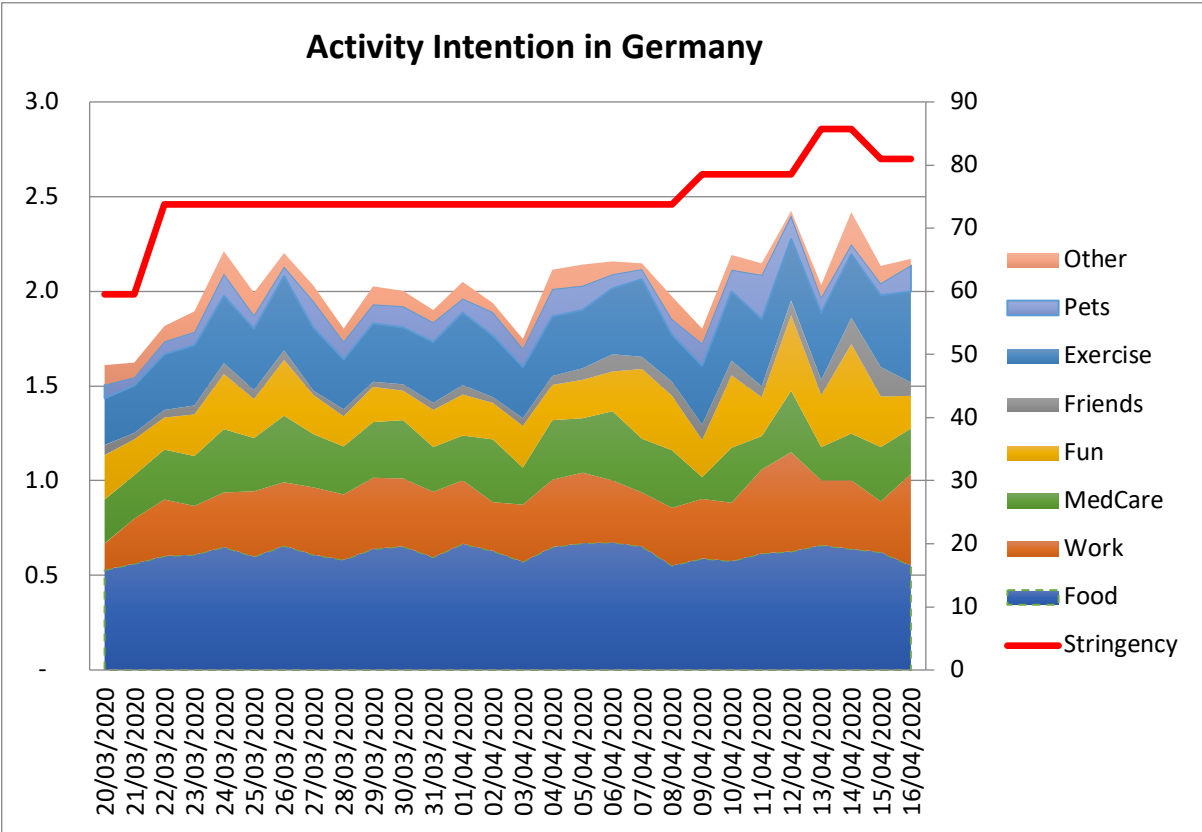
In the following analysis, we summarize activities 5-7 as “MedCare” and activities 9–12 as “Fun”. Some of the suggested reasons certainly can be considered as necessity, particularly

reasons 5 or 6. Others are also quite unavoidable (reasons 1,2,4,7), but might be abused (consciously or subconsciously) as excuse to leave the house. We will come back later for some indicator for this. Activity 3 (doing physical activity) is, when done alone, harmless and is probably even good for the health. Activities 9–12, however, are not really good reasons and some might lead to activities with a large infection risk.

