Seaborn - Categorical Data Plots

- catplot()

In [1]:
```
import seaborn as sns
import matplotlib.pyplot as plt
import pandas as pd
import numpy as np

sns.set(style="ticks")
```

In [2]:
```
exercise =  sns.load_dataset("exercise")
exercise.head(10)
```

Out[2]:

	Unnamed: 0	id	diet	pulse	time	kind
0	0	1	low fat	85	1 min	rest
1	1	1	low fat	85	15 min	rest
2	2	1	low fat	88	30 min	rest
3	3	2	low fat	90	1 min	rest
4	4	2	low fat	92	15 min	rest
5	5	2	low fat	93	30 min	rest
6	6	3	low fat	97	1 min	rest
7	7	3	low fat	97	15 min	rest
8	8	3	low fat	94	30 min	rest
9	9	4	low fat	80	1 min	rest

In [3]:
```
exercise.time.unique()
```

Out[3]:
```
[1 min, 15 min, 30 min]
Categories (3, object): [1 min, 15 min, 30 min]
```

In [4]:
```
exercise.kind.unique()
```

Out[4]:
```
[rest, walking, running]
Categories (3, object): [rest, walking, running]
```

In [5]:
```
exercise.diet.unique()
```

Out[5]:
```
[low fat, no fat]
Categories (2, object): [low fat, no fat]
```

In [6]:
```
tips = sns.load_dataset("tips")
tips.head()
```

Out[6]:

	total_bill	tip	sex	smoker	day	time	size
0	16.99	1.01	Female	No	Sun	Dinner	2
1	10.34	1.66	Male	No	Sun	Dinner	3
2	21.01	3.50	Male	No	Sun	Dinner	3
3	23.68	3.31	Male	No	Sun	Dinner	2
4	24.59	3.61	Female	No	Sun	Dinner	4

In [7]:
```
tips.day.unique()
```

Out[7]:
```
[Sun, Sat, Thur, Fri]
Categories (4, object): [Sun, Sat, Thur, Fri]
```

In [8]:
```
tips.time.unique()
```

Out[8]:
```
[Dinner, Lunch]
Categories (2, object): [Dinner, Lunch]
```

In [9]:
```
tips.smoker.unique()
```

Out[9]:
```
[No, Yes]
Categories (2, object): [No, Yes]
```

In [10]:
```
tips.sex.unique()
```

Out[10]:
```
[Female, Male]
Categories (2, object): [Female, Male]
```

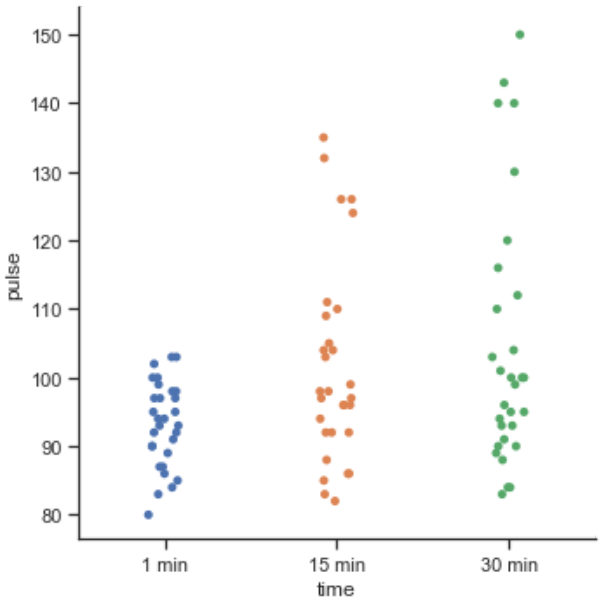
In [11]:
```
tips["size"].unique()
```

Out[11]:
```
array([2, 3, 4, 1, 6, 5])
```

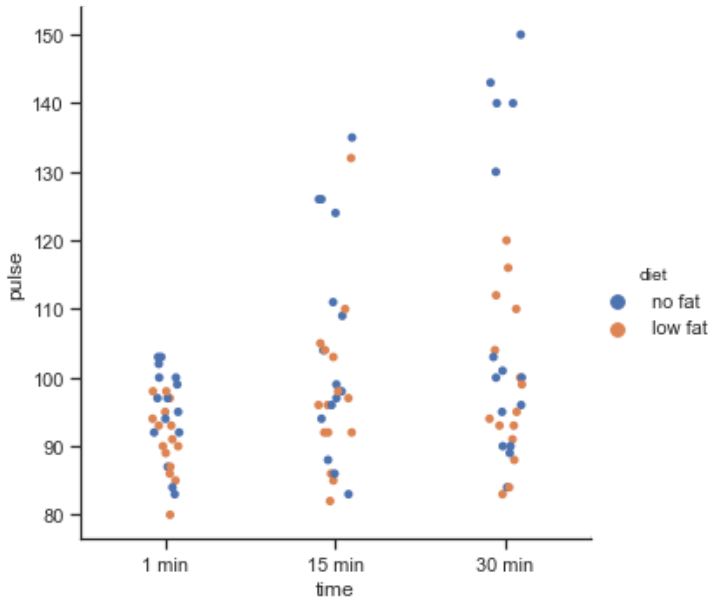
In [ ]:

In [ ]:

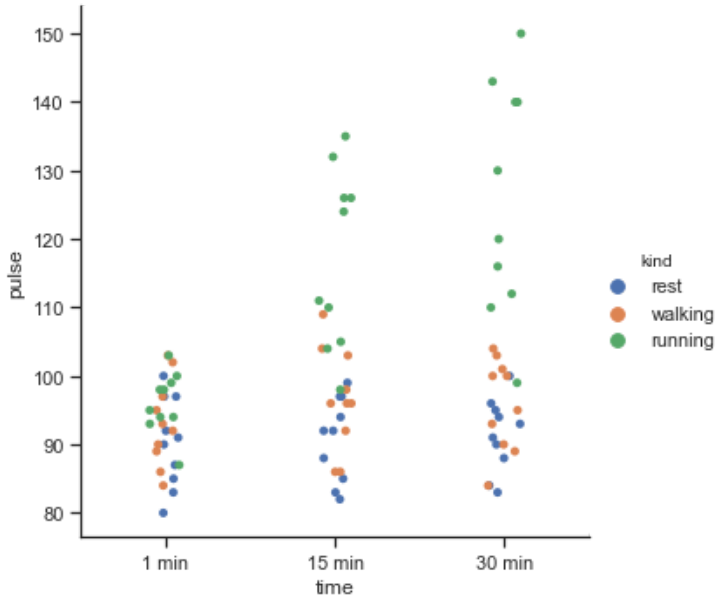
In [12]:
```
sns.catplot(x="time", y="pulse", data=exercise);
```



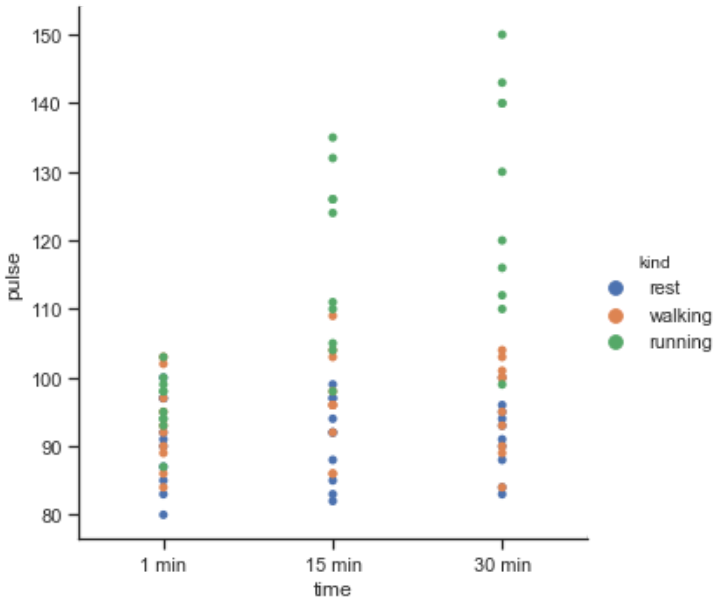
In [13]:
```
sns.catplot(x="time", y="pulse", hue="diet", data=exercise);
```



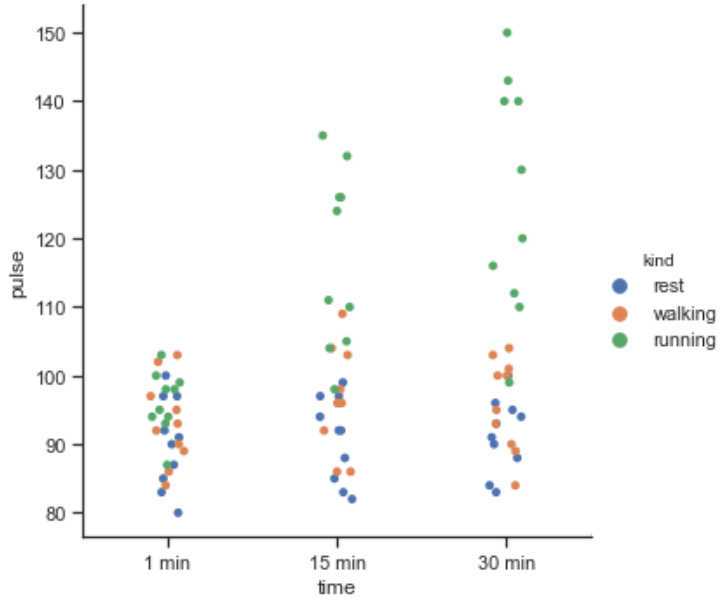
In [14]:
```
sns.catplot(x="time", y="pulse", hue="kind", data=exercise);
```



