

PSYC 027: Scientific Computing for Psychology

5 November 2019

Professor Youssef Ezzyat
McCabe Library 306
T/Th 9:55-11:10

Updates

- No office hours tomorrow
- No class on Thursday
- HW5 to be rolled into HW6
- Final Project

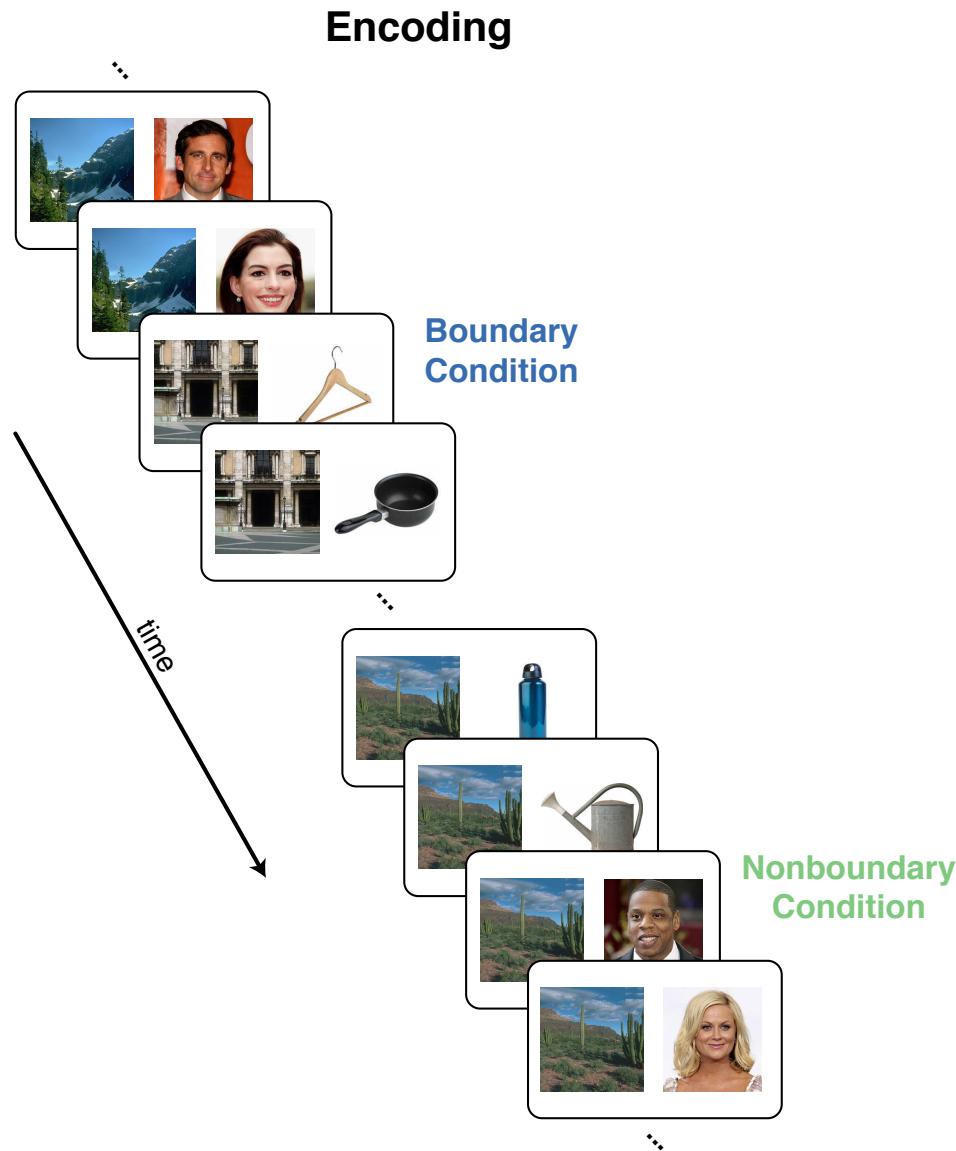
Associations in memory

- At retrieval (during a recognition memory task), making a memory decision about an item brings to mind that item's representation
- Memory theories suggest this may inadvertently (automatically?) make **related** items in memory more active
- If we could measure these associations, it could tell us something about the kinds of relations that our memory system is sensitive to

