



# Pricing Prediction

Interim Checkpoint, July 23<sup>rd</sup> 2020



**01** TARGET & DATA

**02** FEATURE  
SELECTION

**03** NEXT STEPS



# 01 TARGET & DATA

Why are we here today?

## 02 FEATURE SELECTION

## 03 NEXT STEPS



# OUR TASK IS TO ESTABLISH A MODEL TO PROVIDE A PRICING RECOMMENDATION

## BACKGROUND



### Situation

- Airbnb does not publicly publish **booking data** as this presents one of its core assets
- To **estimate potential earnings**, one can get this through the listing creation process
- It is, however, **not possible to estimate earnings beforehand** based on past data
- Data on **current listings** is publicly available, excluding hidden info such as occupation rate

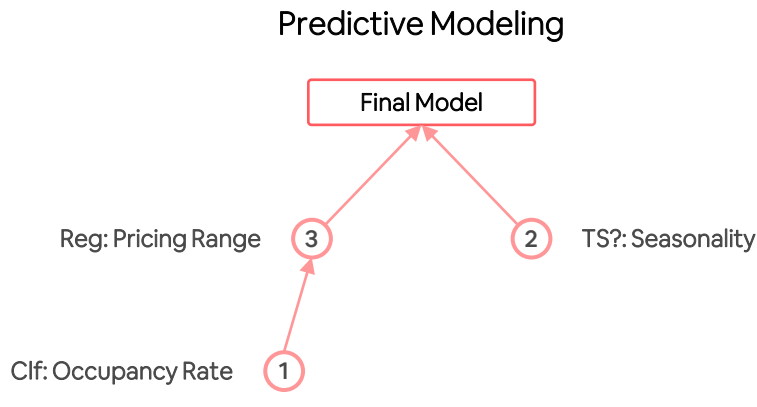


### Challenge

- Given the available data, **can we predict the expected occupation rate** of new listings? (classification)
- Based on parameters (incl. occupation rate), can we build an app to derive a **pricing recommendation** for his listing? (regression)

# THE MODEL IS THE BASIS FOR A WEB APP WITH A USER INPUT INTERFACE

## CORE IDEA



## User Interface

Month (to consider seasonality)	March ▼
Accommodates	2 ▼
Are you a Superhost?	No ▼
Room type	Private room ▼
Property type	Apartment ▼

Recommended Pricing Range

€55-65\*

\*Airbnb will, by default, apply dynamic pricing for your listing, to account for seasonality and other listings if you wish. You can of course opt out.

Potential yearly revenue (excl. Airbnb fees)

€15.330

?