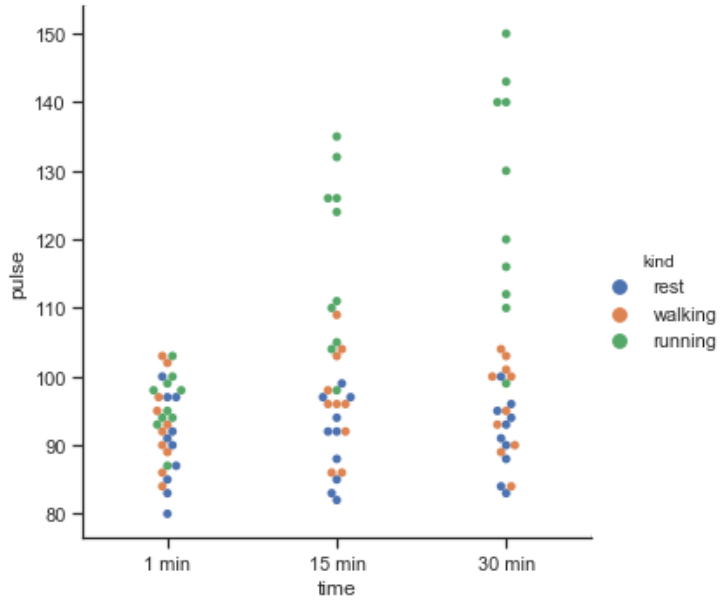
In [15]:
```
sns.catplot(x="time", y="pulse", hue="kind", jitter=False, data=exercise);
```



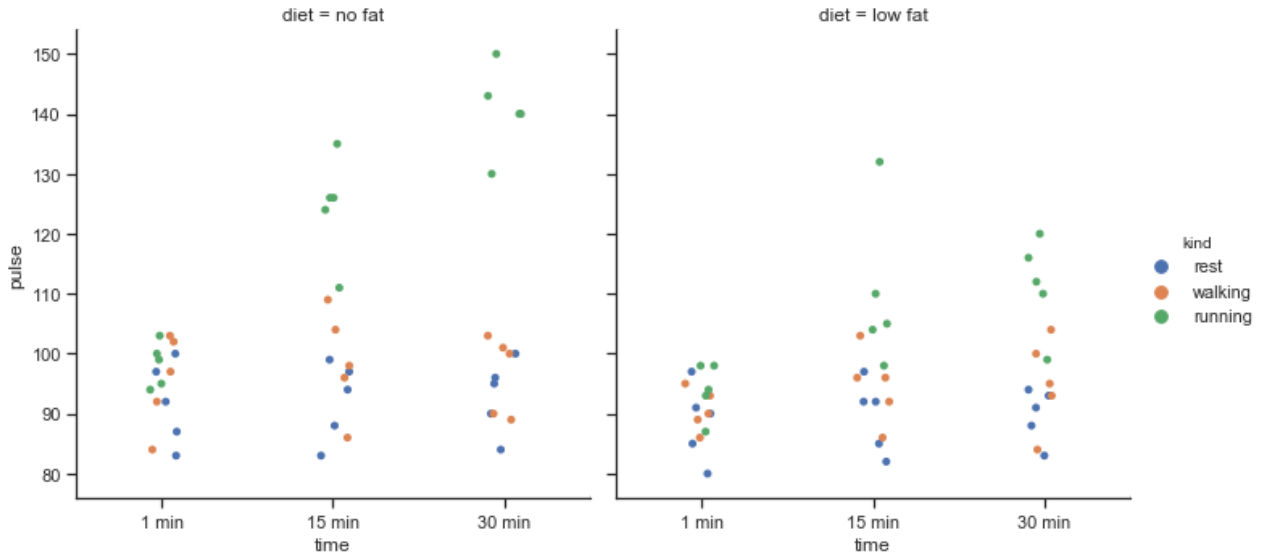
In [16]:
```
# strip plot is default

sns.catplot(x="time", y="pulse", hue="kind",
            data=exercise, kind='strip');
```



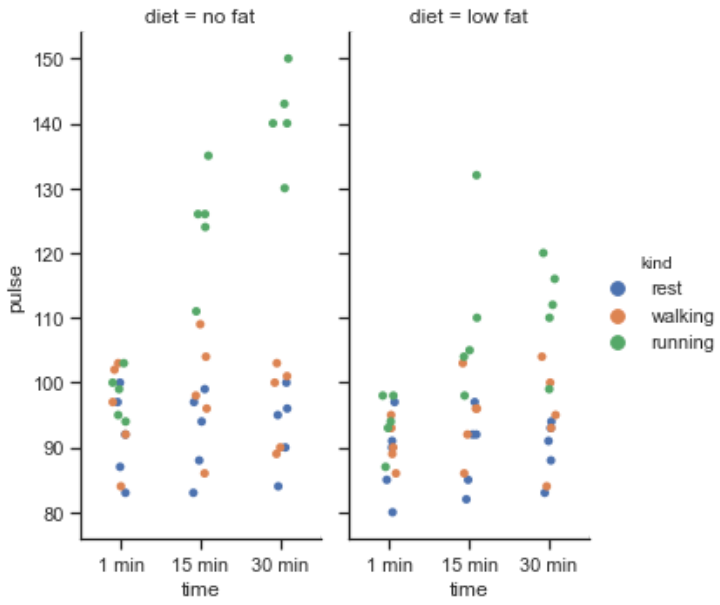
In [17]:
```
# swarm plot

sns.catplot(x="time", y="pulse", hue="kind",
            data=exercise, kind='swarm');
```



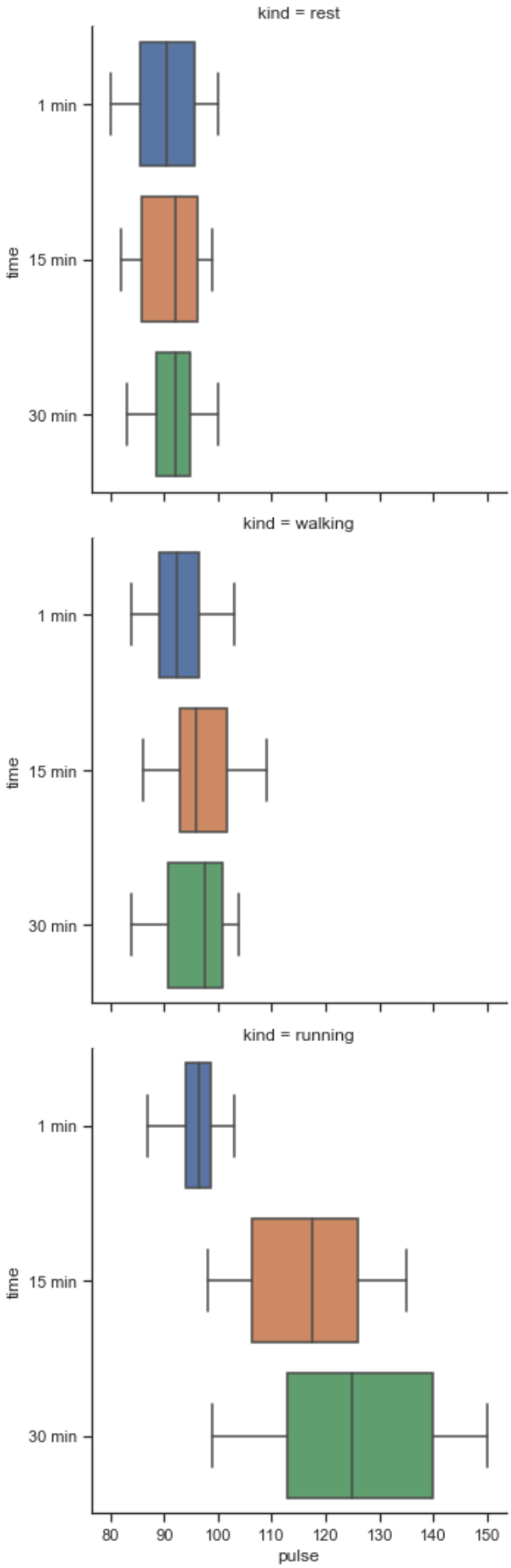
In [18]:
```
# Facet along the columns to show a third categorical variable


sns.catplot(x="time", y="pulse", hue="kind",
                 col="diet", data=exercise);
```