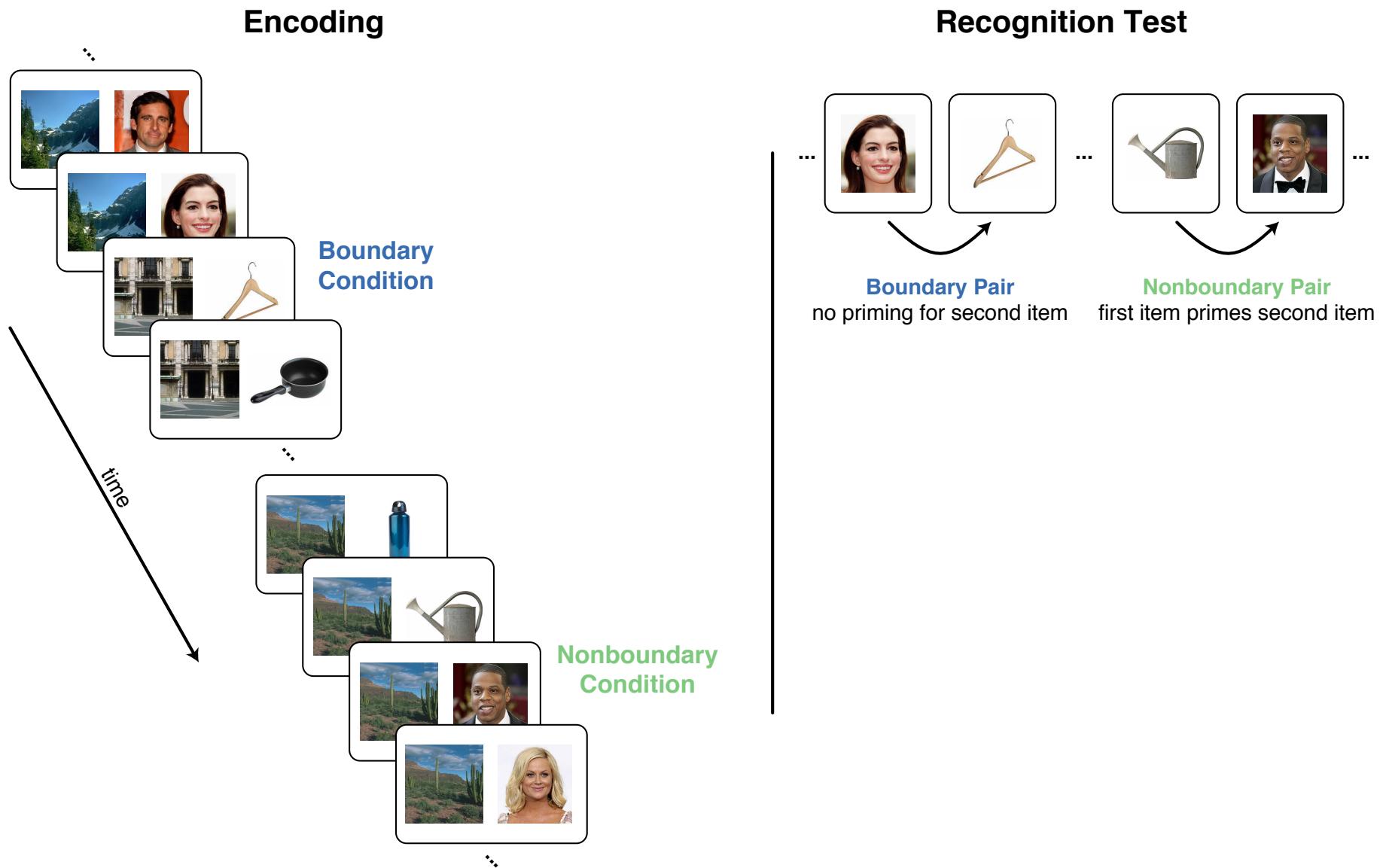
Associations in memory

- Semantic (DOG—BONE)
- Temporal (walk into class—think about Python)
- Events (ordering food and paying the check)
- How do we measure these?