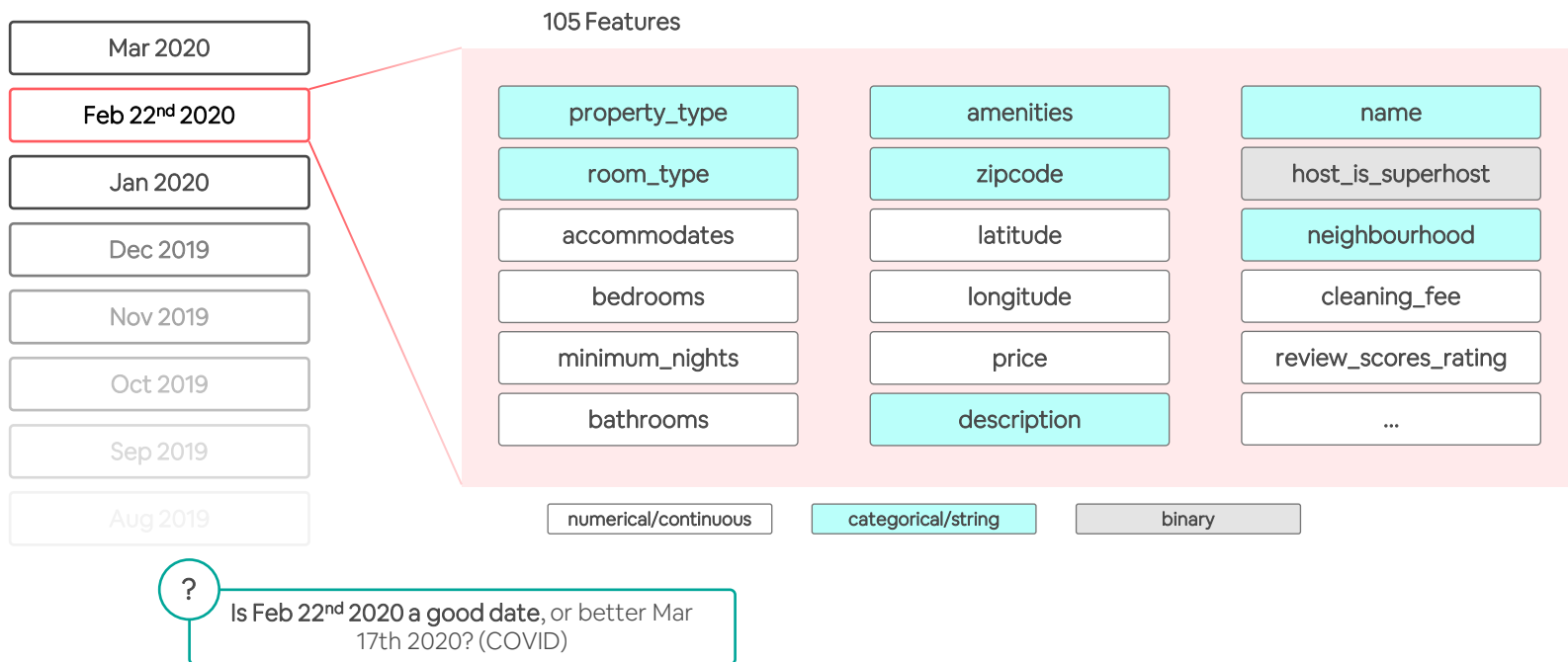
Does this general approach make sense or is it too generic as a business question?

?

Does COVID affect the validity of using such a business question for the capstone?

# TO ACHIEVE THIS WE ANALYZE DATA AVAILABLE AT INSIDEAIRBNB.COM

## DATA



# OCCUPANCY RATE IS NOT GIVEN AND PRESENTS A CORE CHALLENGE FOR MODELING

1 | OCCUPANCY RATE (CURRENTLY F1 SCORE: 0.52)

## Calculation

Inspired by the **San Francisco model**, which is also applied by [Inside AirBnB](#):

- (A) Determine the **average length of stay** for Berlin
- (B) Calculate **reviews in last two years**
- (C) Determine **active months in last two years** from price
- (D) Estimate **# of bookings in last two years** using (B)
- (E) **Occupancy rate** =  $(D) \times (A) / ((C) / 23 \times 365)$

Read more about the core idea behind the calculations of the model [here](#). Assumptions were adapted for the purpose of this analysis, mainly due to the core idea of considering only the two most recent years.

## Transformation

Listings were then classified into **six occupancy classes** based on the rate

ID	Rate	Class
3178	65.3%	4
5302	80%	5
6149	0%	0
7032	23.4%	2
9105	34.4%	2
14509	80%	0

## Outcome

Class	Range	Listings
5	>80%	3.983
4	60-80%	1.200
3	40-60%	1.768
2	20-40%	3.005
1	0-20%	5.492
0	0%	8.175

?

