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An observational study on the abidance to mask mandates at tram stops

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Abstract

The corona pandemic has led to the implementation of non pharmaceutical interventions by governments worldwide. The use of face masks limits the spread of the COVID-19 virus and mask mandates are a prominent tool of public heath policy. However, this measure is highly politicized and abidance to mask mandates is crucial for the efficiency of face masks. Here, I present the results of an observational study on the abidance to mask mandates at tram stops in Leipzig, Germany. Based on logistic mixed effects regression models, I show that abidance to mask mandates was generally low, with a mask-wearing rate of 33%. However, mask-wearing was more prominent in situations with an increased risk of infection (high 7 day incidence and numerous people at the tram stops). My results contradict the high abidance to mask mandates of 90% found in surveys and highlights the rationality behind mask-wearing behavior.

1. Introduction

The COVID-19 epidemic had a deep impact on societies worldwide. Most governments have implemented non pharmaceutical interventions (NPIs) in response to the spread of the virus. Although the different NPIs vary in their restrictiveness, intrusiveness, and effectiveness (Haug et al. 2020; Bendavid et al. 2021; Boesch 2021), most do imply changes in the daily lives of citizens. For example, the use of face masks in the public has been made mandatory in a large number of countries. While being cost effective, the use of face masks in the public can nevertheless substantially decrease COVID-19 growth rates if the available masks have a high rate of efficacy and the population adheres to the policy (Howard et al. 2020).

However, mask-wearing is highly politicized, and public opinion regarding mask-wearing strongly polarized (Lang et al. 2021), at least in Western countries. Therefore, identifying drivers of adherence to mandatory public use of face masks can help in implementing NPIs and keeping COVID-19 growth rates low. A number of published studies have addressed this issue. The different factors found to influence individual mask-wearing behavior are, among others, government interventions (Goldberg et al. 2020), COVID–19 death rate, political control of government and individual social capital (Hao et al. 2021), political leadership (Kahane 2021), as well as individual political ideology (Utych 2021).

Crucially, the cited studies did not analyze data of actual mask wearing behavior but instead relied on measures of intended or reported mask-wearing behavior from survey data. This approach has two potentially major drawbacks. First, assuming that questions related to mask-wearing behavior are sensitive to some respondents, it is likely that answers from those respondents will suffer from a social desirability bias (Krumpal 2013). Second, mask-wearing behavior might be a function of situational aspects and unconscious individual choices that are difficult, or even impossible, to capture in survey research. As a result, these studies run the risk of providing a biased and incomplete assessment of factors affecting individual mask-wearing behavior.

Here, I present the results of a study where I followed an entirely different empirical approach: instead of conducting a survey on intended or reported mask-wearing behavior, I conducted a structured and standardized observation of actual mask-wearing behavior. The observation was aimed at users of trams at randomly sampled tram stops with mask mandates during a period of seven weeks in Leipzig, Germany. I merged the observational data with data on COVID-19 incidence at the city level and run logistic mixed effects regression models to identify the drivers of mask-wearing at these tram stops. My results highlight the relevance of individual rationality and contextual factors for abidance to mask mandates.

2. Working hypothesis

Although the published literature on drivers of mask-wearing behavior does focus on individual social capital (Hao et al. 2021), political ideology (Utych 2021) and the political context (Goldberg et al. 2020; Hao et al. 2021; Kahane 2021), I assumed that the use of a face mask was a rational choice (Becker 1976) of individuals. The intention behind the implementation of policies mandating the use of face masks in public, and the rational for the use of face masks, is the protection of individuals from COVID-19 infections (Lyu & Wehbi 2020; Howard et al. 2020). This should be well known by citizens. Therefore, I expected the propensity for individual mask-wearing to increase with the risk for a COVID-19 infection, independently of political context, social capital and ideology. *H1)* T*he higher the risk of a COVID-19 infection, the higher the propensity for mask-wearing*.

3. Methods

The legal basis for the mask mandate at tram stations in Leipzig is laid by corona protection ordinances of the Free State of Saxony (Sächsisches Staatsministerium für Soziales und Gesellschaftlichen Zusammenhalt 2021a, 2021b, 2021c). The city of Leipzig and its municipal transport company, the Leipziger Verkehrsbetriebe (LVB), are responsible for implementation of the mask mandate. In principle, violations of the mask mandate are punished with a fine of 60€ (Sächsisches Staatsministerium für Soziales und Gesellschaftlichen Zusammenhalt 2020). However, these offenses are not actively prosecuted at tram stops and I considered mask-wearing behavior of individuals at tram stops in Leipzig as a manifestation of voluntary and spontaneous adherence to public mask mandates.

3.1 Study design

In order to measure the mask-wearing behavior of individuals, I conducted a structured and standardized observation of individuals at tram stops in Leipzig. The 29 tram stops where the observation took place were randomly sampled (figure 1).

The observation took place from 06/05/2021 to 23/06/2021 and was part of a seminar on the methods of empirical quantitative social research at the Institute of Sociology at the University of Leipzig. During this period of time, wearing a face mask was mandatory on all platforms of all tram stops within the city of Leipzig. Wearing an FFP2 mask was compulsory until 14/05/2021 (LVB 2021a) at all tram stops in Leipzig, after which medical masks were also allowed (LVB 2021b). The goal of the observation study was to visit all sampled stations at least at two different points of time (during daytime) each week. Then, the observers (maximal two participants of the seminar) chose one platform of the station where they would observe waiting individuals. The observation phase began after the first tram had left the observed platform until just before the second tram arrived at the observed platform. The observers behaved as inconspicuously as possible and used an observation form to record information on the individuals arriving and waiting at the platform (appendix 1). The recorded information involved, among others, the sequence of arrival of individuals at the station, whether the individuals did wear a mask properly (covering mouth and nose) over the entire period of their stay at the station and the type of mask used, estimated age categories and gender of individuals, whether the individuals were on their own or with a group of people, as well as whether the individuals wore glasses, consumed food or beverages, smoked or talked on the phone. The observation of individuals was finished after the second tram left the station. Then, the observers used a second observation form (appendix 2) to record information related to the observed platform and the weather during the observation.