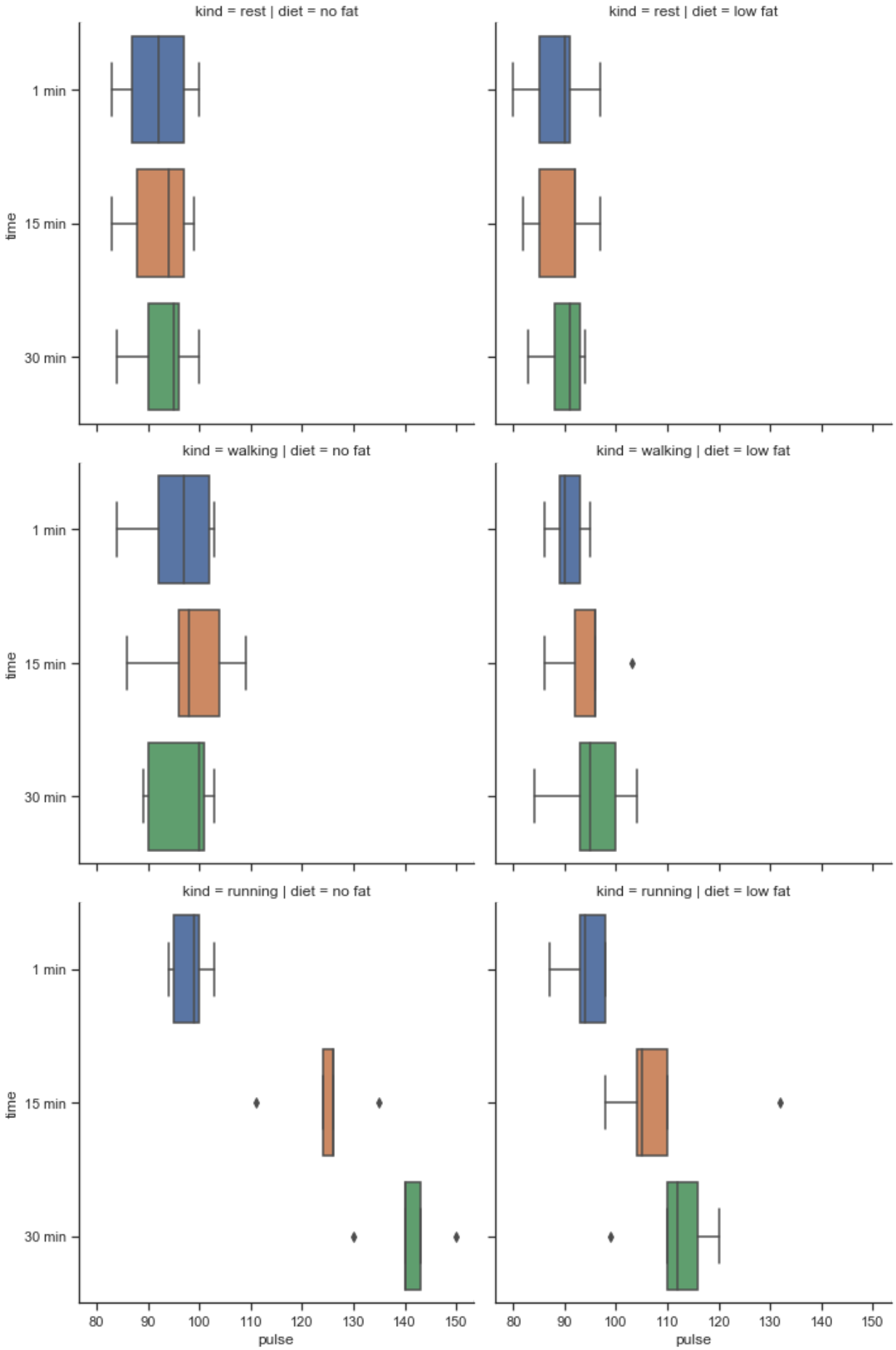
In [19]:
```
# Use a different height (5 inches default) and aspect ratio (width = height * aspect ra

sns.catplot(x="time", y="pulse", hue="kind",
                 col="diet", data=exercise,
                 height=5, aspect=0.5);
```



In [20]:
```
sns.catplot(x="pulse", y="time", row="kind",
            kind="box", orient="h",
                 data=exercise,
                 height=5, aspect=1);
```


kind = rest
kind = walking
kind = running
time
1 min
15 min
30 min
80
90
100
110
120
130
140
150
pulse

In [21]:
```
sns.catplot(x="pulse", y="time", row="kind",
            kind="box", orient="h",
                 col="diet", data=exercise,
                 height=5, aspect=1);
```

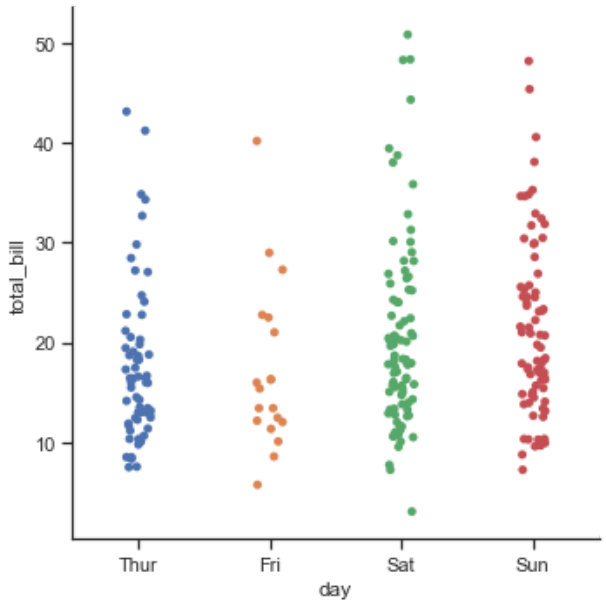

kind = rest | diet = no fat
kind = rest | diet = low fat
kind = walking | diet = no fat
kind = walking | diet = low fat
kind = running | diet = no fat
kind = running | diet = low fat
time
1 min
15 min
30 min
80
90
100
110
120
130
140
150
pulse

In [22]:
```
tips.head()
```

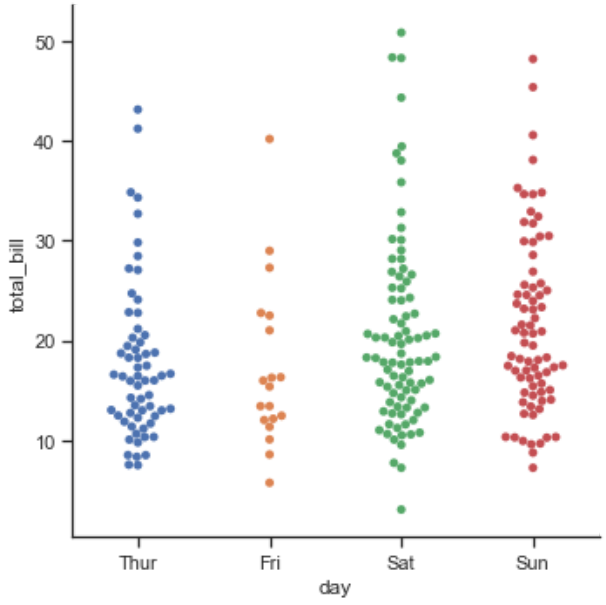
Out[22]:

	total_bill	tip	sex	smoker	day	time	size
0	16.99	1.01	Female	No	Sun	Dinner	2
1	10.34	1.66	Male	No	Sun	Dinner	3
2	21.01	3.50	Male	No	Sun	Dinner	3
3	23.68	3.31	Male	No	Sun	Dinner	2
4	24.59	3.61	Female	No	Sun	Dinner	4

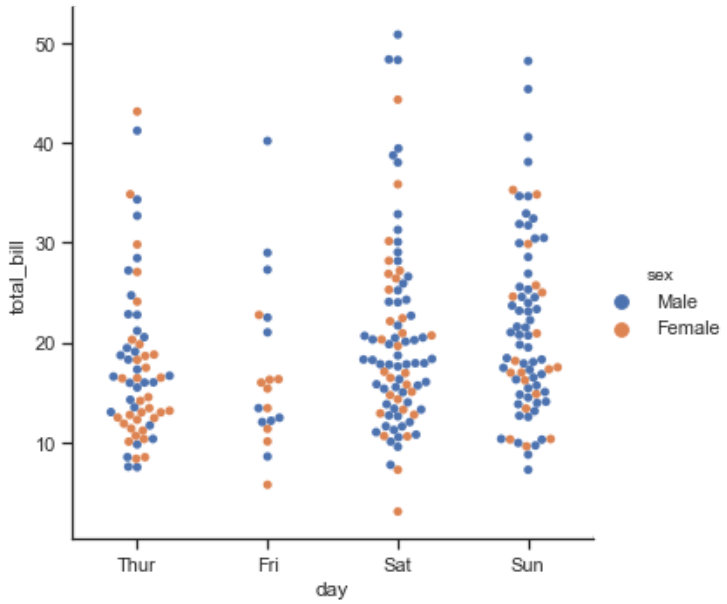
In [23]:
```
sns.catplot(x="day", y="total_bill", data=tips);
```