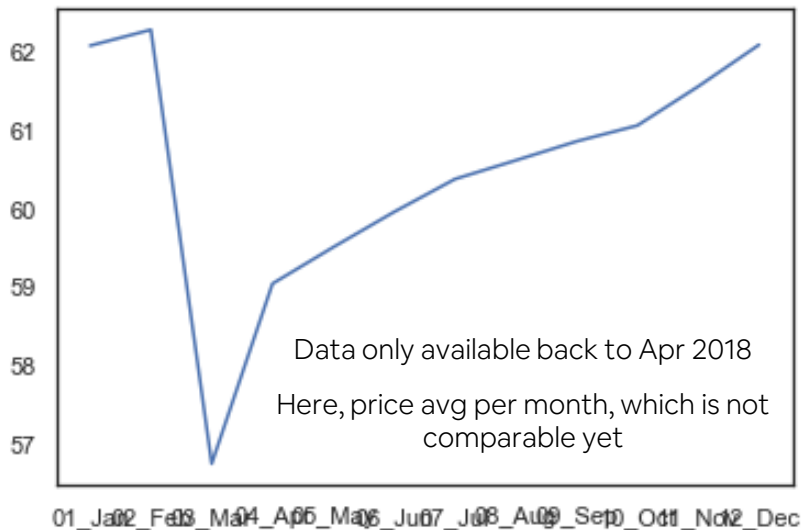
Should I remove listings with occupancy rate/class 0?

- a) how solid are my assumptions for calculating occupancy? Rate 0% can also mean a new listing with no reviews, where the price can give a false indication. Maybe exclude where rate=0 and listing is less than 3 months old?,
- b) predictive models end up classifying 0 and 5 really well, but fail for 1-4

# SEASONALITY IS CALCULATED BASED ON MONTHLY PRICES FOR THE PAST TWO YEARS

## 2 | SEASONALITY

Currently still an **ugly mess**



?

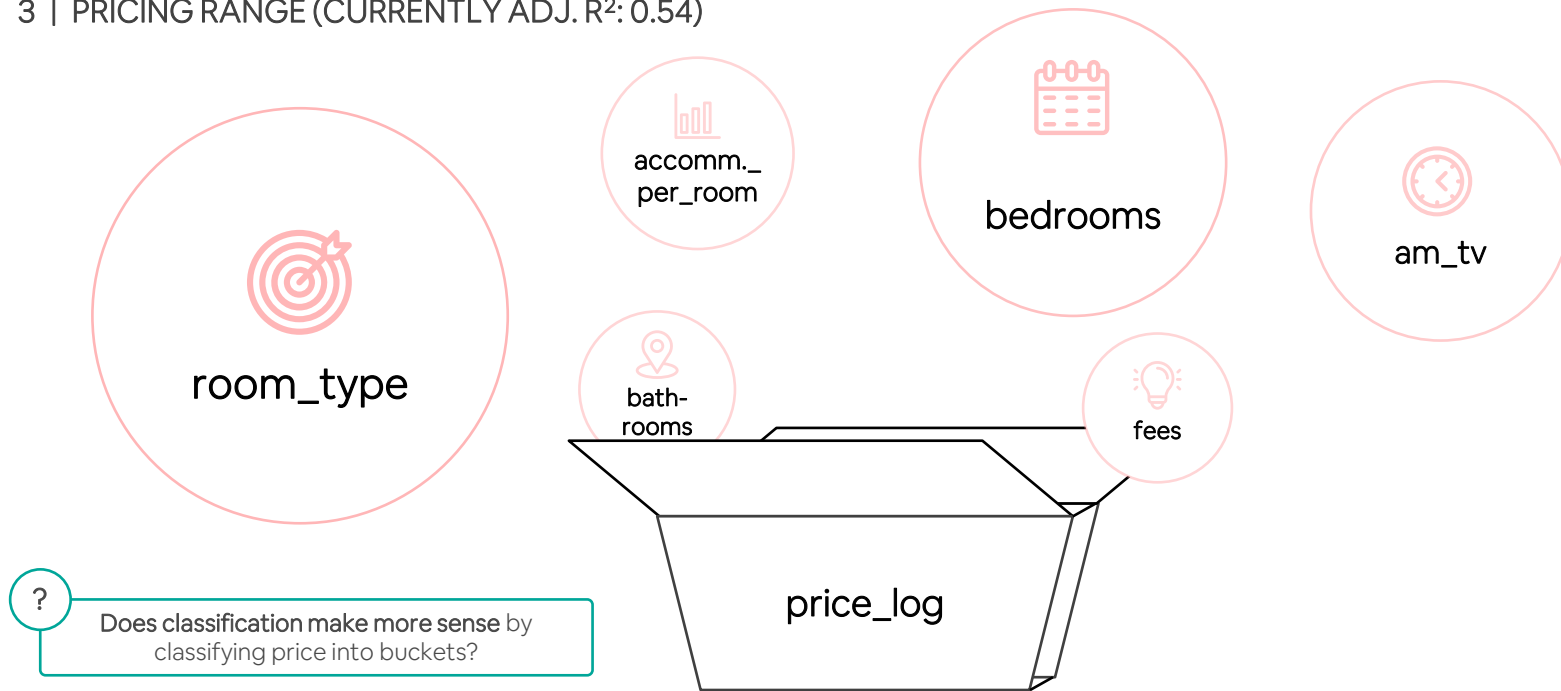
How can I sensibly include seasonality for pricing recommendation and „give it a try“?