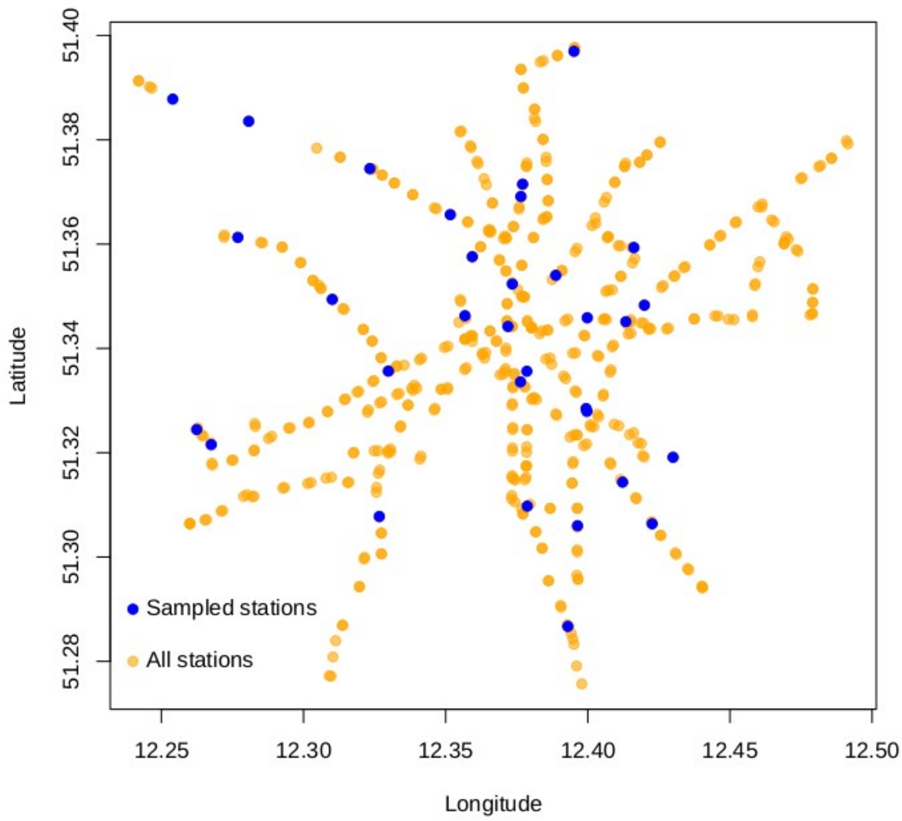

Figure 1. Location of tram stops in Leipzig. *Based on the list of tram stops in service available on the homepage of the LVB on 21/04/2021, I first removed all tram stops with more than two platforms and not located within Leipzig. Then, out of the remaining 220 stations, I randomly selected 29. I obtained the coordinates of the stations used for the figure through openstreetmap (2021) with the sp (Pebesma & Bivand 2005; Bivand et al. 2013) and osmdata (Padgham et al. 2017) libraries in R (R Core Team 2021).*

3.2 Generation of variables and data processing

Before analyzing the data, I recoded and generated a number of variables at the individual and contextual level. First of all, I computed a dichotomous variable for the adherence of individuals to the mask mandate (1 if individuals correctly wore a mask (covering nose and mouth) over the entire period at the platform; 0 if not). Then, I computed a gender dummy variable (1 for estimated gender female; 0 for estimated gender male) and an elderly dummy variable (1 for estimated age larger 60;

0 for estimated age 60 or younger). I built a dummy variable indicating whether the individuals wore glasses (1 for glasses; 0 for no glasses) and a dummy variable indicating whether individuals did drink, eat or smoke on the platform (1 for eating, drinking or smoking; 0 for none). Finally, I also computed a dichotomous variable showing if the individuals stayed on their own at the platform or in a group with other people (1 on their own; 0 with other people). Those were the individual level variables.

At the contextual level, I used information on the sequence at which individuals arrived at the platform to compute a variable counting the number of people present at the platform when individuals arrived (this number includes the individual arriving at the platform). I merged the data recorded during the observation of tram platforms with data on the 7 day incidence of COVID-19 cases in Leipzig (corona-in-zahlen.de 2021) to compute a variable measuring the 7 day incidence in Leipzig at the time individuals were observed at the platforms and used the recorded information on the weather during the observation to generate a variable measuring the temperature (in degree Celsius) at the time of observation. Finally, I built one dichotomous variable measuring the demarcation of the tram stop to the rest of the street and sidewalk (1 for clearly demarcated and developed tram stops; 0 for tram stops not demarcated and developed) and a dichotomous variable showing if the platform was provided with an official note referring to the mask-mandate (1 official note; 0 no official note).

3.4 Statistical Analysis

The outcome variable was the individual abidance to the mask mandate, measured with the dichotomous variable of mask-wearing. However, as the mask mandate did not hold for children (until six years old), I excluded all individuals considered as children by the observers from the analysis.

The predictor variables for the risk of an infection with COVID-19 were the 7 day incidence of COVID-19 cases in Leipzig when individuals were observed at the platform and the number of people, including the arriving individual, present at the platform when the individuals entered the platform. However, for individuals already present at the platform when the observation started, this number was unknown. Therefore, I also excluded all these individuals from the analysis.

In the null model, the outcome variable was a function of gender, age, glass-wearing, smoking, eating or drinking, temperature, station type and official mask mandate note. In the full model, the outcome variable was also a function of 7 day incidence and number of people at the station. The combined effect of the predictors on the outcome was assessed by running an AIC-based likelihood ratio test of the full- against the null model. The hypothesis test was based on the sign and significance of the full model estimates for the predictors.

