

# A neural network to predict real-world human memory

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# You think your memories are special...

- People are highly similar in the items they remember and forget
- Images have an intrinsic ***memorability***, the likelihood of it being remembered

**Memorable**

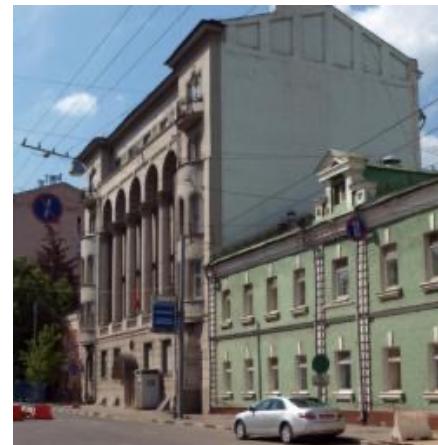


0.83



0.75

**Forgettable**



0.44



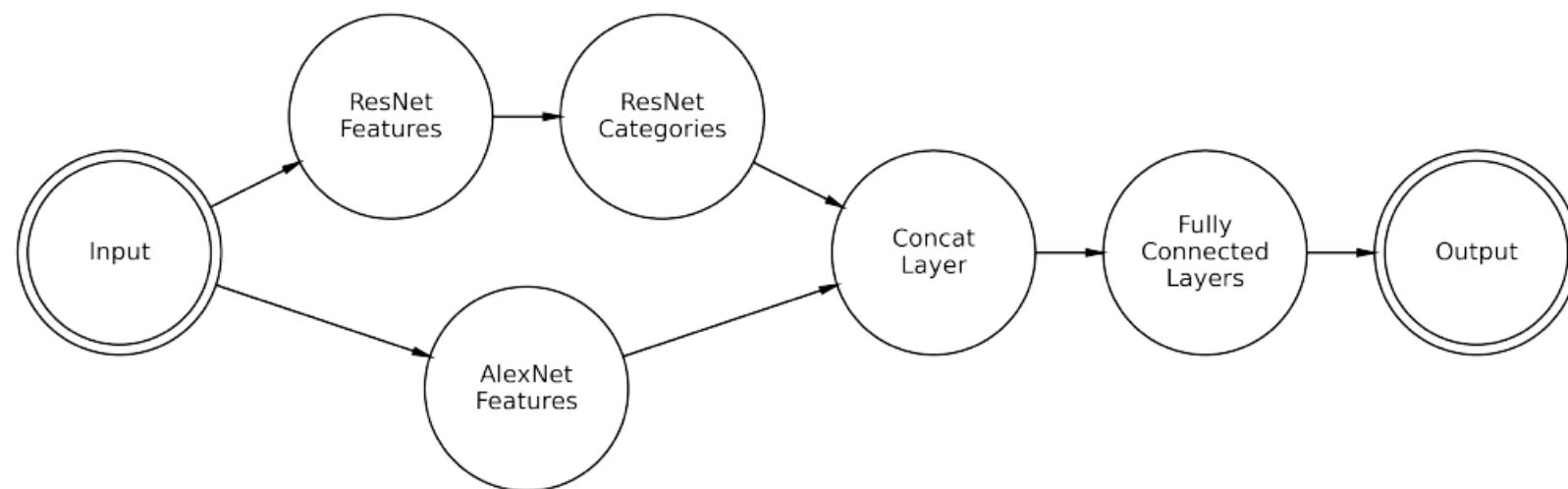
0.43

# Memorability is image-computable

**ResMem:** Current state of the art in memorability prediction



Coen Needell



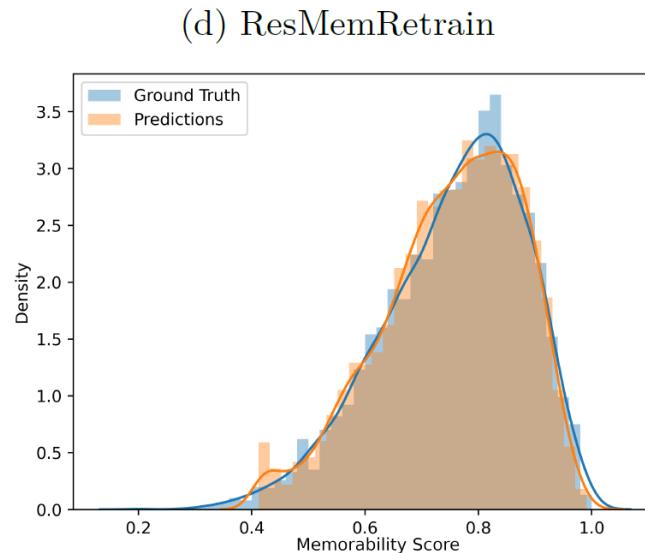
Trained on ~60,000 real-world photographs

# Memorability is image-computable

**ResMem:** Current state of the art in memorability prediction



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Correlation  $\rho = 0.68$  with human memory

<https://brainbridgelab.uchicago.edu/resmem/>

# Can we predict memory in the real world?

One of the times we view images with the intention of remembering them...



