System parameters

Parameter	Type	Description	Values	Notes
Length distribution	Real data (Chicago) [1]	For each TAZ, the other TAZ regions are grouped in 4 sets (short, normal, long, extreme), which represent the distance of the given TAZ with respect to the others.	**36% short** **22% normal** **18% long** **24% extreme**.	The distances are labeled based on the distance quantiles between centroids (in meters). Specifically: [0,3305]: short (3305,5307]: normal (5307,7446]: long (7446,+inf): extreme.
Customer personality distribution	Real data (editable) [2][3]	Generated customers can have 3 different personalities, depending on the acceptance rate based on economic conditions (specifically the surge multiplier value): **hurry, normal, greedy**.	The probability of the personalities is actually the following: **Hurry**: 37% (age 16-24) **Greedy**: 18% (age 45-64) **Normal**: 45% (age 25-44).	Following [2], we see that older riders are less likely to pay the surge price. By using data about riders' age provided in [3], we discretised the age distribution in the 3 personalities.
Customer acceptance distribution	Arbitrary (editable)	The personality of the customer defines the probability that he will accept the ride, given the current economic conditions (surge multiplier value).	The probability of the acceptance distributions (based on the surge multiplier value) is actually the following: **Hurry**: (-inf,1.4]: 100% [1.4,1.6]: 90% [1.6,1.8]: 80% [1.8,2]: 70% [2,2.2]: 60% [2.2,+inf): 50% **Greedy**: (-inf,1]: 100% [1,1.2]: 85% [1.2,1.4]: 70% [1.4,1.6]: 50% [1.6,1.8]: 25% [1.8,+inf): 10% **Normal**: (-inf,1.2]: 100% [1.2,1.4]: 90% [1.4,1.6]: 80% [1.6,1.8]: 70% [1.8,2]: 60% [2,+inf): 40%.	

Driver personality distribution	Real data (editable) [4][5][6]	Generated drivers can have 3 different personalities, depending on the acceptance rate based on economic conditions (specifically the surge multiplier value): **hurry, normal, greedy**.	The probability of the personalities is actually the following: **Hurry**: 21% **Greedy**: 24% **Normal**: 55%.	Considering the papers [4][5], which claim that the more experience the driver has, the more greedy he will be, and the thresholds referred to the number of trips in [5], we computed the proportion using the data provided by [6].
Driver acceptance distribution	Arbitrary (editable)	The personality of the driver defines the probability that he will accept the ride, given the current economic conditions (surge multiplier value).	The probability of the acceptance distributions (based on the surge multiplier value) is actually the following: **Hurry**: (-inf,1]: 70% [1,1.2]: 80% [1.2,1.4]: 90% [1.4,+inf): 100% **Greedy**: (-inf,1]: 1% [1,1.2]: 5% [1.2,1.4]: 20% [1.4,1.6]: 40% [1.6,1.8]: 60% [1.8,2]: 80% [2,+inf): 100% **Normal**: (-inf,1]: 50% [1,1.2]: 70% [1.2,1.4]: 80% [1.4,1.6]: 90% [1.6,+inf): 100%.	
Start hour	Editable	Defines the begin hour of the simulation.	Midnight for normal scenario.	
End hour	Editable	Defines the end hour of the simulation.	Depends on the scenario.	Actually tested until 12 hours.
Time to stabilise	Editable	Timestamp needed to stabilise the simulator behaviour.	**3600 timestamps (1 hour)**.	1 hour is the “safe threshold” for each scenario.
Normal behaviour duration	Editable	Timestamp needed to run the simulator with a normal behaviour.	**3600 timestamps (1 hour)**.	Useful to catch **False Positives**.