All metric predictor and control variables were standardized to a mean of zero and a standard deviation of one prior to estimation (z-transformation) to allow for simple comparison and interpretation of estimates (Schielzeth 2010). Further transformations were performed, when necessary, to achieve approximately symmetrical distributions and avoid influential cases (Quinn & Keough 2002). For all models, I included a random intercept to control for clustered means at the level of the specific tram the individuals were waiting for, as well as at the level of the tram stops. Furthermore, I included random slopes to account for clustered effects of control and test predictors at the level of the tram stops. This approach makes sure that test statistics of fixed effects are unbiased (Barr et al. 2013; Bell et al. 2019). I kept the random term structure constant across models for comparability and included all random effect correlation estimates (appendix 3).

I performed all data processing and analysis in R (R Core Team 2021) and estimated the models with the glmer function of the lme4 library (Bates et al. 2015). I checked for normal distribution of random effects with histograms and calculated the variance inflation factor (VIF) for all estimates with the vif function of the car library (Fox & Weisberg) to assess multicollinearity among predictors. I run two model sensitivity analysis to evaluate the robustness of estimates and computed scaled residuals to test for model missspecification with the simulateResiduals and the plotSimulatedResiduals functions of the DHARMa library (Hartig 2021).

4. Results

Overall, a total of 2350 individuals were observed at the tram platforms. However, 1075 of the observed individuals were identified as children by the observers. Furthermore, 344 individuals were already on the platform when the observers started their observation. Excluding the children and the individuals already on the platform when the observers started their observation, the data of a total of 1780 individuals remained for the analysis. All further results and discussions refer to this sub-sample.

On average, 33% of individuals wore a mask correctly (over mouth and nose) and during the entire time at the platforms. The observers identified 56% of the individuals as females and 17% as older than 60 years. 16% of the individuals wore glasses, 13% did drink, eat or smoke while being at the platform and 69% of the individuals stayed on their own at the platform. 75% of observed individuals were at a well demarcated and developed platform and in 66% of the cases, an official note referring to the mask mandate was placed at the platform. The average temperature at the platforms was 19°, with a minimum of 7° and a maximum of 32°. The number of people present at the platform when individuals arrived (including the arriving individual) ranged from 1 to 22 (mean: 19; median: 4) and the 7 day incidence ranged from 5 to 107, with an average of 43 (table 1).

Observations were made on 45 days of the 49 day observation period. However, the number of observations varied substantially between dates and stations (appendix 4). This resulted, on the one hand, from differences in traffic and number of passengers between the different stations and dates, on the other hand, however, also from differences in effort invested by the observers.

The predictors clearly contributed to our understanding of mask-wearing behavior at the platforms (Chisq: 19.317, Df: 2, p-val.: <0.001). The probability for mask-wearing increased significantly with increasing 7 day incidences (table 2). For the reference (male, 60 years or less, no drinking, eating or smoking, not on its own at the platform, no glasses, at an undeveloped station without mask-mandate notice, with average number of people at the station, average temperature and average 7 day incidence), the estimated probability for wearing a mask was 24.7%. For the minimal 7 day incidence of 5.1, this probability was 15.1% and more than doubled to 32.5% for the maximal 7 day incidence of 106.9 (figure 2). Similarly, the probability for mask-wearing increased significantly with increasing number of people at the platform when individuals arrived (table 2). While the estimate probability for mask wearing was 16.4% for the reference being alone at the platform, this probability raised to an estimated 38.1% when 22 people were at the platform (figure 3).

Table 1. Summary statistics of all variables

Variable	Minimum	Maximum	Mean	Standard deviation
Mask (0: no; 1: yes)			0.331	
Gender (0: male; 1: female)			0.556	
Old (0: <= 60 years; 1: > 60 years)			0.173	
Glasses (0: no glasses; 1: glasses)			0.164	
Drink, eat, smoke? (0:no; 1: yes)			0.135	
Alone (0: in group; 1: alone)			0.691	
Platform type (0: not developed; 1 developed)			0.751	
Mask mandate notice? (0: no; 1:yes)			0.66	
Temperature (degree Celsius)	7	32	19.488	5.465
People (number at arrival, including ego)	1	22	19.488	3.616
Incidence (7 day/100’000 inhabitants)	5	106.9	43.272	29.165

Interestingly, the temperature was a significant predictor of mask wearing (table 2), with estimated probability for the reference decreasing from 34.6% at 7° to 16.9% at 32° (figure 4). The estimates for the 7 day incidence and the average daily temperature allowed to track the strong decline in the share of individuals wearing a mask that occurred during the period of observation (figure 5).

Finally, the probability of mask-wearing was 5.7% higher for females than for males, 7.4% higher for individuals on their own than individuals in groups and 10% higher on developed and demarcated platforms than on undeveloped and not demarcated platforms. Apart from drinking, eating and smoking, none of the other predictors had a significant effect on mask-wearing. The model did detect a substantial variation in the average proportion of individuals wearing a mask at the level of the stations and the specific tram they were waiting for (table 2). These variation terms captureed eventual effects of political context and social capital, as well as other unobserved heterogeneity.

Table 2. Results of the full model estimation

Random effects	Standard deviation	p. value	
Tram: RI	0.575	0.001	
Station: RI	0.500	NA	
Station: gender RS	0.343	0.034	
Station: old RS	0.178	0.232	
Station: alone RS	0.607	0.132	
Station: people § RS	0.126	0.448	
Station: incidence § RS	0.068	0.499	
Number trams: 394			
Number stations: 29			
Number individuals: 1780			
Fixed effects	Estimate	Standard error	p.value
Intercept	-1.113	0.244	NA
Gender	0.285	0.138	0.045
Old	-0.221	0.165	0.187
Alone	0.366	0.182	0.048
Glasses	-0.057	0.166	0.732
Drink, eat, smoke?	-2.956	0.357	<0.001
Platform type	0.491	0.208	0.015
Mask mandate notice	-0.262	0.181	0.147
Temperature #	-0.208	0.086	0.017
People §	0.278	0.072	<0.001
Incidence §	0.261	0.086	0.002

RI=random intercept; RS=random slope; # z-transformed prior to estimation; § log- and z-transformed prior to estimation; p. values were calculated by running AIC-based likelihood ratio tests on reduced models lacking the respective terms (this approach was not feasible for the intercept and the station RI). For random slopes, the resulting p. values were divided by two, as proposed in Bolker et al. 2009. The model did not suffer from multicollinearity (appendix 5) and was robust to the exclusion of single days and stations (appendix 6a/6b). Distribution of scaled residuals did not hint to model missspecifications (appendix 7) and random effects were approximately normally distributed (appendix 8). The andom effect correlation estimates not shown for purpose of clarity.