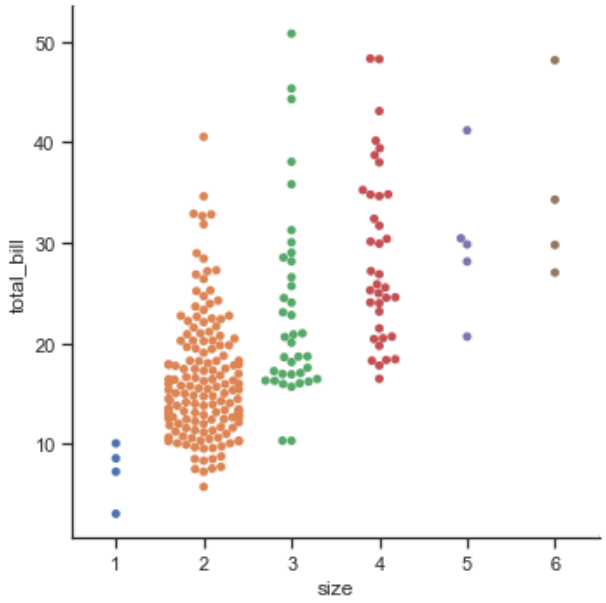
In [24]:
```
sns.catplot(x="day", y="total_bill", kind="swarm", data=tips);
```



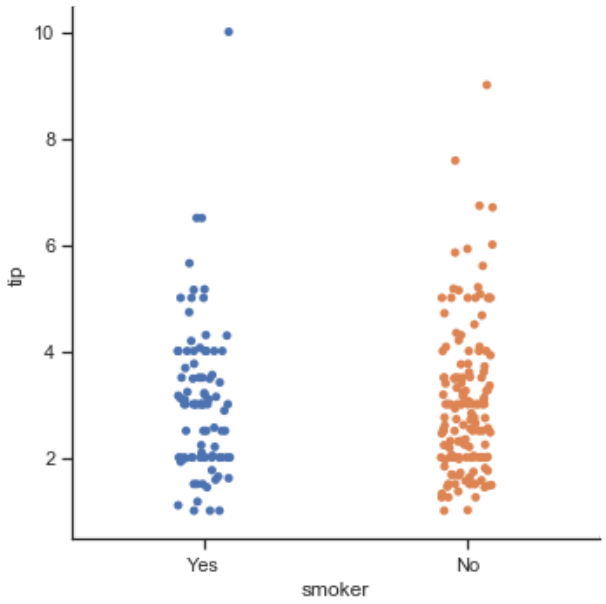
In [25]:
```
sns.catplot(x="day", y="total_bill", hue="sex", kind="swarm", data=tips);
```



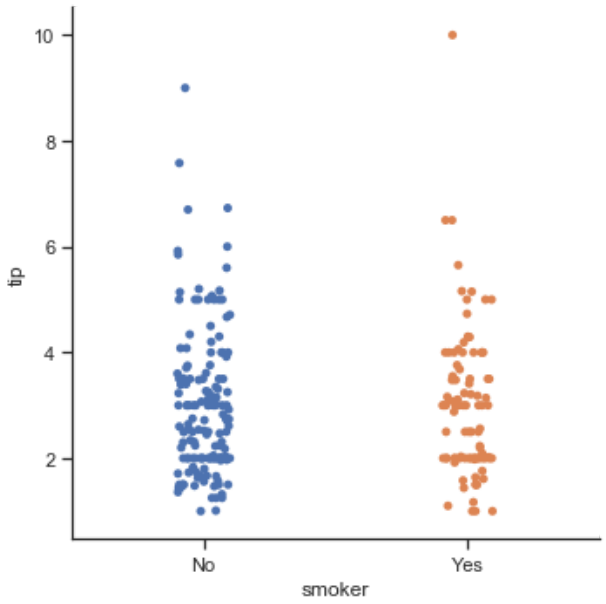
In [26]:
```
sns.catplot(x="size", y="total_bill", kind="swarm", data=tips);
```



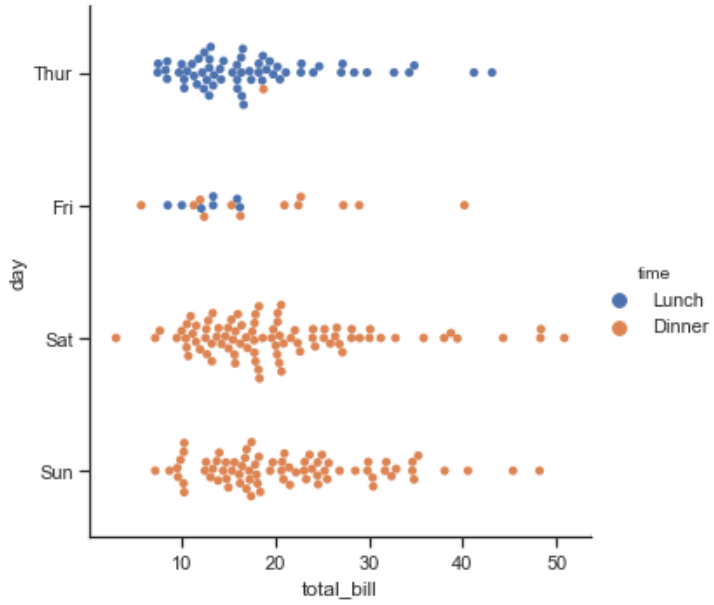
In [27]:
```
sns.catplot(x="smoker", y="tip", data=tips);
```



In [28]:
```
sns.catplot(x="smoker", y="tip", order=["No", "Yes"], data=tips);
```



In [29]:
```
# For many categories, show on y-axis

sns.catplot(x="total_bill", y="day", hue="time", kind="swarm", data=tips);
```

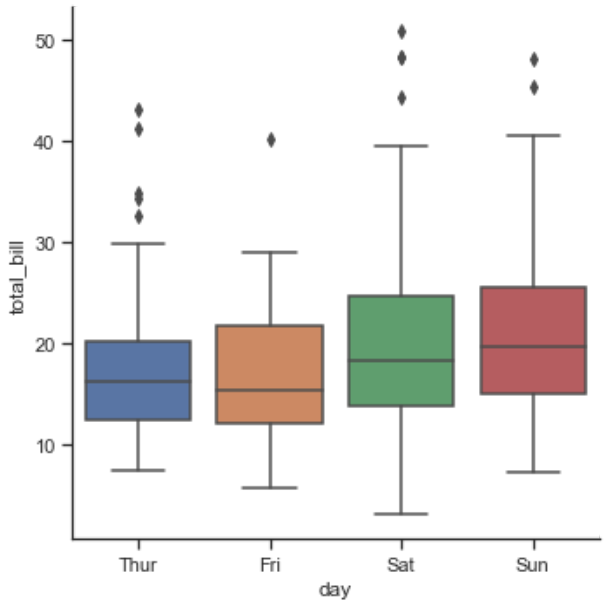


Distribution of observations within categories

- For large datasets, scatter plots can only provide limited information

Boxplots

In [30]:
```
sns.catplot(x="day", y="total_bill", kind="box", data=tips);
```

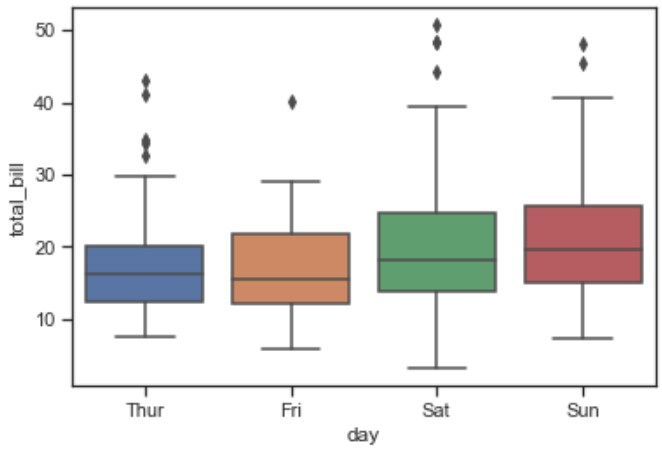


In [31]:
```
tips.groupby('day')['total_bill'].describe()
```

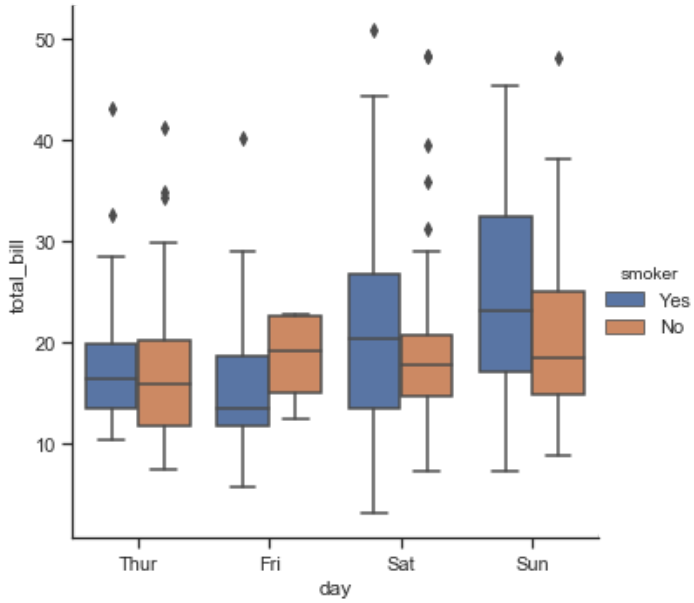
Out[31]:

day	count	mean	std	min	25%	50%	75%	max
Thur	62.0	17.682742	7.886170	7.51	12.4425	16.20	20.1550	43.11
Fri	19.0	17.151579	8.302660	5.75	12.0950	15.38	21.7500	40.17
Sat	87.0	20.441379	9.480419	3.07	13.9050	18.24	24.7400	50.81
Sun	76.0	21.410000	8.832122	7.25	14.9875	19.63	25.5975	48.17