Temporal associations in memory



Temporal associations in memory



Temporal associations in memory

SubjectNumber	Trial	Block	Item	ItemType	ItemOldNew	Accuracy	RT	SDT	ProbeResp	PrimeType
StimOrder	EncPos									
4	1	1	26688112.jpg	obj	new	1	1.841	cr..	new	na
4	2	1	10048739.jpg	obj	old	1	1.602	hit	old	P1
4	3	1	Jane_Fonda{}.jpg	face	old	1	2.430	hit	old	P2
4	4	1	Lucy_Liu{}.jpg	face	old	1	1.079	hit	old	P14
4	5	1	8257486.jpg	obj	old	1	2.458	hit	old	P2
4	6	1	26688127.jpg	obj	new	1	0.877	cr..	new	P14
4	7	1	26684719.jpg	obj	new	1	2.533	cr..	new	na
4	8	1	26684080.jpg	obj	new	1	1.209	cr..	new	na
4	9	1	Lenny_Kravitz.jpg	face	new	1	1.055	cr..	new	na

Temporal associations in memory

- How might we import this data?
- Numpy (.readlines(), loop through each line)
-

Temporal associations in memory

- How might we import this data?
- Numpy (.readlines(), loop through each line)
- Pandas (package for working with tabular data)

```
In [1]: # Import Pandas, for working with tabular data
import pandas as pd
```

```
In [2]: # Import a data file as a pandas DataFrame object
data = pd.read_csv('data_S04_INTEGRATE_fMRI1_Retrieval.txt', sep='\t')
```

Temporal associations in memory

- Pandas *DataFrame* objects have nice tools for working with tables
- E.g. `.head()` shows the table header

```
In [1]: import pandas as pd
```

```
In [2]: data = pd.read_csv('data_S04_INTEGRATE_fMRI1_Retrieval.txt',sep='\t')
```

```
In [3]: data.head()
```

Out[3]:

SubjectNumber	Trial	Block	Item	ItemType	ItemOldNew	Accuracy	RT	SDT	ProbeResp	PrimeType
0	4	1	1 26688112.jpg	obj	new	1	1.841	cr	new	na
1	4	2	1 10048739.jpg	obj	old	1	1.602	hit	old	P1
2	4	3	1 Jane_Fonda{}.jpg	face	old	1	2.430	hit	old	P2
3	4	4	1 Lucy_Liu{}.jpg	face	old	1	1.079	hit	old	P1
4	4	5	1 8257486.ipa	obi	old	1	2.458	hit	old	P2

Temporal associations in memory

data_S04_INTEGRATE_fMRI1_Retrieval.txt

SubjectNumber	Trial	Block	Item	ItemType	ItemOldNew	Accuracy	RT	SDT	ProbeResp	PrimeType
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4	7	1	26684719.jpg	obj	new	1	2.533	cr.	new	B
4	8	1	26684080.jpg	obj	new	1	1.209	cr.	new	F
4	9	1	Lenny_Kravitz.jpg	face	new	1	1.055	cr.	new	16

Out[3]:

SubjectNumber	Trial	Block	Item	ItemType	ItemOldNew	Accuracy	RT	SDT	ProbeResp	PrimeType
0	4	1	26688112.jpg	obj	new	1	1.841	cr	new	na
1	4	2	10048739.jpg	obj	old	1	1.602	hit	old	P1
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Temporal associations in memory

Out[3]:

SubjectNumber	Trial	Block	Item	ItemType	ItemOldNew	Accuracy	RT	SDT	ProbeResp	PrimeType
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3	4	4	1	Lucy_Liu{}.jpg	face	old	1	1.079	hit	old
4	4	5	1	8257486.ipa	obi	old	1	2.458	hit	old

In [8]: `data.RT`

Out[8]:

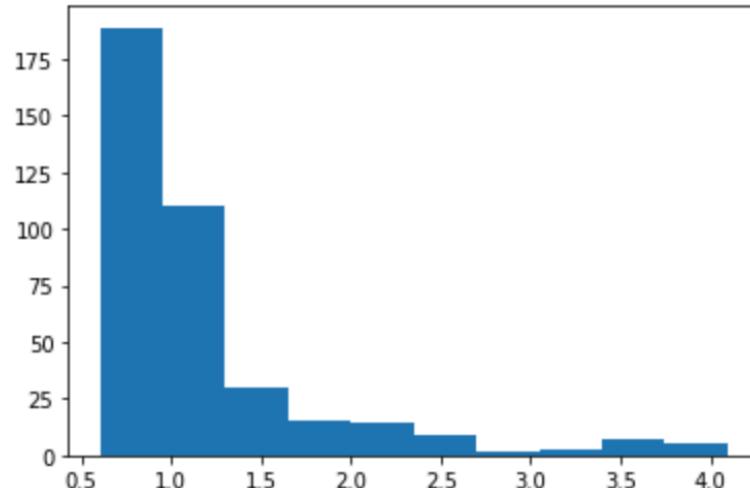
```
0    1.841
1    1.602
2    2.430
3    1.079
4    2.458
5    0.877
6    2.533
7    1.209
8    1.055
9    1.028
10   1.242
11   1.197
12   2.259
```