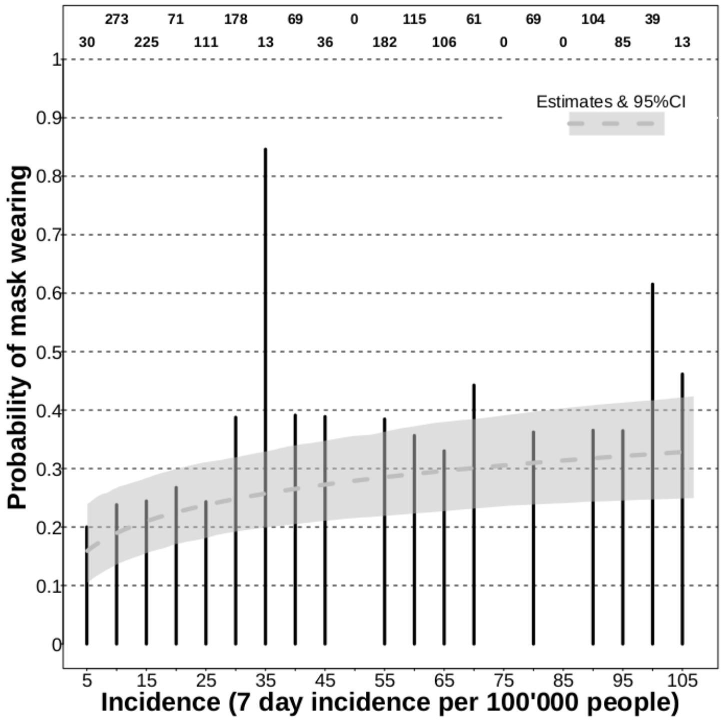

Figure 2. The effect of the 7 day incidence on the probability of mask-wearing. *The estimated values are for the reference from the model shown in table 2. 95% confidence intervals were computed based on estimates from 1000 bootstrapped models (R function provided by Roger Mundry).*

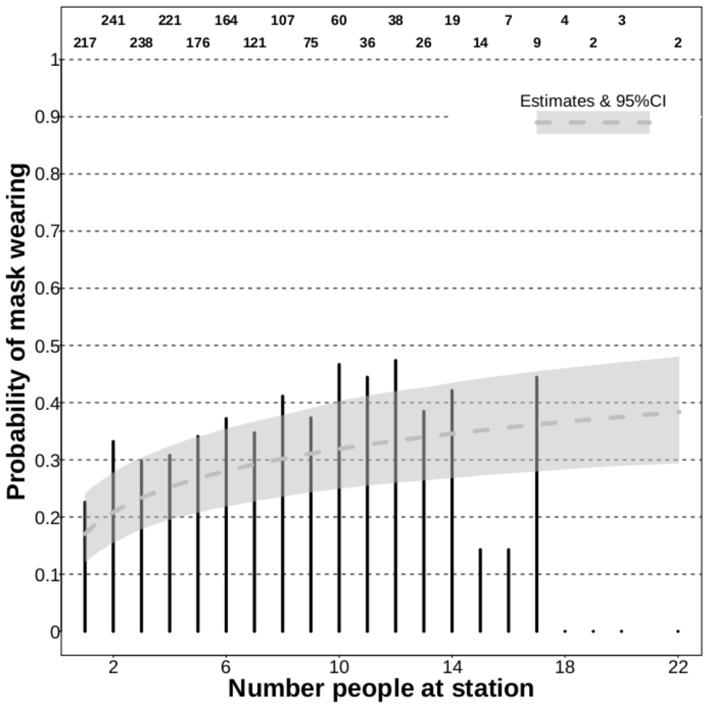

Figure 3. The effect of the number of people at the platform on the probability of mask-wearing. *The estimated values are for the reference from the model shown in table 2. 95% confidence intervals were computed based on estimates from 1000 bootstrapped models (R function provided by Roger Mundry).*

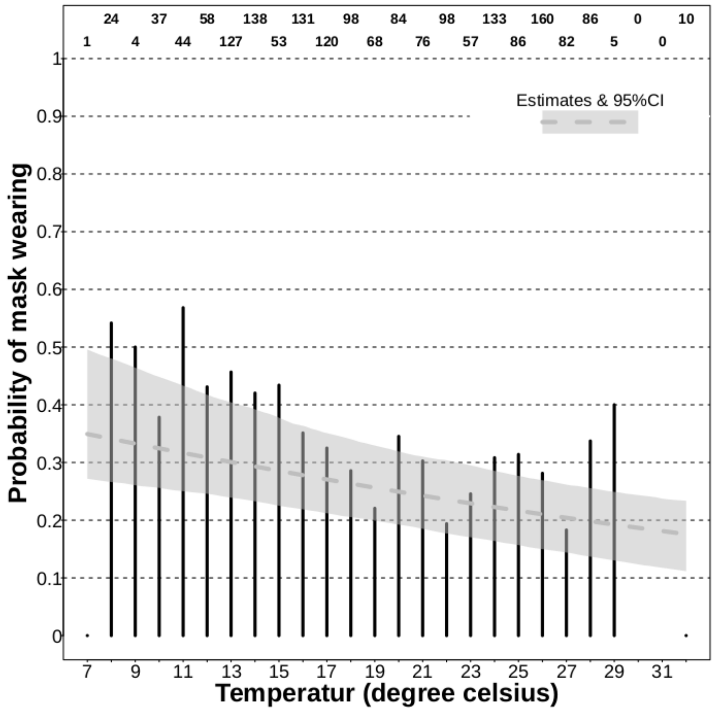

Figure 4. The effect of the temperature on the probability of mask-wearing. *The estimated values are for the reference from the model shown in table 2. 95% confidence intervals were computed based on estimates from 1000 bootstrapped models (R function provided by Roger Mundry).*