# PRICE IS CURRENTLY PREDICTED VIA A REGRESSION ANALYSIS



3 | PRICING RANGE (CURRENTLY ADJ. R<sup>2</sup>: 0.54)



Bubble size indicates relative feature importance

# 01 TARGET & DATA

## 02 FEATURE SELECTION

What should be included in the predictive model?

# 03 NEXT STEPS



# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



## WALKTHROUGH

[Overview](#)[Setup](#)[Safety](#)[Financials](#)[Hosting services](#)

The following pages lead through the **listing creation process**, highlighting the corresponding **features** in the predictive model

Features



### Why host on Airbnb?

No matter what kind of home or room you have to share, Airbnb makes it simple and secure to host travelers. You're in full control of your availability, prices, house rules, and how you interact with guests.

### We have your back

To keep you, your home, and your belongings safe, we cover every booking with \$1M USD in property damage protection and another \$1M USD in insurance against accidents.

# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



Property and guests

## What kind of place are you listing?

First, let's narrow things down

Apartment

Now choose a property type

Apartment

Apartments are typically located in multi-unit residential buildings or complexes where other people live.

What will guests have?

- ☒ Entire place  
Guests have the whole place to themselves. This usually includes a bedroom, a bathroom, and a kitchen.
- ☐ Private room  
Guests have their own private room for sleeping. Other areas could be shared.
- ☐ Shared room  
Guests sleep in a bedroom or a common area that could be shared with others.

< Back

Next >

# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



Property and guests

### How many guests can your place accommodate?

Check that you have enough beds to accommodate all your guests comfortably.

accommodates

bedrooms

Guests

How many bedrooms can guests use?

Studio

1 bedroom

2 bedrooms

3 bedrooms

4 bedrooms

5 bedrooms

6 bedrooms

7 bedrooms

8 bedrooms

9 bedrooms

10 bedrooms

11 bedrooms

12 bedrooms

13 bedrooms

14 bedrooms

15 bedrooms

16 bedrooms

17 bedrooms

18 bedrooms

19 bedrooms

20 bedrooms

21 bedrooms

22 bedrooms

Done

Next

?

For the app, if I exclude features like „accommodates“ and „bedrooms“ due to insignificance, is it not weird if these core questions are not asked?

# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



## Price your space

### Increase your chances of getting booked

Set up Smart Pricing to automatically keep your nightly prices competitive as demand in your area changes.

### Set up Smart Pricing RECOMMENDED

#### Base price

This will be your starting price. You can turn off Smart Pricing.

€ 35

Tips are based on your listing's qualities, nearby prices and demand.