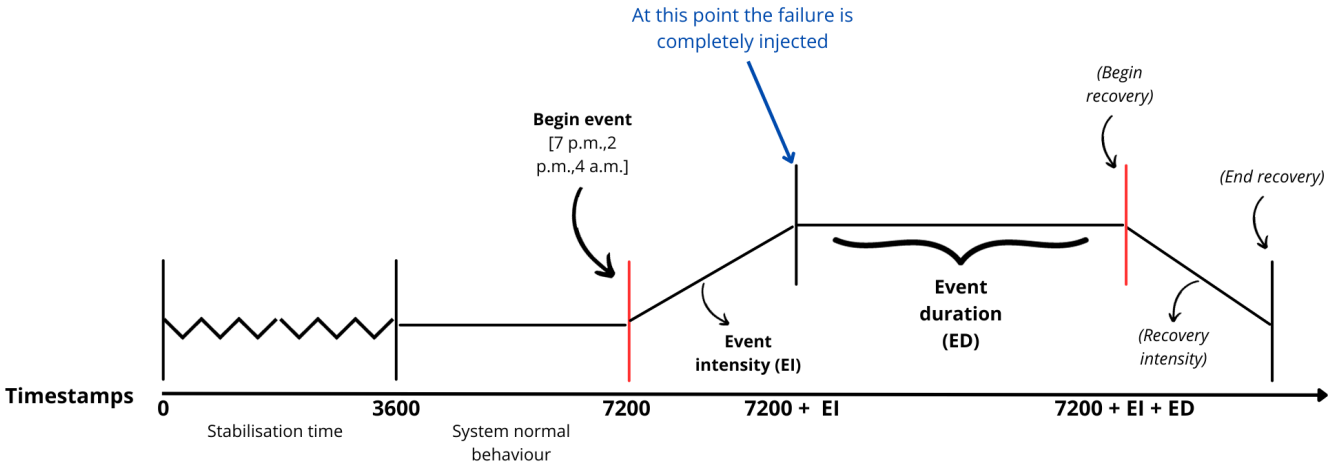
Final timestamps to cut	Editable	Timestamps to cut at the end of the simulation. This has to be done because otherwise we consider indicators referred to rides not yet completed (i.e. with NaN values).	**30 minutes (1800 timestamps)**.	
Surge multiplier	Arbitrary algorithm (editable)	Arbitrary algorithm to emulate the real surge multiplier (ML algorithm not available). It takes into account the ratio between active customers and active drivers, plus the number of unserved requests.	Min: 1 Max: 5	Could use ML to predict it in case we obtain the data (e.g. from API, which are currently not available).
Uber/Lyft choice	Realistic (editable) [7]	Simulates user choice between Lyft and Uber based on current market share (75% Uber, 25% Lyft).		More in detail: With 75% probability the user opens the Uber app to book a ride (25% Lyft). If the request is accepted the ride starts, otherwise the user turns to the other concurrent app to book a ride. If the request fails again, the user is not served.

[1] https://data.cityofchicago.org/Transportation/Transportation-Network-Providers-Trips-2022/2tdj-ffvb/data
[2] Kooti, Farshad & Grbovic, Mihajlo & Aiello, Luca & Djuric, Nemanja & Radosavljevic, Vladan & Lerman, Kristina. (2017). Analyzing Uber's Ride-sharing Economy. 574-582. 10.1145/3041021.3054194.
[3] statista.com/statistics/822833/us-ride-sharing-uber-users-age/
[4] Peyman Ashkrof, Gonçalo Homem de Almeida Correia, Oded Cats, Bart van Arem, Understanding ride-sourcing drivers' behaviour and preferences: Insights from focus groups analysis, Research in Transportation Business & Management, Volume 37, 2020, ISSN 2210-5395, https://doi.org/10.1016/j.rtbm.2020.100516.
[5] Cody Cook, Rebecca Diamond, Jonathan V Hall, John A List, Paul Oyer, The Gender Earnings Gap in the Gig Economy: Evidence from over a Million Rideshare Drivers, The Review of Economic Studies, Volume 88, Issue 5, October 2021, Pages 2210–2238, https://doi.org/10.1093/restud/rdaa081
[6] https://data.cityofchicago.org/Transportation/Transportation-Network-Providers-Drivers/j6wf-834c/about_data
[7] https://secondmeasure.com/datapoints/rideshare-industry-overview/