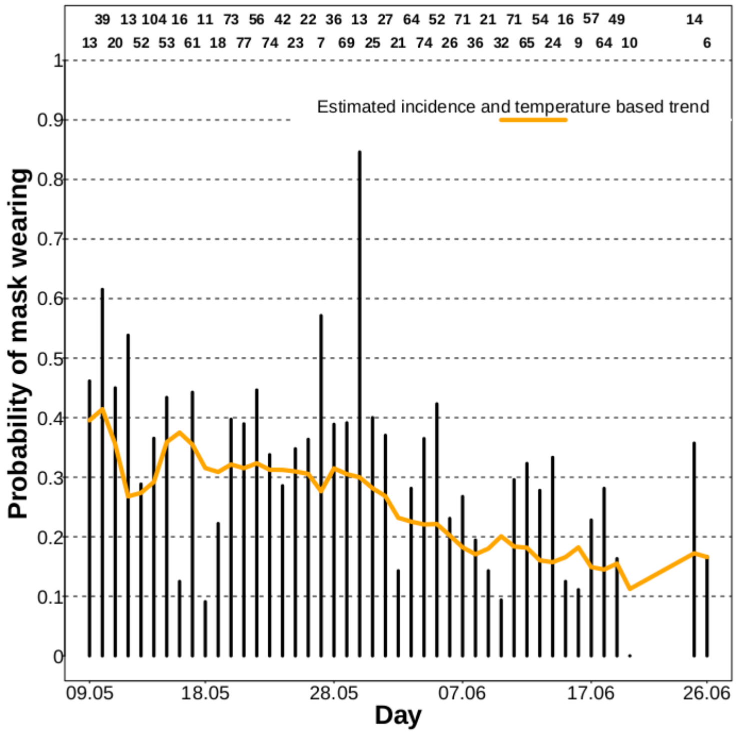

Figure 5. Development of mask-wearing behavior over time. *Estimated values are for the reference from the model shown in table 2, based on daily average temperatures and 7 day incidences. Due to a high correlation between the count of days starting with the beginning of the period and the 7 day incidence (-0.97), it is not meaningful to include a time trend into the full model in table 2. However, substituting the 7 day incidence with a time trend does not lead to substantial changes in the estimates (appendix 9).*

5. Conclusion

First of all, the systematic and standardized observation of individuals at tram stops in Leipzig allowed to obtain a measure for the actual mask-wearing behavior of individuals and the rate of abidance to mask mandates in the public: 33% of individuals did wear a mask correctly (covering mouth and nose) and over their entire stay at the platform. This should be considered as a low rate of abidance to the mask mandate in place at the platforms. Most importantly, this result is in stark contrast to the 90.1% of respondents in the COVID-19 Snapshot Monitoring who claimed to use a face mask in the public (2021). Of course, there are a number of reasons that might explain these diverging results. For example, tram stops are outdoors and respondents did probably think about indoor locations when reporting their mask-wearing behavior. Additionally, the population of Leipzig and the sample of observed individuals might have differed from the sample of participants in the COVID-19 Snapshot Monitoring. Furthermore, a face mask can be used in different ways, which grants room for interpretation. Nevertheless, this result highlights that survey research on reported behavior must be taken with caution.

Of course, observational studies have their drawbacks too. Most importantly, it is impossible to observe the motives and the knowledge of individuals. Even basic characteristics, such as gender and age, can only be assessed with uncertainty. However, observed behavior can be linked to hard facts, such as the environmental context. In my study, the environmental context was a strong predictor of individual mask-wearing behavior. The 7 day incidence, the number of people, the temperature, the development of the station and the presence of other acquainted people strongly influenced individual mask-wearing behavior. When the context was favorable for a COVID-19 infection (high 7 day incidence and the presence of many people), individuals were more likely to wear a mask than when there were no other people at the platform and the 7 day incidence was low. This clearly is in line with the axioms of homo oeconomicus (Becker 1976).

On the other hand, an official note drawing attention to the requirement to wear a mask was not sufficient to trigger mask-wearing. As already noted by Homans (1950), sanctions are an essential part of social norms. As long as deviations from the prescribed behavior are not punished in some form, the prescribed behavior is not a social norm and the prescription does not matter for individuals. Punishment, on the other hand, leads to norm abidance as it will be in the self-interest of individuals to follow the norm and not getting punished for a violation.

In summary, observed abidance to the mask mandate at tram stops in Leipzig was entirely in line with fundamental social theory: as deviations from the prescribed behavior were not sanctioned, mask-wearing mainly followed from the self-interest of individuals and was not observed as frequently as expected based on the mask mandate. This leads to the question of why a mask mandate is introduced at all if it is not enforced.