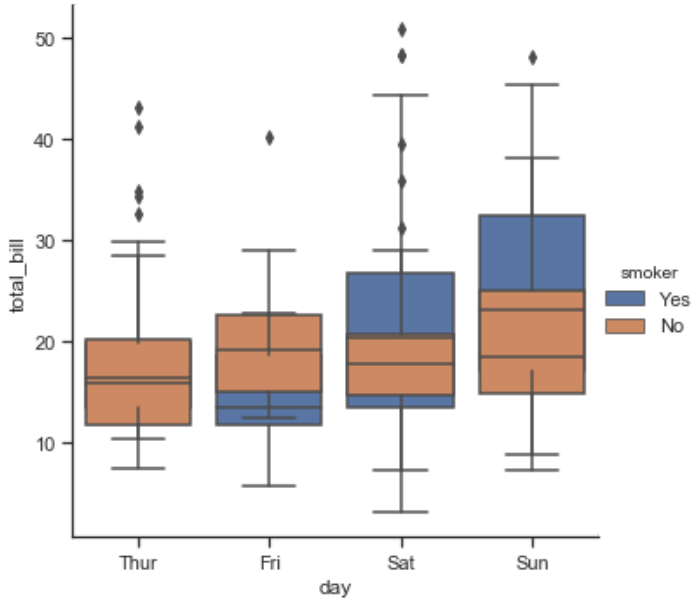
In [32]:
```
sns.boxplot(x="day", y="total_bill", data=tips);
```



In [33]:
```
# with hue, the box for each level is moved along the categorical axis (dodging)
# default dodging is true - semantic variable (hue) nested within main categorical varia

sns.catplot(x="day", y="total_bill", hue="smoker", kind="box", data=tips);
```



In [34]:
```
# not useful

sns.catplot(x="day", y="total_bill", hue="smoker", dodge=False,
            kind="box", data=tips);
```

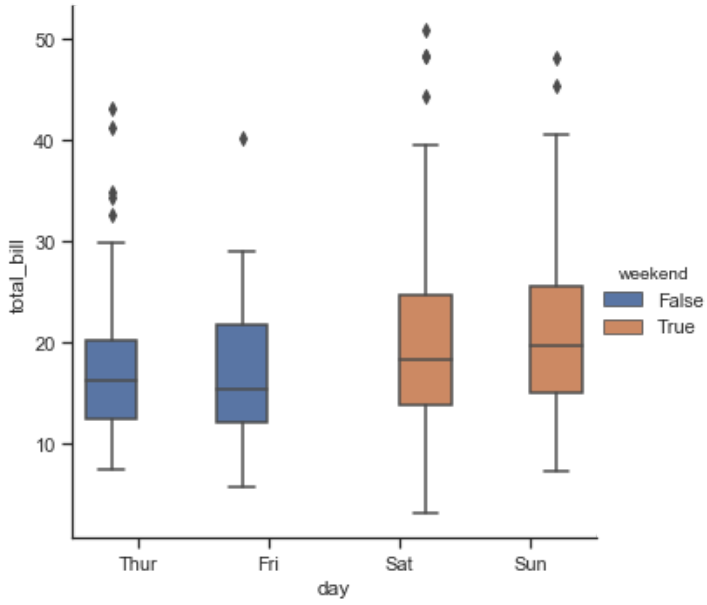


In [35]:
```
tips["weekend"] = tips["day"].isin(["Sat", "Sun"])
tips.head()
```

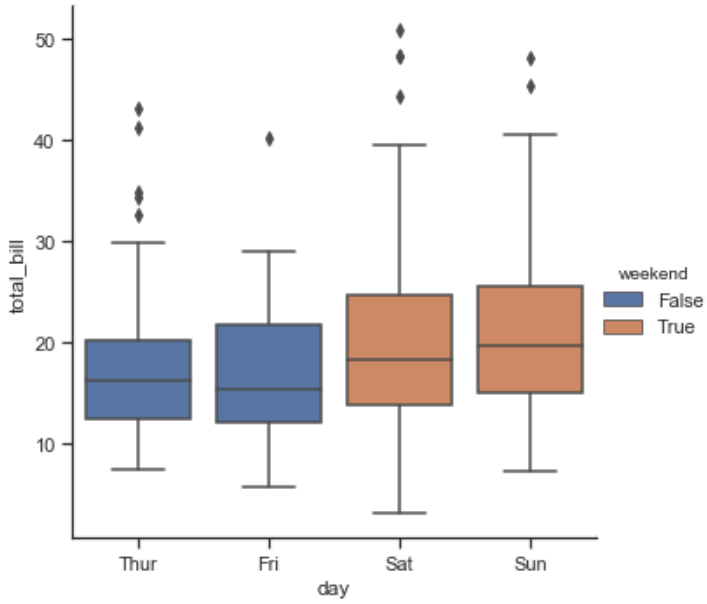
Out[35]:

	total_bill	tip	sex	smoker	day	time	size	weekend
0	16.99	1.01	Female	No	Sun	Dinner	2	True
1	10.34	1.66	Male	No	Sun	Dinner	3	True
2	21.01	3.50	Male	No	Sun	Dinner	3	True
3	23.68	3.31	Male	No	Sun	Dinner	2	True
4	24.59	3.61	Female	No	Sun	Dinner	4	True

In [36]:
```
sns.catplot(x="day", y="total_bill", hue="weekend",
            kind="box", data=tips);
```

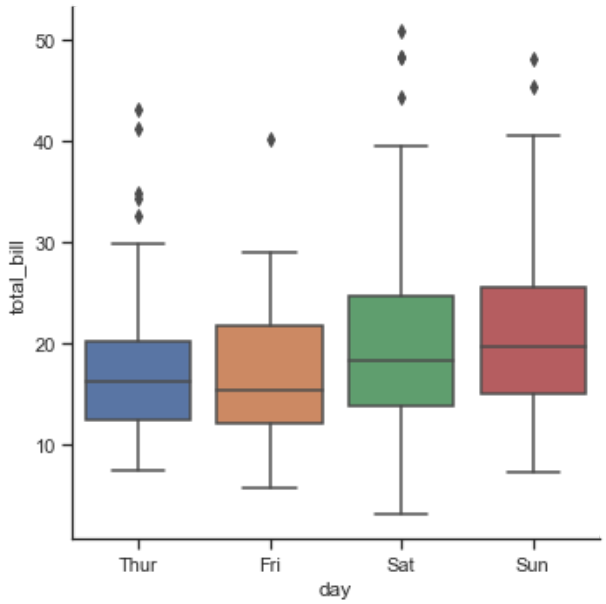


In [37]:
```
# disable dodging

sns.catplot(x="day", y="total_bill", hue="weekend", dodge=False,
            kind="box", data=tips);
```

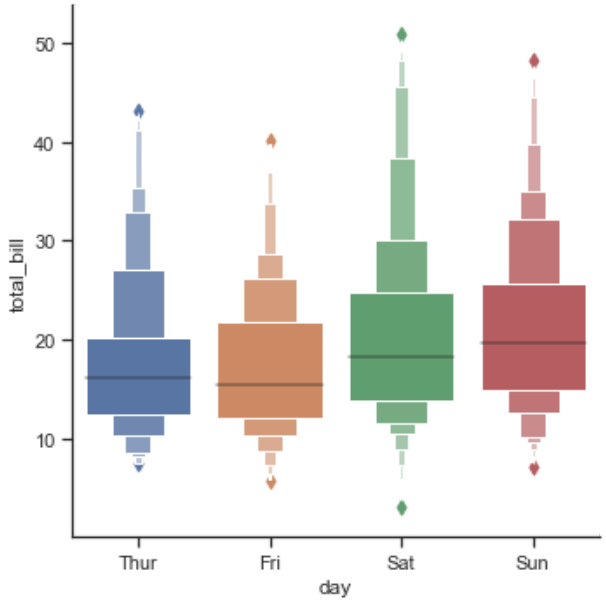


Boxen plot (Letter-Value plots)

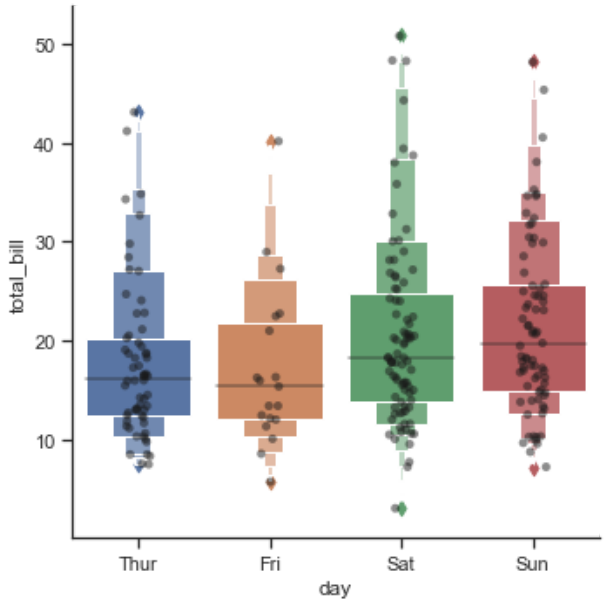
In [38]:
```
sns.catplot(x="day", y="total_bill", kind="box", data=tips);
```