*** Other secondary parameters in General parameters file**.

Scenario parameters

Scenario	Parameter	Type	Description	Values	Notes
All scenarios	Begin event	Arbitrary (editable)	Beginning hour of the failure. Always **7200 timestamps after the start**.	**Peak: 7 p.m.** Normal: 2 p.m. Night: 4 a.m.	Before: **3600 timestamps** of stabilisation time + **3600 timestamps** of normal behaviour.
	Event intensity (**EI**)	Arbitrary (editable)	Spreading time of the failure.		Depends on the scenario.
	Event duration (**ED**)	Arbitrary (editable)	Duration of the failure.		Depends on the scenario.
	Begin recovery	Arbitrary (editable)	Beginning hour of the recovery.		Depends on the scenario.
	Recovery intensity	Arbitrary (editable)	Spreading time of the recovery.		Depends on the scenario.



Driver strike

	Parameter	Type	Description	Values	Notes
Failing status	Begin event	Arbitrary (editable)	Beginning hour of the failure. Always **7200 timestamps (2 hours) after the start**.	**Peak: 7 p.m.** Normal: 2 p.m. Night: 4 a.m.	Before: **3600 timestamps** of stabilisation time + **3600 timestamps** of normal behaviour.
Failing event	Participation	Arbitrary (editable)	% of drivers who stop work.	80 %	We keep the same % decrease for existing drivers and new drivers to generate.
Event intensity	Information sharing	Arbitrary (editable)	Spreading time of the strike.	40 minutes	

References

- Taxi strike between 7 p.m. and 9 p.m. in NY (https://norcalpublicmedia.org/npr-news-feed-national/uber-and-lyft-drivers-are-striking-and-call-on-passengers-to-boycott).
- 500 NY Uber drivers (less than 1%) strike between 7 a.m. and 9 a.m. in 2019 (https://edition.cnn.com/business/live-news/uber-lyft-strike-may-2019/index.html).
- 10/15% Uber drivers strike one day in 2023 (https://www.thehindubusinessline.com/news/ola-uber-drivers-strike-in-tn-withdrawn/article67434074.ece).
- 2000 Uber drivers strike between 1 p.m. and 7 p.m. in 2024 in Minneapolis (https://www.mprnews.org/episode/2024/01/11/uber-lyft-drivers-begin-oneday-strike-in-twin-cities).
- 15000 Uber+Taxi+Lyft NY drivers 24h strike in 2022 (https://www.cbsnews.com/news/uber-strike-new-york-city-pay-raises/).
- Timeline of strikes: https://www.toynbeehall.org.uk/08/08/2023/deliverance-the-story-of-the-2018-uber-strike-and-its-impact/.

Flash mob

	Parameter	Type	Description	Values	Notes
Failing status	Begin event	Arbitrary (editable)	Beginning hour of the failure. Always **7200 timestamps (2 hours) after the start**.	**Peak: 7 p.m.** Normal: 2 p.m. Night: 4 a.m.	Before: **3600 timestamps** of stabilisation time + **3600 timestamps** of normal behaviour.
Failing event	Traffic slowdown	Arbitrary (editable)	Default slowdown of each TAZ involved.	90% for center, 80% for nearby zones.	
	TAZ involved	Arbitrary (editable)	Zones of SF where the flash mob happens.	94104, 94102, 94109, 94133, 94111, 94115, 94123, 94117, 94103, 94105.	These are the busiest zones.
Event intensity	Engagement	Arbitrary (editable)	Spreading time of the flash mob.	15 minutes for center, 20 minutes for nearby zones	

References

- Flash mob for Palestine in SF 90 min until police intervention 16/11/23 (https://www.nytimes.com/2023/11/16/world/asia/san-francisco-bay-bridge-protest.html).