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Appendix

1) Observation form for individuals at the platform (in German original)

Passantenbogen

Datum (DD.MM.YYYY):

Uhrzeit Einfahrt erste Bahn (hh:mm):
Uhrzeit Abfahrt zweite Bahn (hh:mm):
Straßenbahnlinien 1./2. Bahn (X/Y):

Haltestelle:

Richtung 2. Bahn (Endhaltestelle):

Beobachter/in auf Haltestelle (ja/nein):

Beobachter/in:

Anmerkungen:
Reihenfolge (i): Alle Personen die sich zum Zeitpunkt des Beobachtungsbeginns an der Haltestelle befinden erhalten die Nummer 0. Hinzukommende Personen werden entsprechend der Reihenfolge nummeriert, mit der sie an der Haltestelle eintreffen. Personen die gleichzeitig zur Haltestelle kommen erhalten dieselbe Nummer.
Maske (**Nein/FFP2/OP/Stoff/Jein/0.5)**: Person trägt keine Maske über Nase und Mund/Person trägt FFP2 Maske/Person trägt OP Maske/Person trägt Stoffmaske/Person trägt Maske nur über Mund /Verhaltenswechsel, setzt Maske auf bzw. ab
Alter (K/J/E/A): Kind (0 - 14) / jugendlich (14 - < 18) / erwachsen (18 - <60) / alt (graue Haare, 60+)
Geschlecht (M/W): Männlich/weiblich
R/T/E/B/H: Raucht/trinkt/isst/Brille/telefoniert mit Handy
Gruppe (g): wenn Sie das Gefühl haben, dass mehrere Personen zusammengehören, dann vergeben Sie diesen Personen eine gemeinsame Gruppennummer. Personen, von denen Sie ausgehen, dass Sie sich alleine an der Haltestelle befinden, erhalten keine Gruppennummer
Trifft nicht zu: Falls in einer bestimmten Zelle keine Angabe zutrifft, geben Sie bitte eine 0 ein
Unklar: Falls Sie zu einer bestimmten Angabe wirklich keine Auskunft treffen können, notieren Sie bitte ein „?“.

Reihen-folge (i)	**Maske** (Nein/FFP2/OP/ Stoff/Jein/0.5)	**Gelesenes Alter** (K/J/E/A)	**Gelesenes Geschlecht** (M/W)	**Rauchen/Trinken /Essen/Brille/Handy** (R/T/E/B/H)	**Gruppe** (g)	**Kommentar**

2) Observation form for the platform of the waiting individuals (in German original).

Haltestellenbogen

Datum (DD.MM.YYYY):	Uhrzeit (MM:HH):
Haltestelle:	Beobachter/in:
Temperatur (grad):	Witterung (Sonnig, bewölkt, regnersich...):
Unterstand/Häuschen (ja/nein):	Elektronische Anzeige (ja/nein):
Aushang Maske Tragen (ja/nein):	Haltestellentyp: Bürgersteig Halbinsel Kreis (Endhaltestelle) Ausgebauter Bürgersteig Andere____________________
Richtung (Stadt ein/auswärts):	Anzahl Haltestellenseiten (1/2)
Müll nicht in Mülleimer (Anzahl): 0, 1-9, 10-19, 20-49, 50-74, 75-99, >100	Aufkleber (Anzahl): 0, 1-9, 10-19, 20-49, 50-74, 75-99, >100
Graffiti (Grosse Schriftzüge) (Anzahl):	Tags (kleine Kritzeleien) (Anzahl): 0, 1-9, 10-19, 20-49, 50-74, 75-99, >100
Kippenstummel Boden (Anzahl): 0, 1-9, 10-19, 20-49, 50-74, 75-99, >100	Hundekot Boden (Anzahl):
Flaschen nicht im Mülleimer (Anzahl):	Vandalismus Art: (Anzahl):