For our analysis, we computed the average number of the selected reasons per country and day (Fig. 5). Given that daily data in April was (besides Germany) not sufficiently large, we used two-day averages for the other countries and stopped the time series when data became too small (<30 observations). The time series starts around the time when the lockdown occurred, so we do not see the initial downwards trend that we had seen in the other studies. This is even more so, since the study asked about the planned behaviour of the *next five days*, so the measure is “future looking”. The figures suggest an upwards trend in the sum of reasons, at least for France and Germany. A closer look reveals that changes in the “quite unavoidable” reasons dominate, and they increase in a way suggesting that not pure necessity, but probably also boredom and a decline in perceived risk contribute to this trend. Indeed, “walking a pet” is in this respect a telling category, as the need for this should obviously be constant, but we measure a statistically significant increase (at least for Germany), which suggests that the increase in buying food might also have other causes than pure necessity. As a more rigorous analysis we estimate the Pearson correlation between the various activity variables and the date (Table 2).⁴ The analysis shows that in all countries, but France, activity intention has been significantly increasing. Most single reasons, however, increase only for Germany. In all countries, physical exercises increased.



⁴ Comparing average levels for March and April using t-tests (as robustness check) yields very similar results.



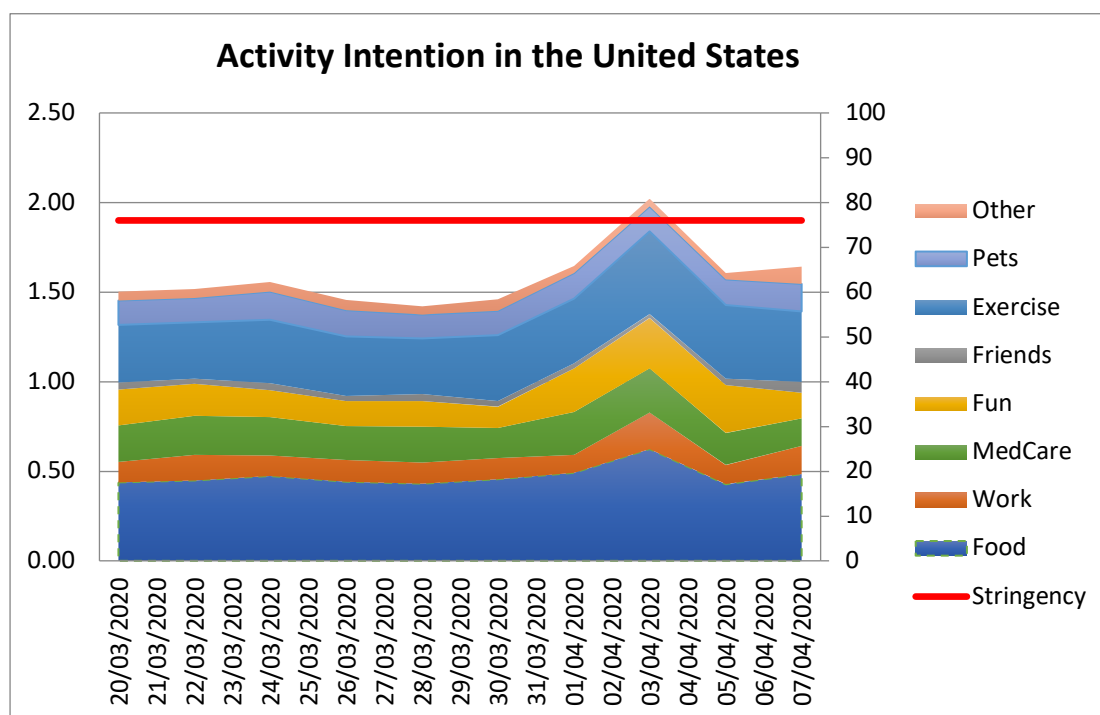


Fig. 5: Activity motivations in the four selected countries over time. Left axis: activity intention (proportion of subjects). Right axis: stringency index.

	France		Germany		USA		UK	
	correl.	p-value	correl.	p-value	correl.	p-value	correl.	p-value
Do you need to leave your home in the next 5 days?	-0.01	0.741	.047**	0	.029**	0.002	.022*	0.018
Going to work	0.013	0.49	.068**	0	0.017	0.07	-.056**	0
Walking a pet	-0.03	0.082	.054**	0	0.011	0.25	0.007	0.44
Doing physical activity	.040*	0.033	.038**	0	.027**	0.004	.052**	0
Procuring food	-0	0.878	.031**	0.001	0.012	0.189	.024*	0.011
Going to the pharmacy	0.001	0.962	0.003	0.778	0.003	0.777	0.004	0.633
Hospital / medical treatments	-0.03	0.093	-0.01	0.41	-0	0.72	-0.01	0.209
Taking care of dependents	0.027	0.155	.020*	0.037	-0	0.863	0.01	0.31
Meeting friends or relatives	-0.01	0.807	.032**	0.001	-0.01	0.619	-.035**	0
Getting tired of being inside	-0.02	0.422	-0.01	0.198	-0.01	0.555	-0.02	0.117
Getting bored	-0	0.967	.032**	0.001	-.020*	0.031	-0.01	0.382
Getting some adrenaline	0.012	0.513	.022*	0.026	-0.01	0.351	0.012	0.216
Exercising my freedom	-0	0.962	.054**	0	0	0.99	.038**	0
Other	-0.02	0.195	-0.02	0.078	0.004	0.678	0.002	0.863
	N	2829		10610		11604		11399