Can we predict memory for  
an art museum visit?

# The answer is not obvious...

- Appreciation of art is highly personal, memory may be idiosyncratic
- Museum visits involve more than just viewing images:
  - **Space:** the location of pieces
  - **Time:** the order you view the pieces
  - **Social:** how you discuss the piece with friends
  - **Emotional:** your mood at the time
  - Etc...

# What do we remember in a museum visit?

Art Institute of Chicago

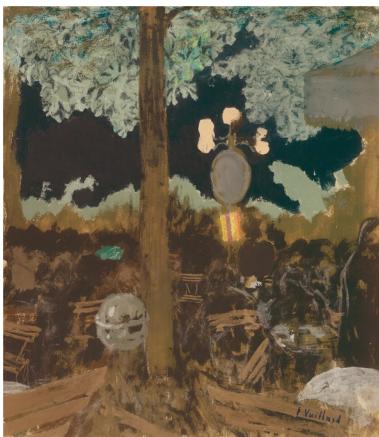


Trent Davis



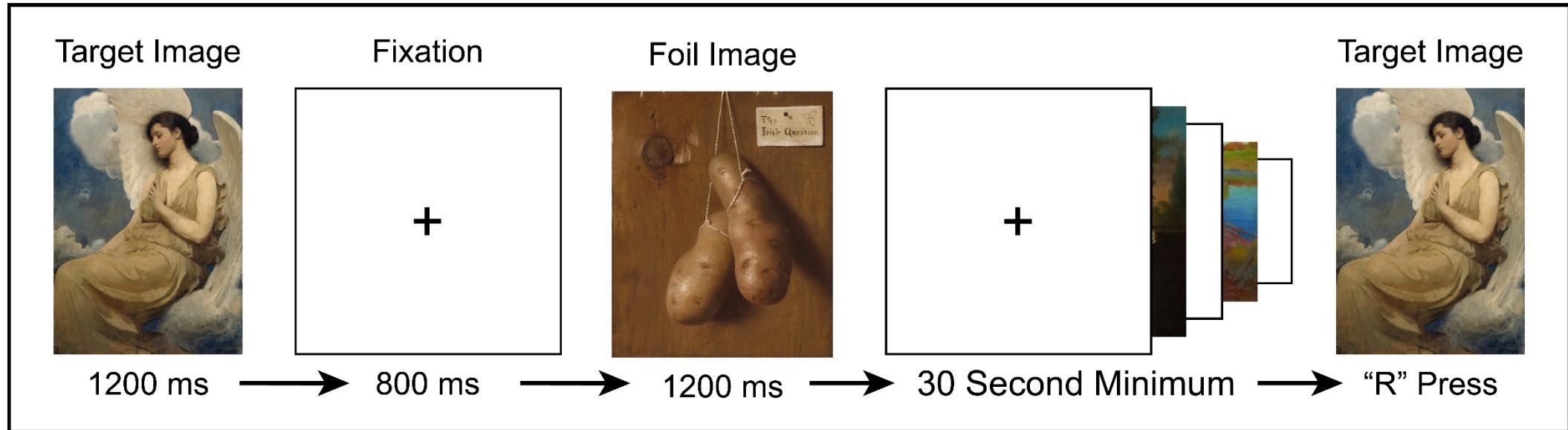
# Stimulus set

All 4,021 paintings



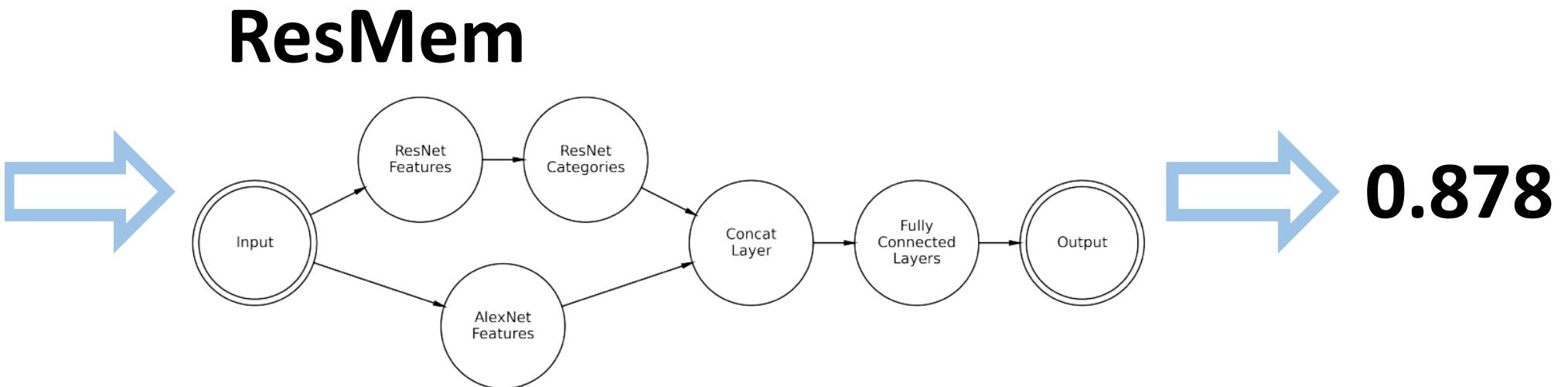
# Can we predict memory for art in an experiment?

N=3,216, 50 targets/participant, 40 participants/image



Online participants were significantly consistent in their memory for artwork:  $\rho = 0.53$ ,  $p < 0.001$