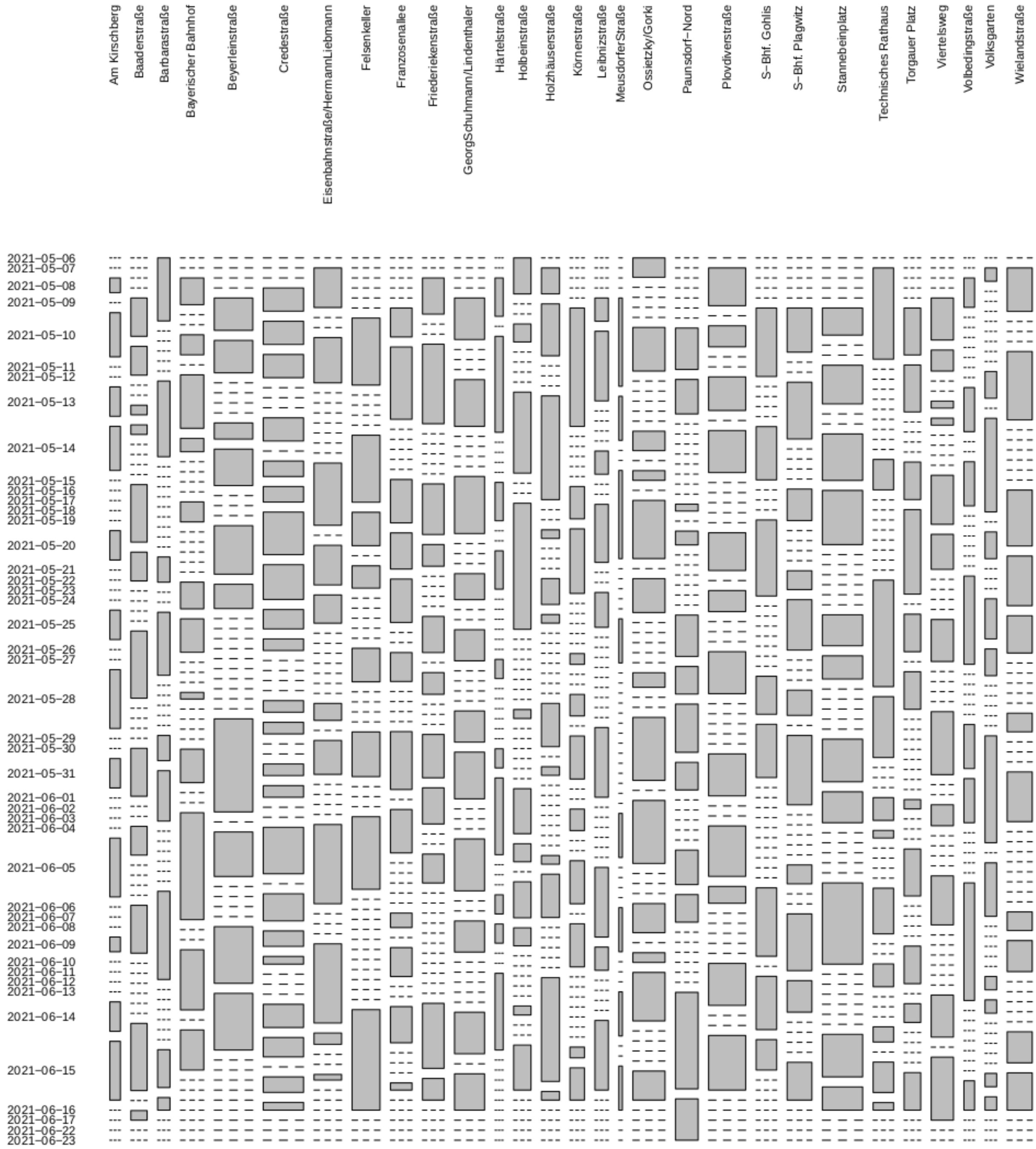
Sonstiges:____________________________

3) R syntax for model specifications and estimations

```
null=glmer(mask_yes_no~
        old+gender+drink_eat_smoke+glasses+alone+z.temperature+type+note+
        (1|tram)+
        (1+gender+old+z.log.people+z.log.incidence+alone|tram_stop),
        data = findata, family = "binomial", control=glmerControl(optimizer="bobyqa",
        optCtrl=list(maxfun=1000000)))

full=glmer(mask_yes_no ~
        old+gender+drink_eat_smoke+glasses+alone+z.temperature+type+note+
        z.log.incidence+z.log.people+
        (1|tram)+
        (1+gender+old+z.log.people+z.log.incidence+alone|tram_stop),
        data = findata, family = "binomial", control=glmerControl(optimizer="bobyqa",
        optCtrl=list(maxfun=1000000)))
```

4) Number of observations per tram stop and date.



The larger/higher the column/row/cell-block, the greater the number of observations

5) VIF values of test and control predictors from the model in table 2

Predictor	VIF
Gender	1.026
Old	1.035
Alone	1.042
Glasses	1.043
Drink, eat, smoke?	1.040
Platform type	1.083
Mask mandate notice	1.094
Temperature #	1.499
People §	1.053
Incidence §	1.508

 # z-transformed prior to estimation; § log- and z-transformed prior to estimation

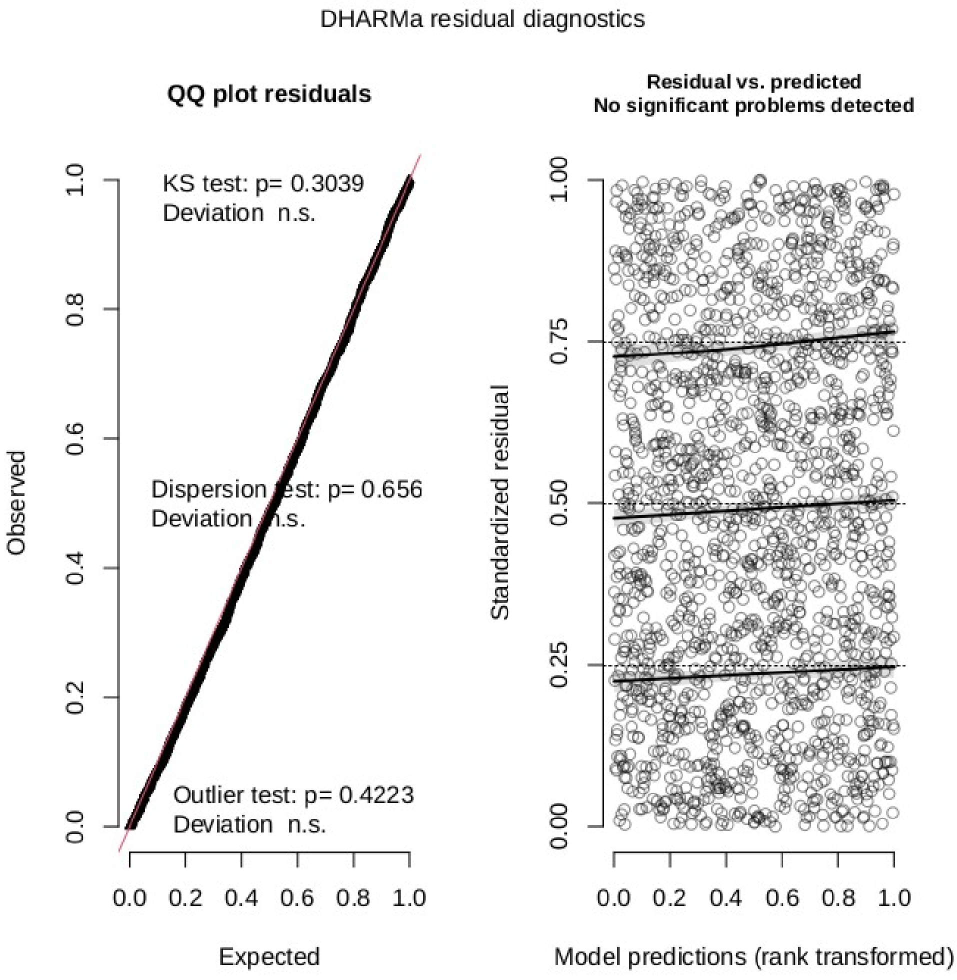
6a) Sensitivity analysis on the exclusion of single days for estimates of the model in table 2

Fixed effects	Minimum	Original	Maximum
Intercept	-1.196	-1.113	-1.039
Gender	0.242	0.285	0.310
Old	-0.287	-0.221	-0.160
Alone	0.314	0.366	0.411
Glasses	-0.140	-0.057	-0.003
Drink, eat, smoke?	-3.335	-2.956	-2.859
Platform type	0.412	0.491	0.558
Mask mandate notice	-0.345	-0.262	-0.153
Temperature #	-0.240	-0.208	-0.175
People §	0.253	0.278	0.311
Incidence §	0.228	0.261	0.298