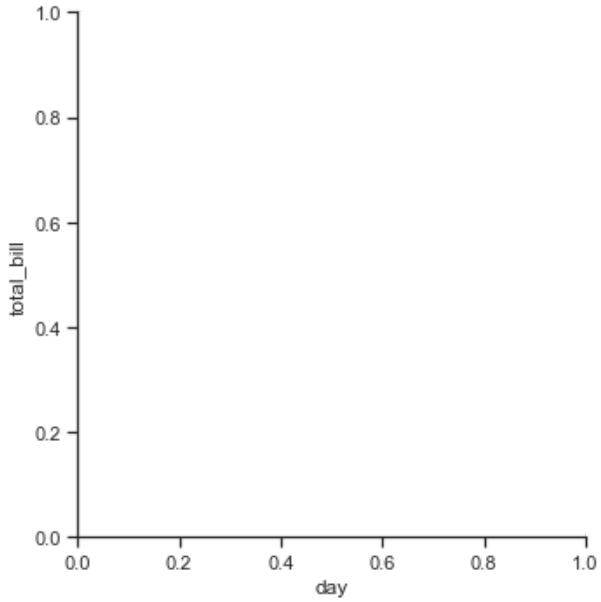


In [39]:
```
sns.catplot(x="day", y="total_bill", kind="boxen", data=tips);
```



In [40]:
```
g = sns.catplot(x="day", y="total_bill", kind="boxen", data=tips)

sns.catplot(x="day", y="total_bill", data=tips,
            color="k", alpha=0.5, ax=g.ax);
```



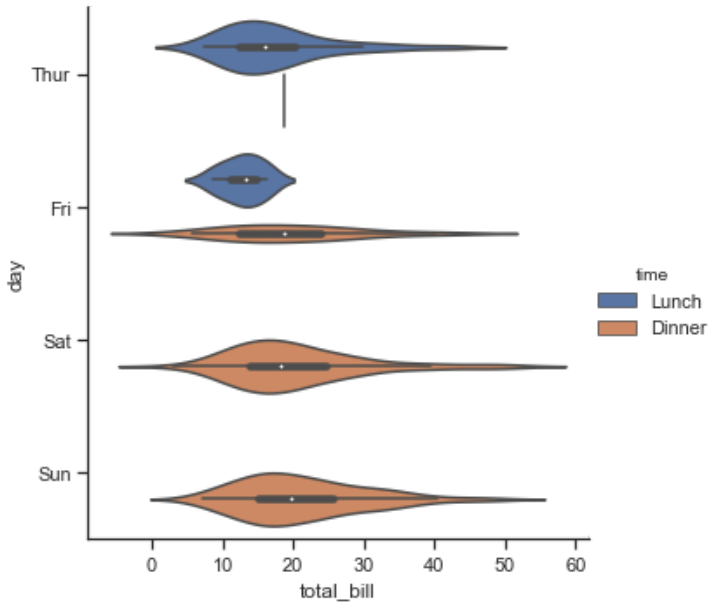


Violin Plots

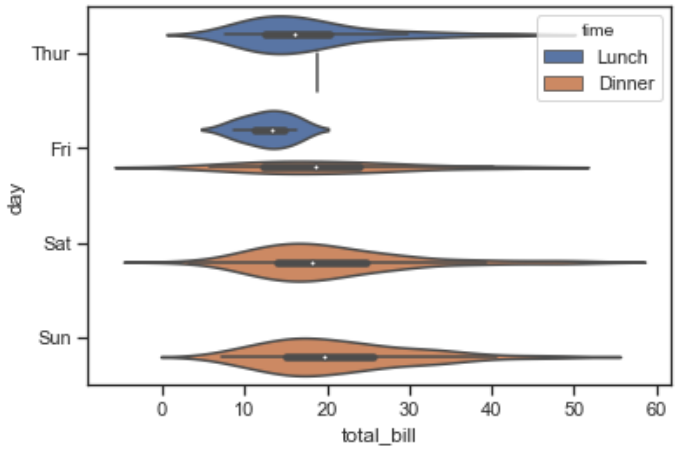
- combines boxplot with kernel density estimation (KDE)

In [41]:
```
g = sns.catplot(x="total_bill", y="day", hue="time",
                kind="violin", data=tips);
```

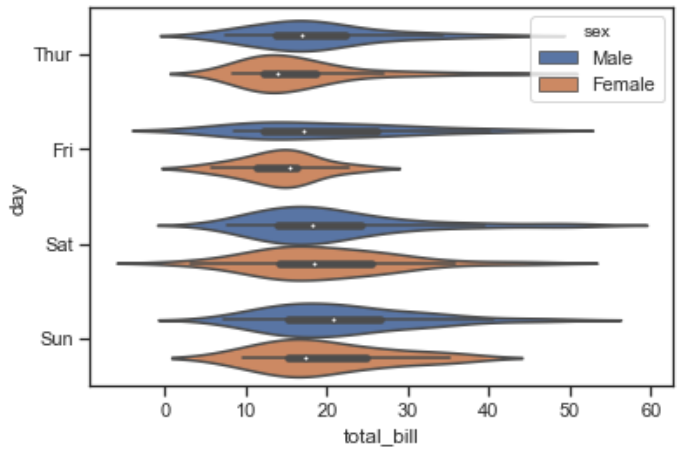
```
/Library/Frameworks/Python.framework/Versions/3.7/lib/python3.7/site-packages/scipy/stats/stats.py:1713: FutureWarning: Using a non-tuple sequence for multidimensional indexing is deprecated; use `arr[tuple(seq)]` instead of `arr[seq]`. In the future this will be interpreted as an array index, `arr[np.array(seq)]`, which will result either in an error or a different result.
  return np.add.reduce(sorted[indexer] * weights, axis=axis) / sumval
```



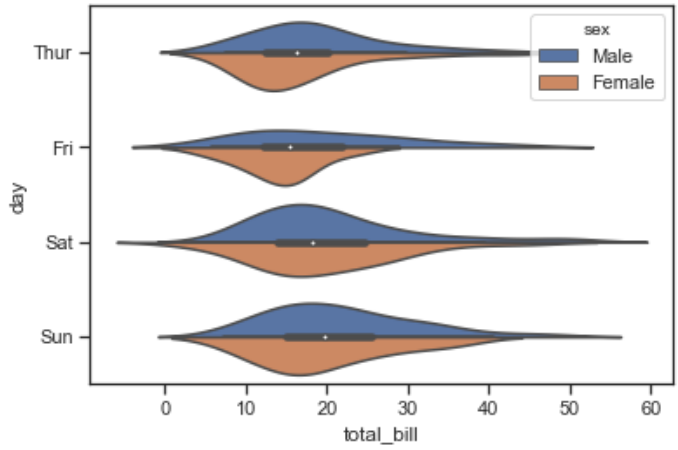
In [42]:
```
sns.violinplot(x="total_bill", y="day", hue="time",
               data=tips);
```



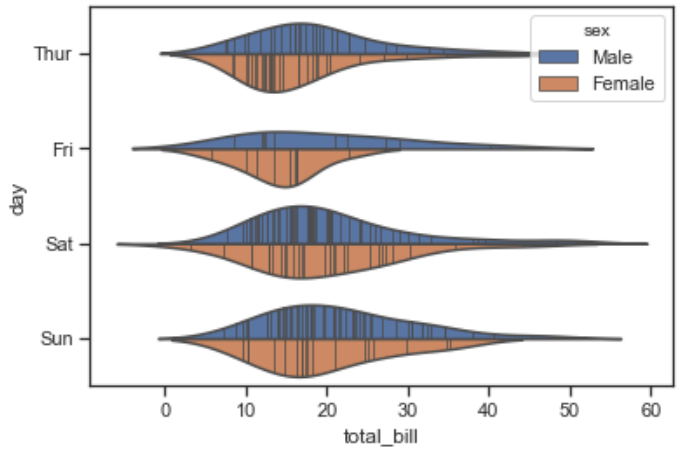
In [43]:
```
sns.violinplot(x="total_bill", y="day", hue="sex",
               data=tips);
```



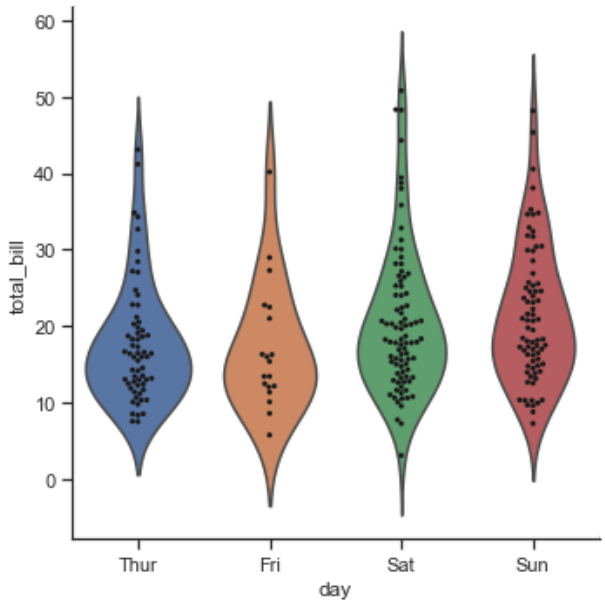
In [44]:
```
# If the hue has only two-levels, use split for more better plot

sns.violinplot(x="total_bill", y="day", hue="sex",
               split=True, data=tips);
```