# Can we predict memorability for artwork?



Significant predictive ability:  $\rho=0.45$ ,  $p < 10^{-203}$

*How predictive is ResMem of memory  
in the real world?*

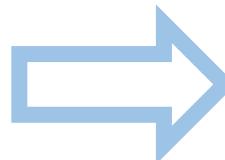
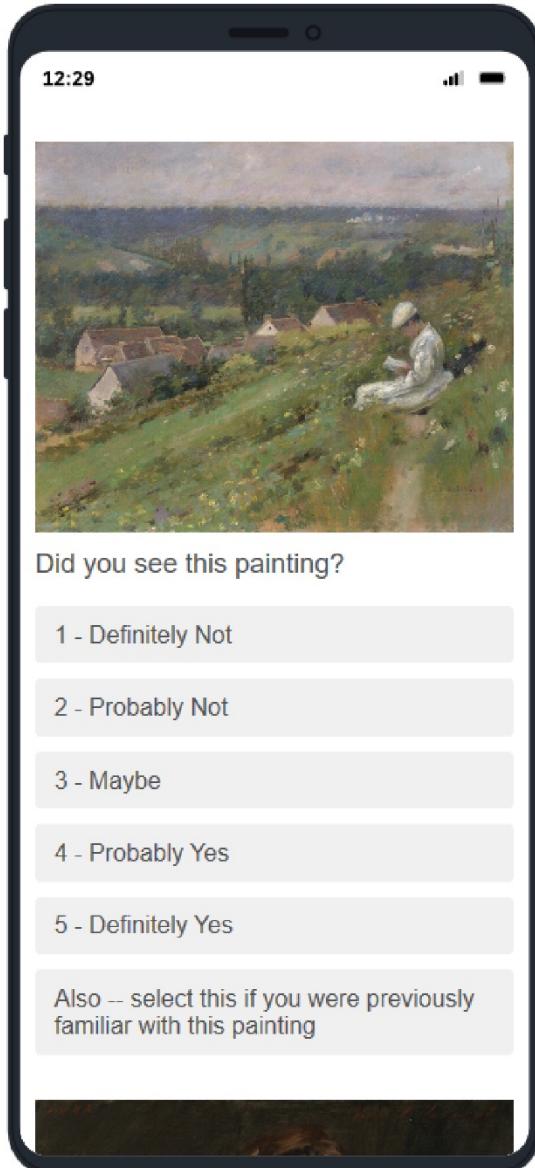
# Memory in the real world



- N=20
- Free exploration
- American Art Wing  
(162 pieces)

# Memory in the real world

Old/new  
recognition task



Hit Rates (HR)  
across participants  
for each image

# Other attributes



How beautiful is this painting?

Not at all Beautiful	Extremely Beautiful			
<input type="radio"/>	<input type="radio"/>			
1	2	3	4	5

What type of emotions do you feel when viewing this painting?

Extremely Negative	Extremely Positive			
<input type="radio"/>	<input type="radio"/>			
1	2	3	4	5

How interesting do you find this painting?

Not at all Interesting	Extremely Interesting			
<input type="radio"/>	<input type="radio"/>			
1	2	3	4	5

How familiar are you with this painting?