Underground failure

	Parameter	Type	Description	Values	Notes
Failing status	Begin event	Arbitrary (editable)	Beginning hour of the failure. Always **7200 timestamps (2 hours) after the start**.	**Peak: 7 p.m.** Normal: 2 p.m. Night: 4 a.m.	Before: **3600 timestamps** of stabilisation time + **3600 timestamps** of normal behaviour.
Failing event	Demand increase	Arbitrary (editable)	Requests increase for each TAZ.	70 %	+70% with respect to real requests data.
	TAZ involved	Arbitrary (editable)	Zones of SF where the failure happens.	94104, 94108, 94109, 94133, 94103.	These are the busiest zones.
Event intensity	Impatience	Arbitrary (editable)	Spreading time of the failure.	10 minutes for center, 15 minutes for nearby zones	

References

- Milan underground failure 45 min 2009: https://www.atm.it/it/AtmNews/Comunicati/Pagine/Lineam1circolazioneregolaredalle.aspx
- Milan underground failure 11 hours 2023: https://milano.corriere.it/notizie/cronaca/23_novembre_28/milano-guasto-in-metropolitana-linea-rossa-m1-chiusa-tra-cairoli-e-pasteur-treni-sostituiti-da-bus-e9883d90-a734-4564-a5fe-1a8a32db0xlk.shtml
- New York underground failure several days 2024: https://www.cbsnews.com/newyork/news/new-york-city-train-collision-cause-ntsb-report/

Progressive greedy

	Parameter	Type	Description	Values	Notes
Failing status	Begin event	Arbitrary (editable)	Beginning hour of the failure. Always **7200 timestamps (2 hours) after the start**.	**Peak: 7 p.m.** Normal: 2 p.m. Night: 4 a.m.	Before: **3600 timestamps** of stabilisation time + **3600 timestamps** of normal behaviour.
Failing event	Personality distribution	Arbitrary (editable)	Personality distribution (%) for new drivers generated.	Hurry 1%, Greedy 94%, Normal 5%.	Default: Hurry 35% Greedy 15% Normal 50%.
	Personality strength	Arbitrary (editable)	New driver rate acceptance given an expected price increase.	New acceptance rates: **Hurry** -10% **Greedy** -25% **Normal** -15%.	We expect drivers to become “greedier” if they think there will be a price raise.
Event intensity	Bet propagation	Arbitrary (editable)	Spreading time of the greedy behaviour.	30 minutes	

References

- Just hypotheses here: https://eu.usatoday.com/story/tech/2019/05/15/uber-lyft-drivers-can-probably-manipulate-apps-charge-you-more/3678461002/.

Long rides

	Parameter	Type	Description	Values	Notes
Failing status	Begin event	Arbitrary (editable)	Beginning hour of the failure. Always **7200 timestamps (2 hours) after the start**.	**Peak: 7 p.m.** Normal: 2 p.m. Night: 4 a.m.	Before: **3600 timestamps** of stabilisation time + **3600 timestamps** of normal behaviour.
Failing event	Ride length increase	Arbitrary (editable)	New ride length requests distribution (%) for new customers generated.	**Short** 5% **Normal** 15% **Long** 30% **Extreme** 50%.	Default: **Short** 36% **Normal** 22% **Long** 18% **Extreme** 24%.
Event intensity	Diffusion	Arbitrary (editable)	Spreading time of the failure.	60 minutes	

References

- Summary on long rides, which are also convenient for drivers: https://bestreferraldriver.com/long-distance-uber.html.

No requests (e.g. Uber boycott from users because of greenwashing)

	Parameter	Type	Description	Values	Notes
Failing status	Begin event	Arbitrary (editable)	Beginning hour of the failure. Always **7200 timestamps (2 hours) after the start**.	**Peak: 7 p.m.** Normal: 2 p.m. Night: 4 a.m.	Before: **3600 timestamps** of stabilisation time + **3600 timestamps** of normal behaviour.
Failing event	Participation	Arbitrary (editable)	Customer generation decrease (%).	70 %	
Event intensity	Information sharing	Arbitrary (editable)	Spreading time of the boycott.	20 minutes	

References

- 200k+ people deleted Uber account trying to boycott Uber in 2017: https://www.businessinsider.com/uber-deleteuber-protest-hundreds-of-thousands-quit-app-2019-4?r=US&IR=T https://www.sustainalytics.com/esg-research/resource/investors-esg-blog/deleteuber-the-changing-face-of-consumer-boycotts https://en.wikipedia.org/wiki/Controversies_involving_Uber