In [45]:
```
# Show each value inside the violin instead of boxplot

sns.violinplot(x="total_bill", y="day", hue="sex",
               split=True, inner="stick", data=tips);
```



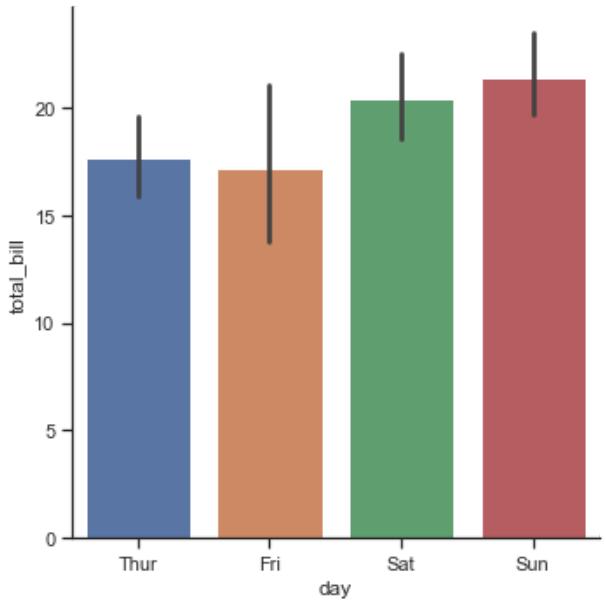
In [46]:
```
# Show each observation along with a summary of the distrbution

g = sns.catplot(x="day", y="total_bill", kind="violin", inner=None, data=tips)

sns.swarmplot(x="day", y="total_bill", color="k", size = 3, data=tips, ax=g.ax);
```



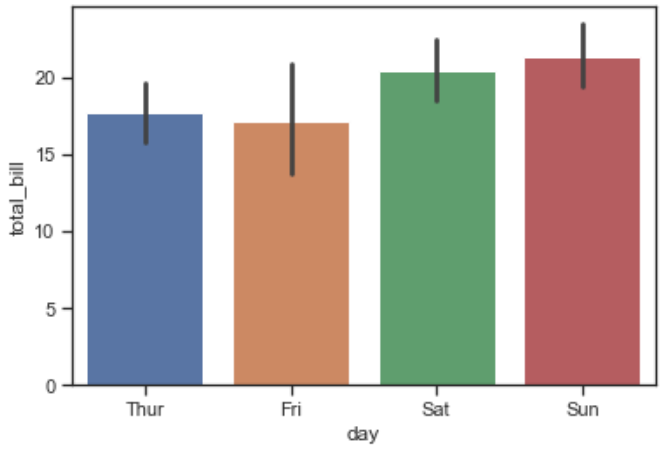
Statistical estimation within categories

Bar plots

In [47]:
```
# estimate is mean by default
# error bars show the confidence interval (95% default)

sns.catplot(x="day", y="total_bill", kind="bar", data=tips);
```



In [48]:
```
sns.barplot(x="day", y="total_bill", data=tips);
```

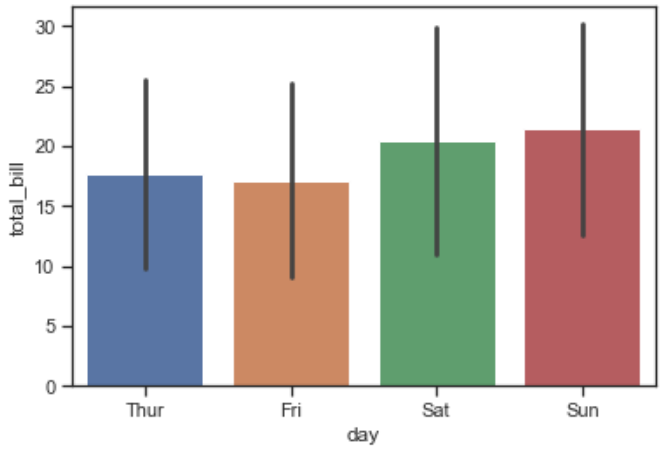


In [49]:
```
tips.groupby('day')['total_bill'].describe()
```

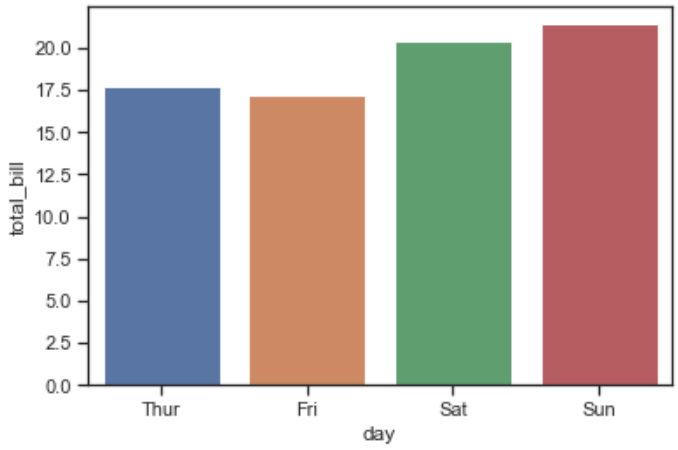
Out[49]:

day	count	mean	std	min	25%	50%	75%	max
Thur	62.0	17.682742	7.886170	7.51	12.4425	16.20	20.1550	43.11
Fri	19.0	17.151579	8.302660	5.75	12.0950	15.38	21.7500	40.17
Sat	87.0	20.441379	9.480419	3.07	13.9050	18.24	24.7400	50.81
Sun	76.0	21.410000	8.832122	7.25	14.9875	19.63	25.5975	48.17

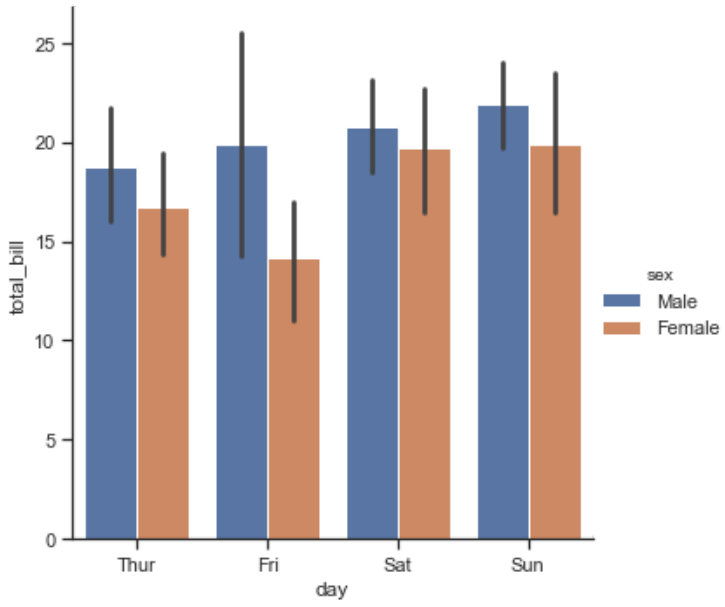
In [50]:
```
sns.barplot(x="day", y="total_bill", ci="sd", data=tips);
```



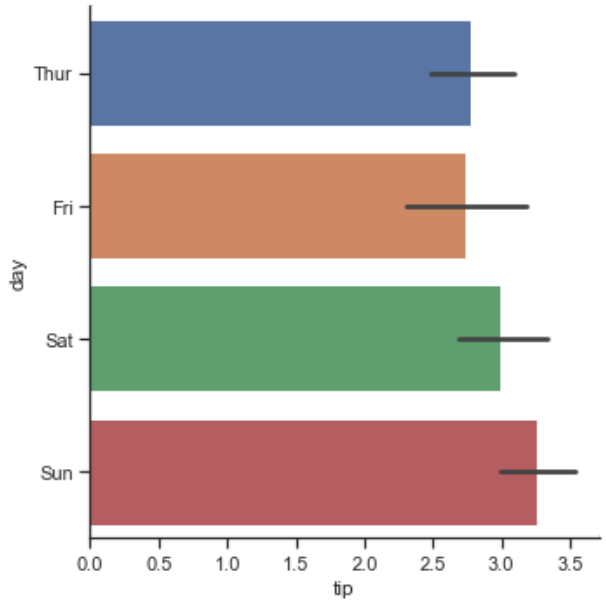
In [51]:
```
sns.barplot(x="day", y="total_bill", ci=None, data=tips);
```