Temporal associations in memory

- Quick representation of the response time data: histogram

```
In [6]: # Import some other packages
import numpy as np
import scipy.stats as st
import matplotlib.pyplot as plt
```

```
In [7]: # Let's make a histogram to do a quick visual inspection of the data
plt.hist(data.RT)
plt.show()
```



```
In [8]: data.RT
```

```
Out[8]: 0      1.841
1      1.602
2      2.430
3      1.079
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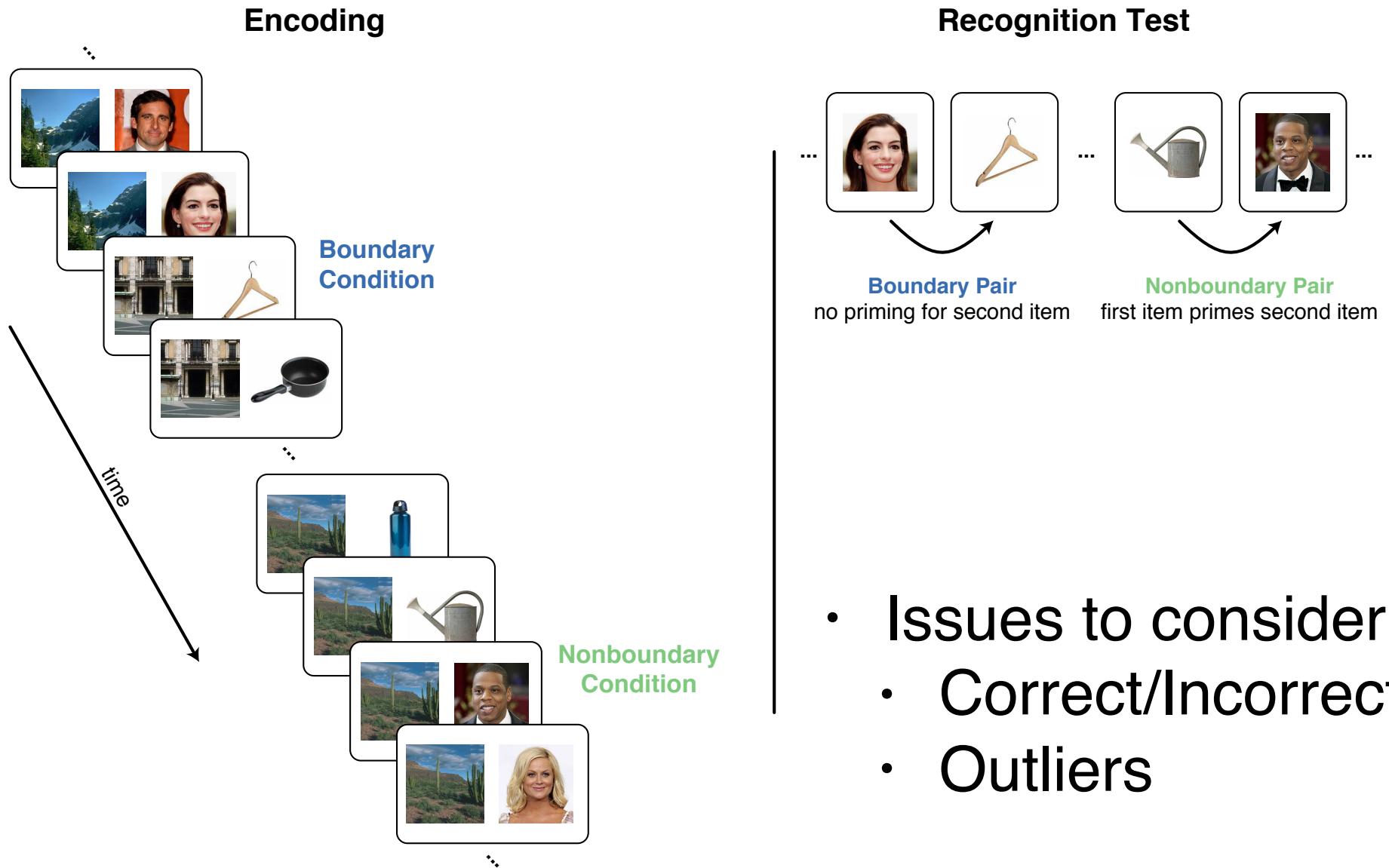
Temporal associations in memory

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- Interested in response time **priming** as a measure of association