Tip: €35

#### Minimum price

When demand for your space is low, nightly prices will drop to attract more guests to book. What's the lowest price you're comfortable with?

Tip: €24

#### Maximum price

If demand is high, e.g. if there's a popular festival in town, what's the highest price you're willing to charge guests per night?

Tip: €105

[Back](#)

[Next](#)



### Start with a lower price to attract bookings

New hosts start with a lower price to attract their first few bookings. Hosts who set prices within 5% of price tips are nearly 4x more likely to get booked.



price

# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



## Length-of-stay prices

Encourage guests to stay longer by offering a weekly or monthly discount—you'll spend less time turning over your space between guests.

### Weekly discount

Tip: 21 %

Travelers often search by price. To help increase your chances of getting weekly stays, try setting a discount.

### Monthly discount

Tip: 49 %

Most travelers staying longer than one month book listings with discounts greater than 25%.



### Discount for longer stays

To encourage longer stays, some hosts set a weekly or monthly discount. If you want your listing to appear in searches for reservations of 28 nights or more, set a monthly discount.

Weekly discounts will apply to any reservation of 7 to 27 nights.

weekly\_price

monthly\_price

# THIS SUMMARY SHOWS THE FEATURES RETRIEVED DURING LISTING CREATION



## LISTING CREATION

property_type	am_tv	name
room_type	am_breakfast	am_child_friendly
accommodates	am_private_entrance	am_pets_allowed
bedrooms	am_white_goods	am_smoking_allowed
beds	am_parking	notes
bathrooms	description	minimum_nights
zipcode	space	maximum_nights
latitude	interaction	price
longitude	neighborhood_overview	weekly_price
am_essentials	transit	monthly_price

## OTHER SOURCES (E.G. PROFILE)

host_is_superhost
host_identity_verified
is_location_exact
security_deposit
cleaning_fee
availability_365
review_scores_rating
instant_bookable
cancellation_policy
calc_host_listings



01 TARGET & DATA

02 FEATURE  
SELECTION

03 NEXT STEPS

Where do we go from here?



# THE FOCUS FOR THE NEXT WEEK IS ON BUILDING A CLEAN, ROBUST MODEL



## NEXT STEPS

- 1 Read Géron to get a better feeling of how to **structure predictive modeling**
- 2 **Optimize current code** (e.g. including cleaning/engineering steps in pipeline, dive into plotly, ...)
- 3 Brainstorm on feature engineering **structure predictive modeling**
- 4 **Shortlist topics for the last two weeks** (e.g. App, presentation, neural networks, NLP, GCP, ...)

?

Do you have any **recommendations on target and approach?**

?

Should I split **classification and regression** into two notebooks?

?

When working with pipelines, **how do I treat X\_test?**  
(save `X_test_prep = preprocessing.transform(X_test)` before predicting with „best\_model“)

**Book your next vacation at ...**

# Thank You!

Mauricio Malzer

[linkedin.com/in/mauriciomalzer](https://www.linkedin.com/in/mauriciomalzer)  
[github.com/Rurbinasal](https://github.com/Rurbinasal)

# APPENDIX

# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



Property and guests

What kind of place are you listing?

First, let's narrow things down

✓ Select one

Apartment

House

Secondary unit

Unique space

Bed and breakfast

Boutique hotel

# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



Property and guests

What kind of place are you listing?

First, let's narrow things down

Apartment



Now choose a property type

- ✓ Select property type
- Apartment
- Condominium
- Casa particular (Cuba)
- Loft
- Serviced apartment



property\_type

# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



Property and guests

## What kind of place are you listing?

First, let's narrow things down

Apartment

Now choose a property type

Apartment

Apartments are typically located in multi-unit residential buildings or complexes where other people live.

What will guests have?