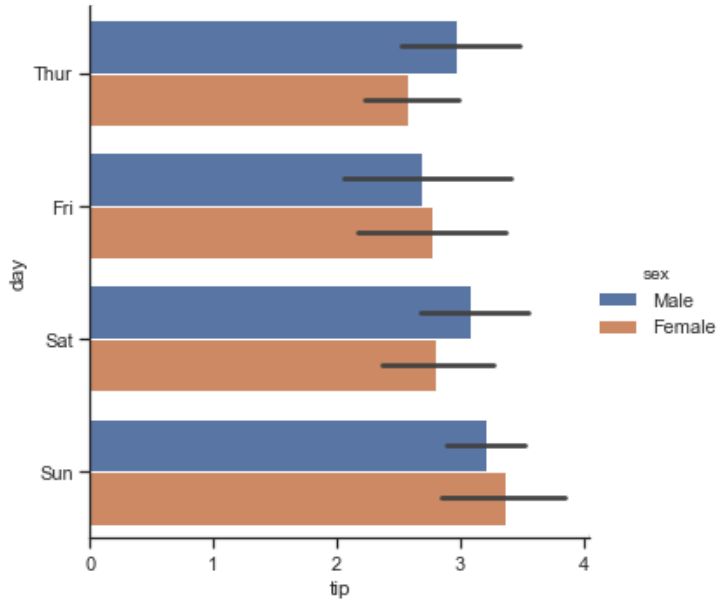
In [52]:
```
sns.catplot(x="day", y="total_bill", hue="sex", kind="bar", data=tips);
```



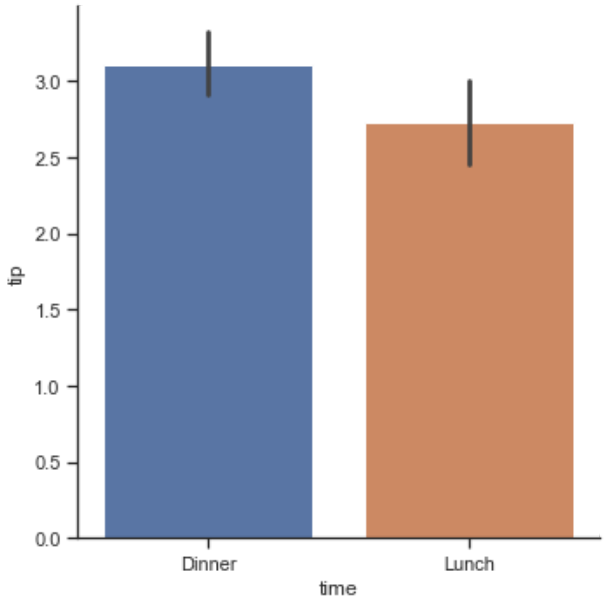
In [53]:
```
sns.catplot(x="tip", y="day", kind="bar", data=tips);
```



In [54]:
```
sns.catplot(x="tip", y="day", hue="sex", kind="bar", data=tips);
```



In [55]:
```
sns.catplot(x="time", y="tip", kind="bar", data=tips,
            order=["Dinner", "Lunch"]);
```



Count plot

In [56]:
```
exercise.head()
```

Out[56]:

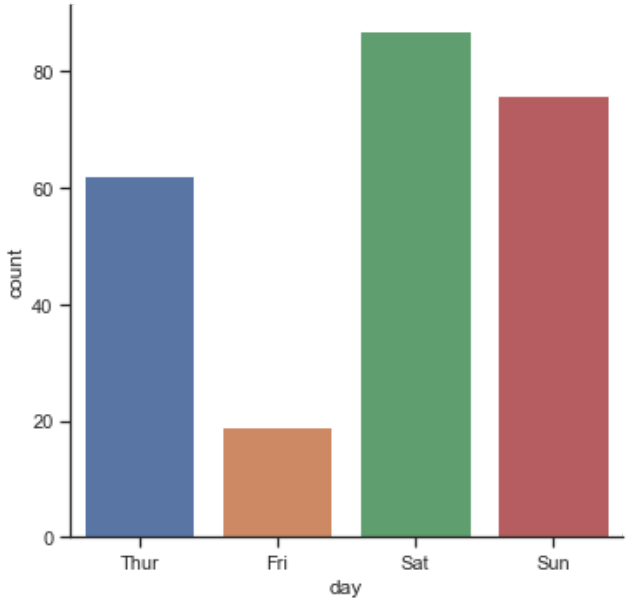
	Unnamed: 0	id	diet	pulse	time	kind
0	0	1	low fat	85	1 min	rest
1	1	1	low fat	85	15 min	rest
2	2	1	low fat	88	30 min	rest
3	3	2	low fat	90	1 min	rest
4	4	2	low fat	92	15 min	rest

In [57]:
```
tips.head()
```

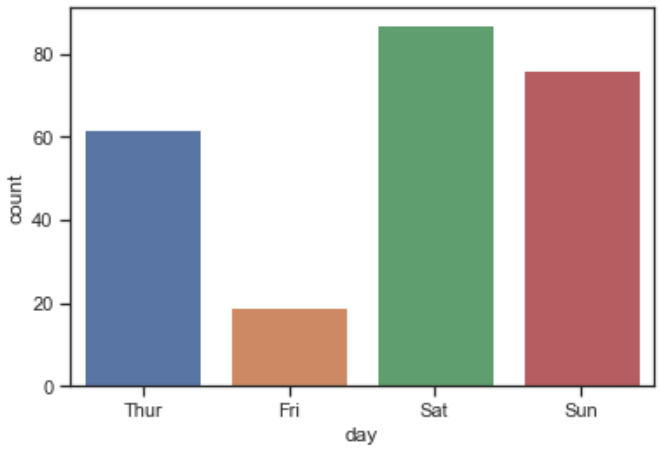
Out[57]:

	total_bill	tip	sex	smoker	day	time	size	weekend
0	16.99	1.01	Female	No	Sun	Dinner	2	True
1	10.34	1.66	Male	No	Sun	Dinner	3	True
2	21.01	3.50	Male	No	Sun	Dinner	3	True
3	23.68	3.31	Male	No	Sun	Dinner	2	True
4	24.59	3.61	Female	No	Sun	Dinner	4	True

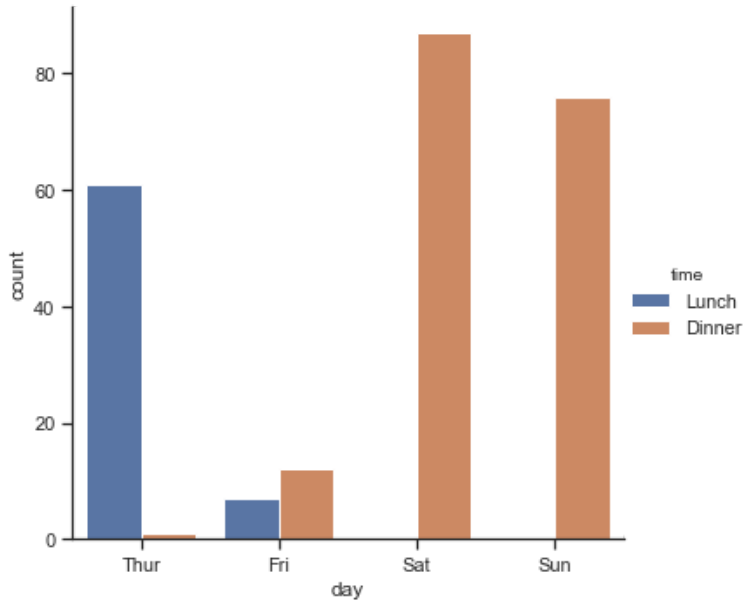
In [58]:
```
sns.catplot(x="day", kind="count", data=tips);
```



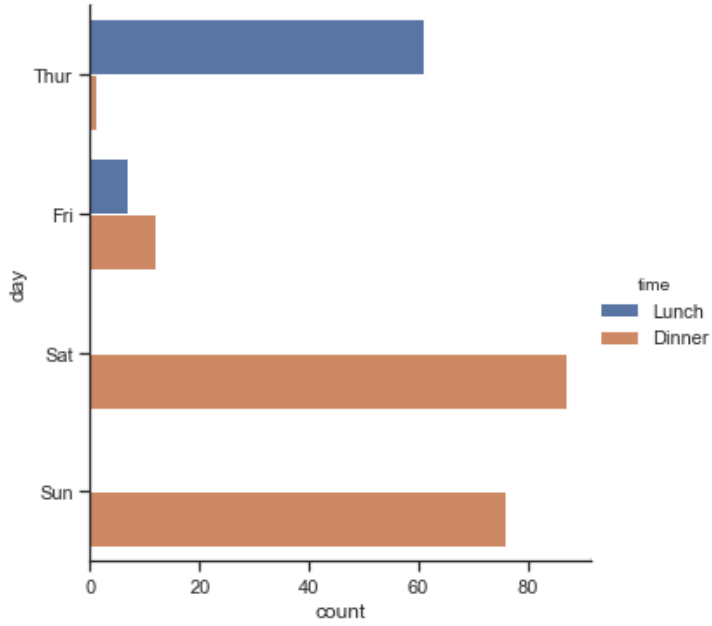
In [59]:
```
sns.countplot(x="day", data=tips);
```



In [60]:
```
sns.catplot(x="day", kind="count", hue="time", data=tips);
```



In [61]:
```
sns.catplot(y="day", kind="count", hue="time", data=tips);
```



In [62]:
```
sns.catplot(x="day", kind="count", hue="sex", col="time", data=tips,
            height=4, aspect=.7);
```