Not at all Familiar	Extremely Familiar			
<input type="radio"/>	<input type="radio"/>			
1	2	3	4	5

# Can we predict memory in the real world?

Linear model to predict memory (HR):

- Floor (1<sup>st</sup> or 2<sup>nd</sup>)
- Painting size (area in cm<sup>2</sup>)
- Beauty
- Emotion
- Familiarity
- Interestingness
- ResMem prediction
- Measures of other pieces in the same room:
  - Average ResMem prediction
  - Average size
- Interactions

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- ResMem prediction: **p<0.0001,  $\beta=0.35$**
- Measures of other pieces in the same room:
  - ~~Average ResMem prediction~~
  - ~~Average size~~
- Interactions: smaller pieces benefitted when surrounded by larger pieces: **p=0.0001**

# Can we predict memory in the real world?

Linear model to predict memory (HR):  $R_{adj}^2 = 0.44$ ,  $p < 0.0001$

- Floor (1<sup>st</sup> or 2<sup>nd</sup>): 2<sup>nd</sup> more memorable,  $p = 0.004$
- Painting size (area in cm<sup>2</sup>): larger paintings,  $p < 0.0001$
- ~~Beauty~~

*We can predict what people  
remember in the messy real world.*

- Measures of other pieces in the same room:
  - ~~Average ResMem prediction~~
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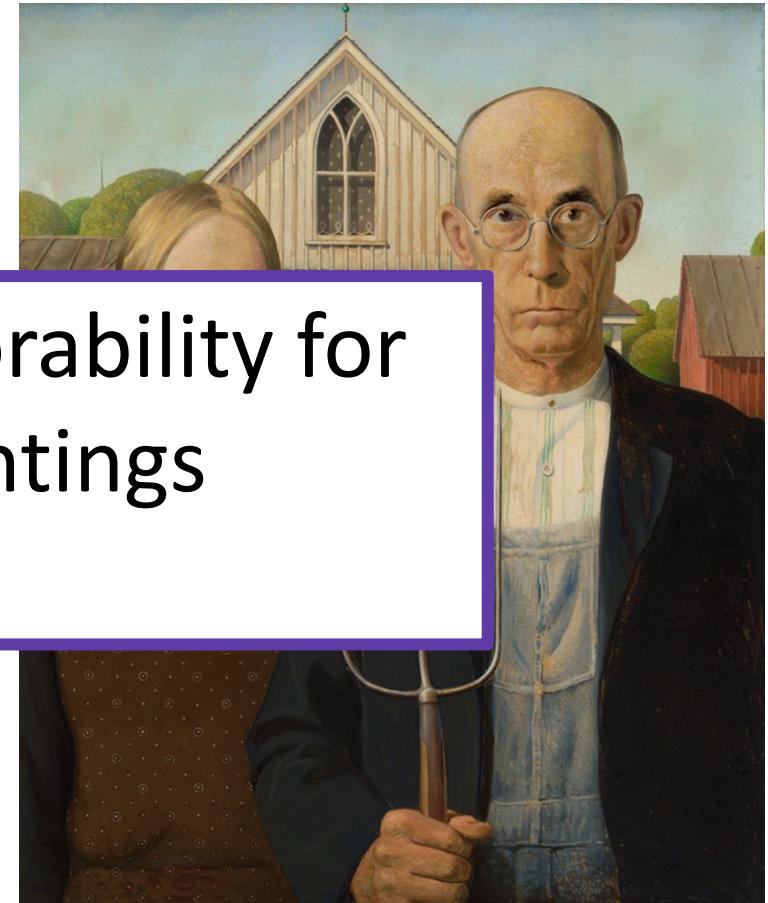
# How about memory across generations?



*Cow's Skull with Calico Roses*  
Georgia O'Keeffe



*Self Portrait*  
Vincent Van Gogh



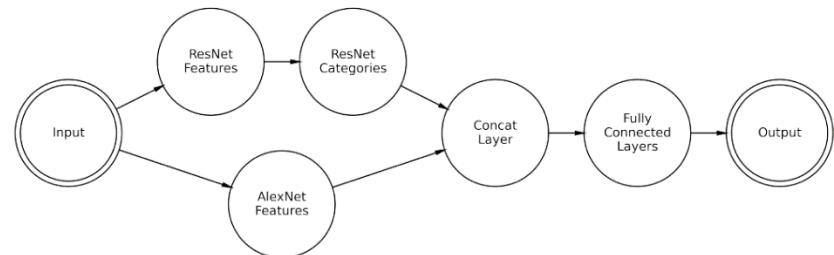
*American Gothic*  
Grant Wood

ResMem predicted higher memorability for famous vs. non-famous paintings

$$t=2.17, p=0.030$$

# Summary

We've created a neural network  
ResMem for predicting memory



We can predict people's memory for  
artwork online and in the real-world



Memorability may influence a piece's fame



# Thank you!



National Eye Institute



National  
Science  
Foundation



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