- Issues to consider:
 - Correct/Incorrect
 - Outliers

Temporal associations in memory



- Issues to consider:
 - Correct/Incorrect
 - Outliers

Temporal associations in memory

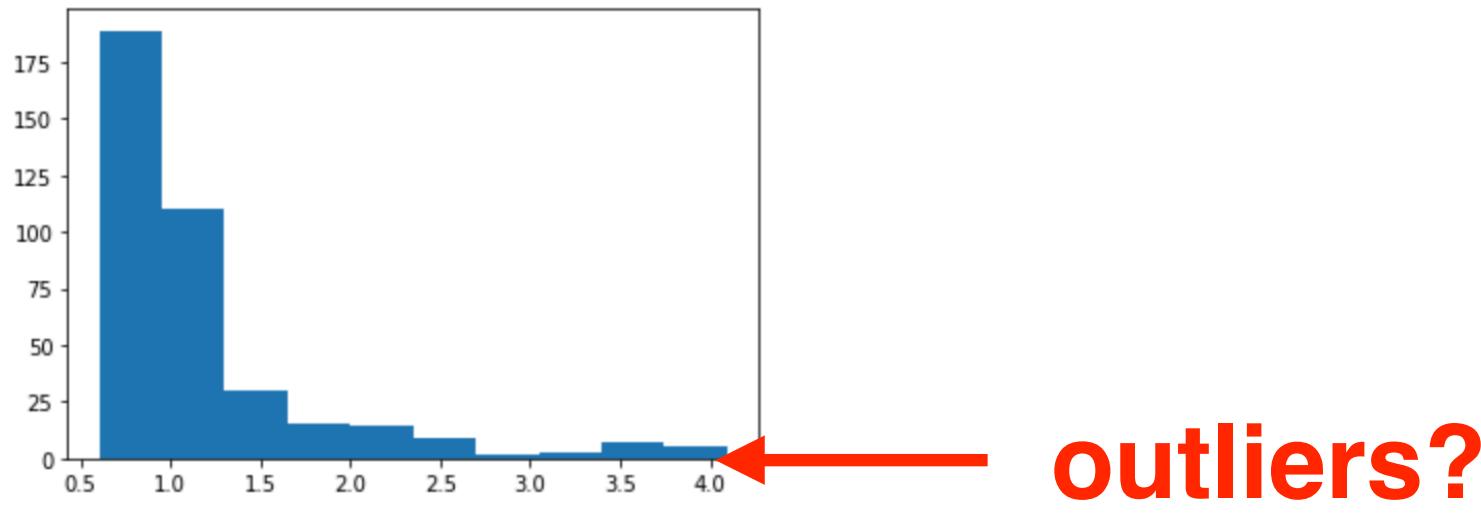
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4	4	5	1	8257486.ipa	obi	old	1	2.458	hit	old

- How do we identify correct/incorrect?

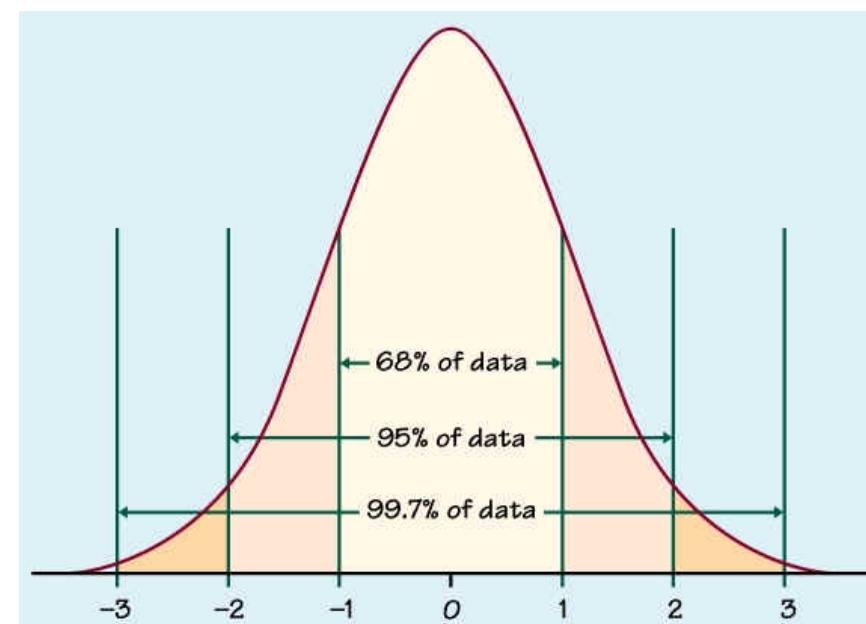
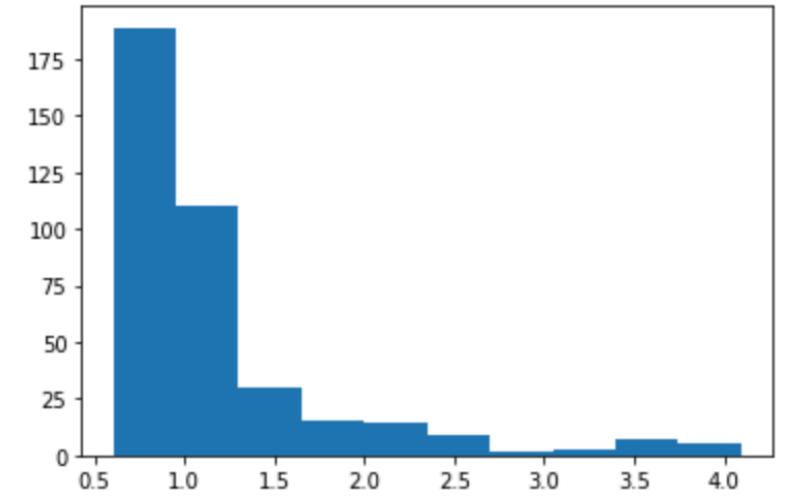
Temporal associations in memory

- How do we identify outliers?