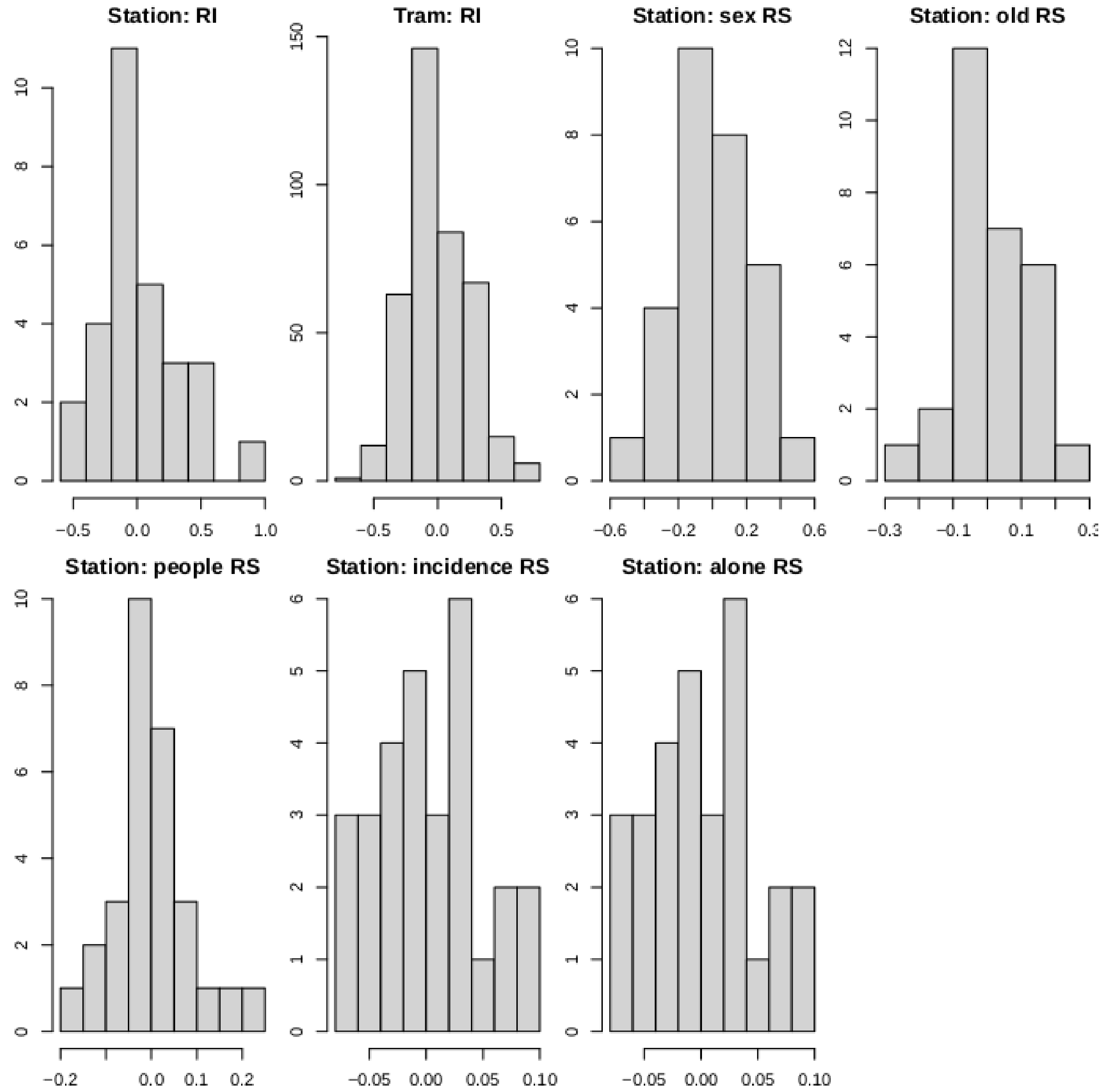
6b) Sensitivity analysis on the exclusion of single stations for estimates of the model in table 2

Fixed effects	Minimum	Original	Maximum
Intercept	-1.210	-1.113	-1.011
Gender	0.225	0.285	0.326
Old	-0.275	-0.221	-0.174
Alone	0.284	0.366	0.462
Glasses	-0.113	-0.057	0.005
Drink, eat, smoke?	-3.061	-2.956	-2.825
Platform type	0.390	0.491	0.614
Mask mandate notice	-0.331	-0.262	-0.161
Temperature #	-0.256	-0.208	-0.167
People §	0.248	0.278	0.303
Incidence §	0.218	0.261	0.288

7) Residual analysis of the model in table 2, based on scaled residuals and functions from the DHARMa library (Hartig 2021).



8) Distribution of random effects from the model in table 2.



9) Fixed effects of the model from table 2, where the 7 day incidence was substituted with the sequence of days to model a time trend

Number trams: 394			
Number stations: 29			
Number individuals: 1780			
Fixed effects	Estimate	Standard error	p.value
Intercept	-1.112	0.245	NA
Gender	0.283	0.139	0.048
Old	-0.222	0.165	0.186
Alone	0.369	0.183	0.047
Glasses	-0.059	0.165	0.721
Drink, eat, smoke?	-2.958	0.357	<0.001
Platform type	0.490	0.208	0.015
Mask mandate notice	-0.264	0.180	0.142
Temperature #	-0.222	0.086	0.010
People §	0.276	0.072	<0.001
Day #	0.241	0.085	0.005

RI=random intercept; RS=random slope; # z-transformed prior to estimation; § log- and z-transformed prior to estimation; p. values were calculated by running AIC-based likelihood ratio tests on reduced models lacking the respective terms (this approach was not feasible for the intercept).

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