- ☒ **Entire place**  
Guests have the whole place to themselves. This usually includes a bedroom, a bathroom, and a kitchen.
- ☐ **Private room**  
Guests have their own private room for sleeping. Other areas could be shared.
- ☐ **Shared room**  
Guests sleep in a bedroom or a common area that could be shared with others.

< Back

Next >

# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



Property and guests

room\_type

What will guests have?

- ☒ **Entire place**  
Guests have the whole place to themselves. This usually includes a bedroom, a bathroom, and a kitchen.
- ☐ **Private room**  
Guests have their own private room for sleeping. Other areas could be shared.
- ☐ **Shared room**  
Guests sleep in a bedroom or a common area that could be shared with others.

Is this set up as a dedicated guest space?

- ☐ Yes, it's primarily set up for guests
- ☒ No, I keep my personal belongings here

Are you listing on Airbnb as part of a company?

- ☐ I'm hosting as a registered business
- ☒ I'm hosting as an individual or sole owner

This helps you get the right features for how you host—it won't show up to guests or impact how you show up in search.

[< Back](#)

[Next >](#)



# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



Property and guests

accommodates

bedrooms

## How many guests can your place accommodate?

Check that you have enough beds to accommodate all your guests comfortably.

Guests

- 2 +

How many bedrooms can guests use?

Studio



How many beds can guests use?

Beds

- 1 +

## Sleeping arrangements

Sharing the types of beds in each room can help people understand the sleeping arrangements.

Common spaces

1 bed

Done

Sofa bed

- 0 +

< Back

Next

# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



Property and guests

**How many guests can your place accommodate?**

Check that you have enough beds to accommodate all your guests comfortably.

accommodates — Guests - 2 +

**How many bedrooms can guests use?**

bedrooms —


- ✓ Studio
- 1 bedroom
- 2 bedrooms
- 3 bedrooms
- 4 bedrooms
- 5 bedrooms
- 6 bedrooms
- 7 bedrooms
- 8 bedrooms
- 9 bedrooms
- 10 bedrooms
- 11 bedrooms
- 12 bedrooms
- 13 bedrooms
- 14 bedrooms
- 15 bedrooms
- 16 bedrooms
- 17 bedrooms
- 18 bedrooms
- 19 bedrooms
- 20 bedrooms
- 21 bedrooms
- 22 bedrooms

Done

Next

# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



 Property and guests

Studio

How many beds can guests use?

Beds - 1 +

**Sleeping arrangements**

Sharing the types of beds in each room can help people understand the sleeping arrangements.

**beds**

Common spaces  
0 beds

**Done**

Sofa bed - 0 +

Couch - 0 +

Floor mattress - 0 +


Bunk bed - 0 +

Add another bed

[< Back](#) [Next](#)

# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



 Property and guests

Studio

How many beds can guests use?

Beds - 1 +

**Sleeping arrangements**

Sharing the types of beds in each room can help people understand the sleeping arrangements.

**beds**

Common spaces  
1 bed

**Done**

Sofa bed - 0 +

Couch - 0 +

Floor mattress - 0 +

Bunk bed - 1 +

Add another bed

[< Back](#) [Next >](#)

# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



 Property and guests

## How many bathrooms?

Count bathrooms that don't have a shower or bathtub as a half bathroom.

bathrooms

Bathrooms

- 1 +

# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



 Location

## Where's your place located?

Guests will only get your exact address once they've booked a reservation.

 Use current location

Country / Region

Germany

Street address

Hasenkamp 13

z. B Kurfürstendamm 67

Apt, suite. (optional)

z. B Gebäude 1

City

Schwentental

z. B Berlin

ZIP code

24222

z. B 10719

zipcode

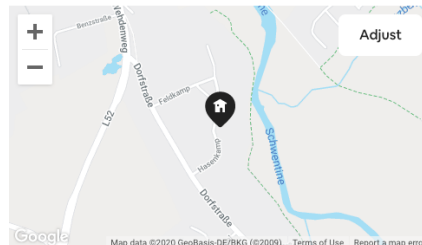
# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



## Is the pin in the right place?

If needed, you can adjust the map so the pin is in the right location. Only confirmed guests will see this, so they know how to get to your place.