*=significant on 5%, **=significant on 1%

Table 2: Statistical tests for the increase (or decrease) of certain activities over time. Cells in orange indicate an increasing activity while the lockdown lasted, green indicates a decrease.

3.4 Different main activities across regions

The reasons to go out vary between countries. Table 3 lists the main three reasons to go out in a number of countries: in all cases, buying food was the number one activity. Work, physical exercise or walking a pet were other frequent reasons, but their distribution differed widely. It is also worth noticing how much the frequencies differed between countries: in Germany more than 60% planned to go out within the next five days to buy food, in France only 37%. Note that this is not a percentage of the households, but of individuals.

The table might be useful for policy makers as it clearly shows that country differences can be large. When trying to reduce social interactions with potential for new infections, the efficiency of countermeasures will therefore vary.

	Germany	France	UK	US
Food	61.2%	Food 37.0%	Food 50.7%	Food 44.9%
Work	30.9%	Physical Exercise 14.0%	Physical Exercise 33.2%	Physical Exercise 32.5%
Physical Exercise	30.6%	Work 9.0%	Work 17.5%	Pet 13.8%

Table 3: Main activities for the four countries under study

4 Conclusions and policy suggestions

The foremost conclusion from our survey is that activity patterns tend to bounce back: regardless of whether we use map inquiries, locations or survey responses about intended activities, we find in most cases that after a steep decline in activity due to the COVID-19 outbreak and the various lockdown measures, a small but steady increase in activity sets in. This increase is already very visible in the German data, but also in the France data. The UK and the USA started their lockdown later, so the increase is not yet visible in the Google data, but already quite visible in the (forward looking) survey data and the Apple map inquiry data (which also has some forward-looking component, since travel plans might be made a few days ahead).

The nature and intensity of activities varies strongly between countries. This suggests that it might be possible, if need be, to reduce some of these activities, although they look at first glance necessary. It seems surprising, e.g., that Germans need to go shopping for food much more frequently than French.

It also gives some ideas where each country should focus to reduce the risk of a new spread of COVID-19. In Germany, e.g., grocery shops might play an important role, as well as public transportation.

Finally, the slow “erosion” of the lock-down is an important point that needs to be considered when modelling the further development of the epidemics: it’s pivotal to keep in mind that even a good compliance will not last forever.

We recommend to continuously watch the development reflected in these data sets!

Acknowledgement

We thank Jon Jachimowicz (Harvard Business School) for generously sharing the data of Fetzer et al. (2020) with us. We also thank the research teams of Apple and Google to make their data publicly available.

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Appendix : additional material

	France, starting 3/21			Germany, starting 3/21		
	driving	public trans.	walking	driving	public trans.	walking
correl.	0.78	0.79	0.59	0.89	0.95	0.81
p-value	0.00	0.00	0.00	0.00	0.00	0.00
	UK, starting 3/21			USA, starting 3/21		
	driving	public trans.	walking	driving	public trans.	walking
correl.	-0.04	-0.50	0.42	0.51	-0.41	0.48
p-value	0.01	0.00	0.00	0.00	0.00	0.00
	UK, starting 3/28			USA, starting 3/28		
	driving	public trans.	walking	driving	public trans.	walking
correl.	0.64	0.34	0.75	0.66	0.09	0.61
p-value	0.00	0.01	0.00	0.00	0.02	0.00

Fig. A.1: Statistical teste for Apple Map inquiries. Observation period starting from 3/21 and 3/28, respectively. A significant increase is marked in yellow, a significant decrease in green.