- Use the z-transform to identify observations that are far from the mean of the distribution



Temporal associations in memory

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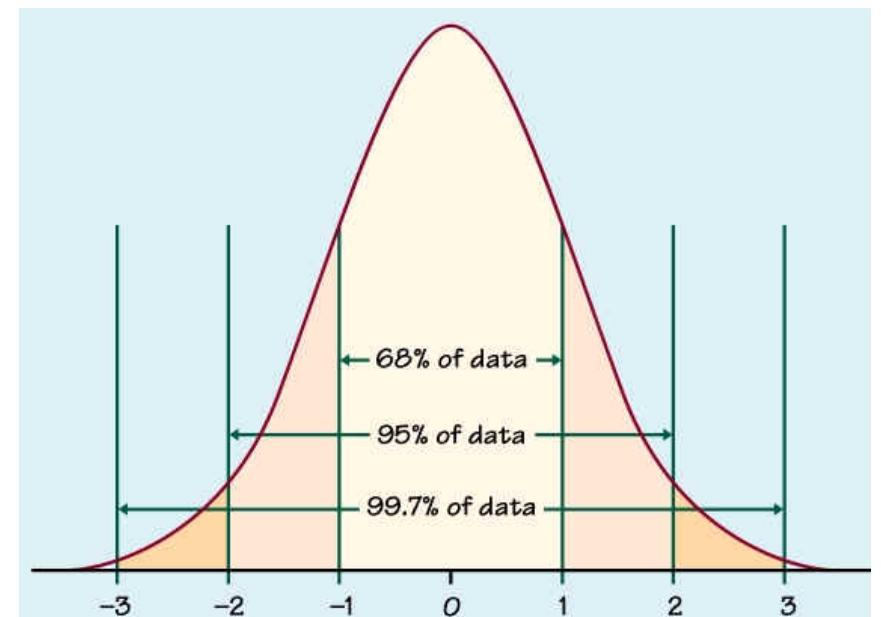
Temporal associations in memory

- How do we identify outliers?
- Use the z-transform to identify observations that are far from the mean of the distribution

$$z = \frac{x - \mu}{\sigma}$$

Mean
Standard deviation

$$\sigma = \sqrt{\frac{1}{N} \sum_{i=1}^N (x_i - \mu)^2}$$



Temporal associations in memory

- How do we identify outliers?
- Use the z-transform to identify observations that are far from the mean of the distribution