Hasenkamp 13, 24222 Schwentinental, Deutschland




latitude

longitude

# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



 Amenities

## What amenities do you offer?

These are just the amenities guests usually expect, but you can add even more after you publish.

am\_essentials



Essentials

Towels, bed sheets, soap, toilet paper, and pillows

am\_tv



Wifi



TV



Heat



Air conditioning



Iron



Shampoo



Hair dryer

am\_breakfast



Breakfast, coffee, tea



Desk/workspace



Fireplace

am\_private entrance




Private entrance





# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



 Amenities

**am\_breakfast**

**am\_private entrance**

- ☒ Iron
- ☒ Shampoo
- ☒ Hair dryer
- ☐ Breakfast, coffee, tea
- ☐ Desk/workspace
- ☐ Fireplace
- ☒ Closet/drawers
- ☒ Private entrance

**Safety amenities**

- ☒ Smoke detector  
Check your local laws, which may require a working smoke detector in every room
- ☐ Carbon monoxide detector  
Check your local laws, which may require a working carbon monoxide detector in every room
- ☐ First aid kit
- ☐ Fire extinguisher
- ☒ Lock on bedroom door  
Private room can be locked for safety and privacy

[< Back](#) [Next](#)

# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



 Amenities

## What spaces can guests use?

Include common areas, but don't add spaces that aren't on your property.

- ☒ Kitchen
- ☒ Laundry – washer
- ☒ Laundry – dryer
- ☐ Parking
- ☐ Gym
- ☐ Pool
- ☐ Hot tub

## Does your space have accessibility features?

Every month, thousands of guests search for listings with [accessibility features](#). Adding these features can help your listing get more attention and makes travel possible for more people.

You'll have the chance to tell guests which accessibility features you have once you've finished listing your space. We can remind you to add these features and show you how to take good photos of them.

[< Back](#)

[Next >](#)

# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



## Liven up your listing with photos

Take photos using a phone or camera. Upload at least one photo to publish your listing—you can always add more or edit later.

Upload Photos

Or drag them in from your desktop



### Quick tips for quality photos

- Declutter your space
- Use natural daylight and avoid flash
- Shoot from room corners in landscape mode
- Balance visible floor and ceiling space
- Highlight special decor and amenities
- Add photos of every room guests can access


# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



Description and title

## Describe your place to guests

Write a quick summary of your place. You can highlight what's special about your space, the neighborhood, and how you'll interact with guests.



500

description

## Want to add more info? (optional)

Use the additional fields below to share more details.

### Your space

Add other details that can help set guests' expectations for their stay.

space

# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



Description and title

## Describe your place to guests

Write a quick summary of your place. You can highlight what's special about your space, the neighborhood, and how you'll interact with guests.

This lovely studio consist of one bright, modern living area ...

436

## Want to add more info? (optional)

Use the additional fields below to share more details.

### Your space

Add other details that can help set guests' expectations for their stay.


The space features ...

< Back

Next

# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



 Description and title

---

interaction

**Your availability**  
Let guests know how available you'll be during their stay. For your safety, don't share your phone number or email until you have a confirmed reservation.

Availab...

neighborhood\_overview

**Your neighborhood**  
Share what makes your neighborhood special, like a favorite coffee shop, park, or a unique landmark.

The studio is situated in the heart of...

transit

**Getting around**  
Add info about getting around your city or neighborhood, like nearby public transportation, driving tips, or good walking routes.

Public transport is right in front...

[< Back](#) [Next >](#)

# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



Description and title

name

## Create a title for your listing

Catch guests' attention with a listing title that highlights what makes your place special.

Lovely studio in the heart of...

18



Schwentinental Home with a View



# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



 Booking settings

## Review Airbnb's guest requirements

Airbnb has requirements that all guests must meet before they book.

All Airbnb guests must provide:

- ✓ Email address
- ✓ Confirmed phone number
- ✓ Payment information

Before booking your home, each guest must:

- ✓ Agree to your House Rules
- ✓ Message you about their trip
- ✓ Let you know how many guests are coming
- ✓ Confirm their check-in time if they're arriving within 2 days

[Add additional requirements](#)

[< Back](#)

[Next >](#)

# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



Booking settings

### Set house rules for your guests

Guests must agree to your house rules before they book.

am_child_friendly	Suitable for children (2-12 years) ⓘ	<input type="radio"/>	<input checked="" type="radio"/>
	Suitable for infants (Under 2 years) ⓘ	<input type="radio"/>	<input checked="" type="radio"/>
am_pets_allowed	Suitable for pets ⓘ	<input type="radio"/>	<input checked="" type="radio"/>
	Smoking allowed	<input checked="" type="radio"/>	<input type="radio"/>
am_smoking_allowed	Events or parties allowed	<input checked="" type="radio"/>	<input type="radio"/>

#### Additional rules

Quiet hours? No shoes in the house?	Add
-------------------------------------	-----

#### Details guests must know about your home

- ☐ Must climb stairs
- ☐ Potential for noise
- ☐ Pet(s) live on property

[< Back](#) [Next](#)

# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



Booking settings

notes

Additional rules

Quiet hours? No shoes in the house? Add

Details guests must know about your home

- ☐ Must climb stairs
- ☐ Potential for noise
- ☐ Pet(s) live on property
- ☒ No parking on property

Describe the parking situation around your listing

Parking on the streets...

- ☐ Some spaces are shared
- ☐ Amenity limitations
- ☐ Surveillance or recording devices on property
- ☐ Weapons on property
- ☐ Dangerous animals on property

< Back Next

# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



 Calendar and availability

## How long can guests stay?

Shorter trips can mean more reservations, but you'll turn over your space more often.

minimum\_nights

2 nights min

—

+

maximum\_nights

7 nights max

—

+

For stays longer than 7 nights ?

- ☒ Manually review and approve reservation requests **RECOMMENDED**
- ☐ Don't allow reservation requests for stays longer than 7 nights

2 nights 7 nights



# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



## Price your space

### Increase your chances of getting booked

Set up Smart Pricing to automatically keep your nightly prices competitive as demand in your area changes.

### Set up Smart Pricing RECOMMENDED

#### Base price

This will be your starting price. You can turn off Smart Pricing.

€ 35

Tips are based on your listing's qualities, nearby prices and demand.

Tip: €35

#### Minimum price

When demand for your space is low, nightly prices will drop to attract more guests to book. What's the lowest price you're comfortable with?

Tip: €24

#### Maximum price

If demand is high, e.g. if there's a popular festival in town, what's the highest price you're willing to charge guests per night?

Tip: €105

[Back](#)

[Next](#)



### Start with a lower price to attract bookings

New hosts start with a lower price to attract their first few bookings. Hosts who set prices within 5% of price tips are nearly 4x more likely to get booked.



price

# THE MODEL FOCUSES ON FEATURES PROVIDED DURING LISTING CREATION



## Length-of-stay prices

Encourage guests to stay longer by offering a weekly or monthly discount—you'll spend less time turning over your space between guests.

### Weekly discount

Tip: 21 %

Travelers often search by price. To help increase your chances of getting weekly stays, try setting a discount.

### Monthly discount

Tip: 49 %

Most travelers staying longer than one month book listings with discounts greater than 25%.



### Discount for longer stays

To encourage longer stays, some hosts set a weekly or monthly discount. If you want your listing to appear in searches for reservations of 28 nights or more, set a monthly discount.

Weekly discounts will apply to any reservation of 7 to 27 nights.

weekly\_price

monthly\_price