Predicting Visual Memorability:

A metric of the utility of information

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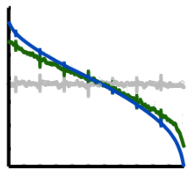
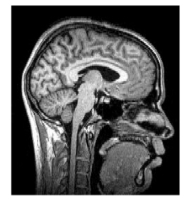
Memorability

What could we do with such knowledge and technology?

Understand human memory

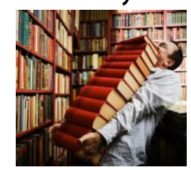


Diagnose memory problems



Design mnemonic aids

"heavy"



"lourds"

Visualization

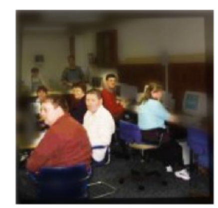
Mobile Applications

Retrieve better images from search

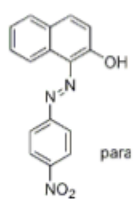
Logos

Social Networking

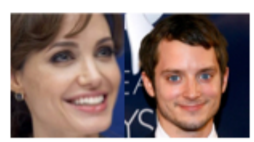
Make an image more memorable



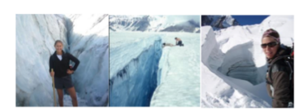
Education



Face Memorability



Summarize photo album or video



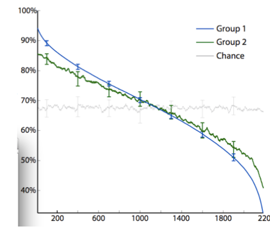
Predicting Memorability

Human Memory

What is the capacity and fidelity of human visual memory?

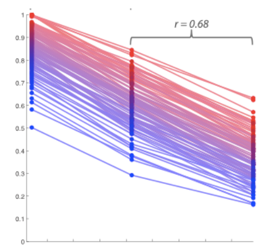
Memory Game I

Is memorability consistency across different observers?



Memory Game II

How does memorability evolve over time?



Computer Vision

Can computer vision methods predict memorability?

Memory Game III, IV, V …

Is memorability a general property of information?

Jennifer

Nature of human long term visual memory

What we know in 2008

Standing (1973)

10,000 images

83% Recognition

... people can remember thousands of images

What we don't know in 2008...

... what people are remembering for each item?

According to Standing

"Basically, my recollection is that we just separated the pictures into distinct thematic categories: e.g. cars, animals, single-person, 2-people, plants, etc.) Only a few slides were selected which fell into each category, and they were visually distinct."

"Abstract Only

Sparse Details

Highly Detailed

Massive Memory Experiment I

A stream of objects will be presented on the screen for ~ 3 second each.

Your primary task:

Remember them ALL!

afterwards you will be tested with…

Completely different objects...

Different exemplars of the same kind of object...

Different states of the same object...

Massive Memory I: Methods

Showed 14 observers 2500 **categorically unique objects**

1 at a time, 3 seconds each

800 ms blank between items

Study session lasted about 5.5 hours

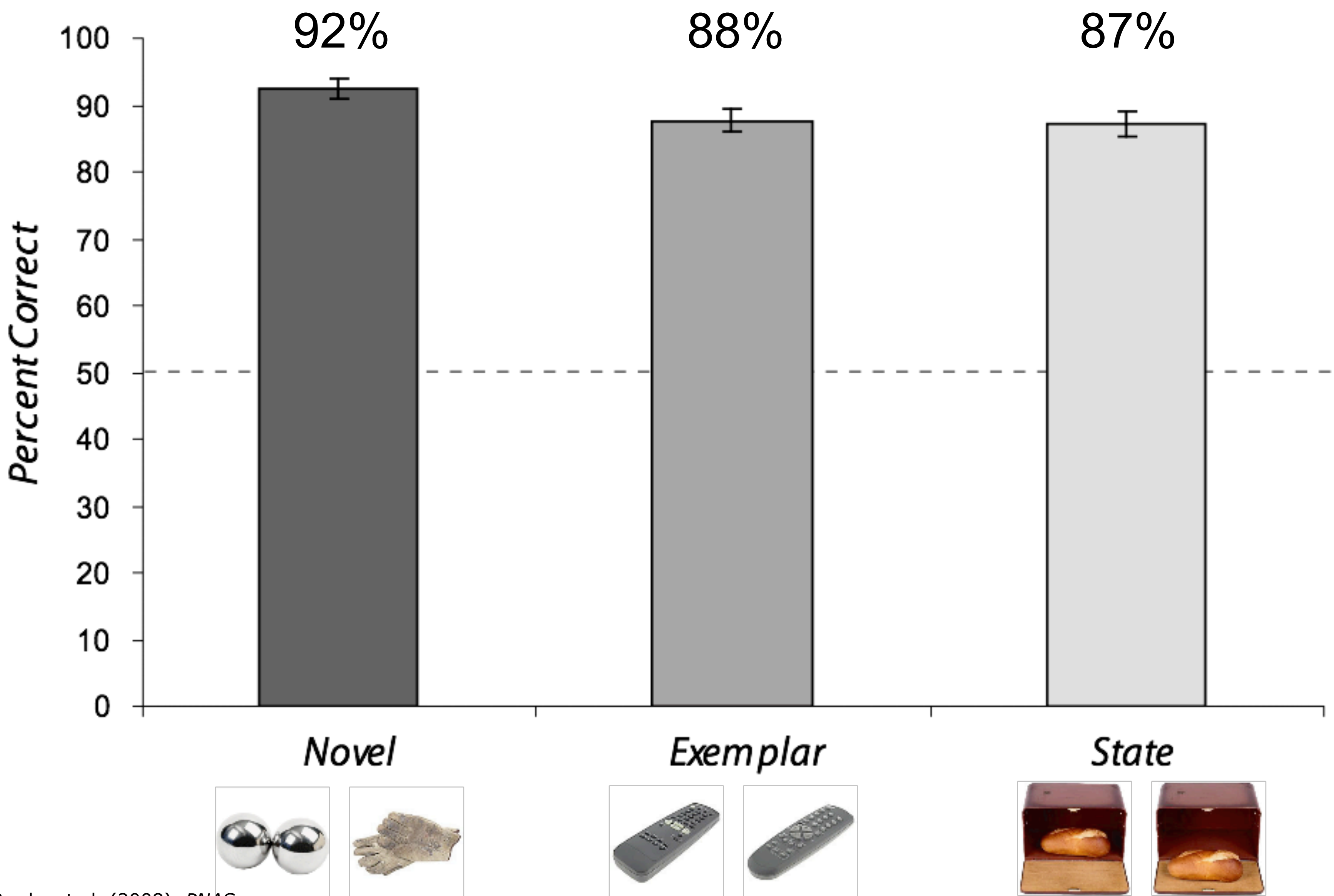
Repeat Detection task to maintain focus

Followed by 300 2-alternative forced choice tests

Examples of **Exemplar** Memory Tests

Examples of **State** memory test

Recognition Memory Results



Brady, et al. (2008), *PNAS*

Models of Object Recognition

A massive memory for details lend credence to object recognition approaches that require brute force storage of *multiples* viewpoints and exemplars (and image alignment approaches)

Human Memory: Summary

Massive Memory I

Visual LTM can store a large number of items (Standing)

with <u>surprising fidelity</u>

Massive Memory II

Maybe the categorical distinctiveness of all items was essential ?

If you see several sets of binoculars…

Will your memory representations be detailed enough ?

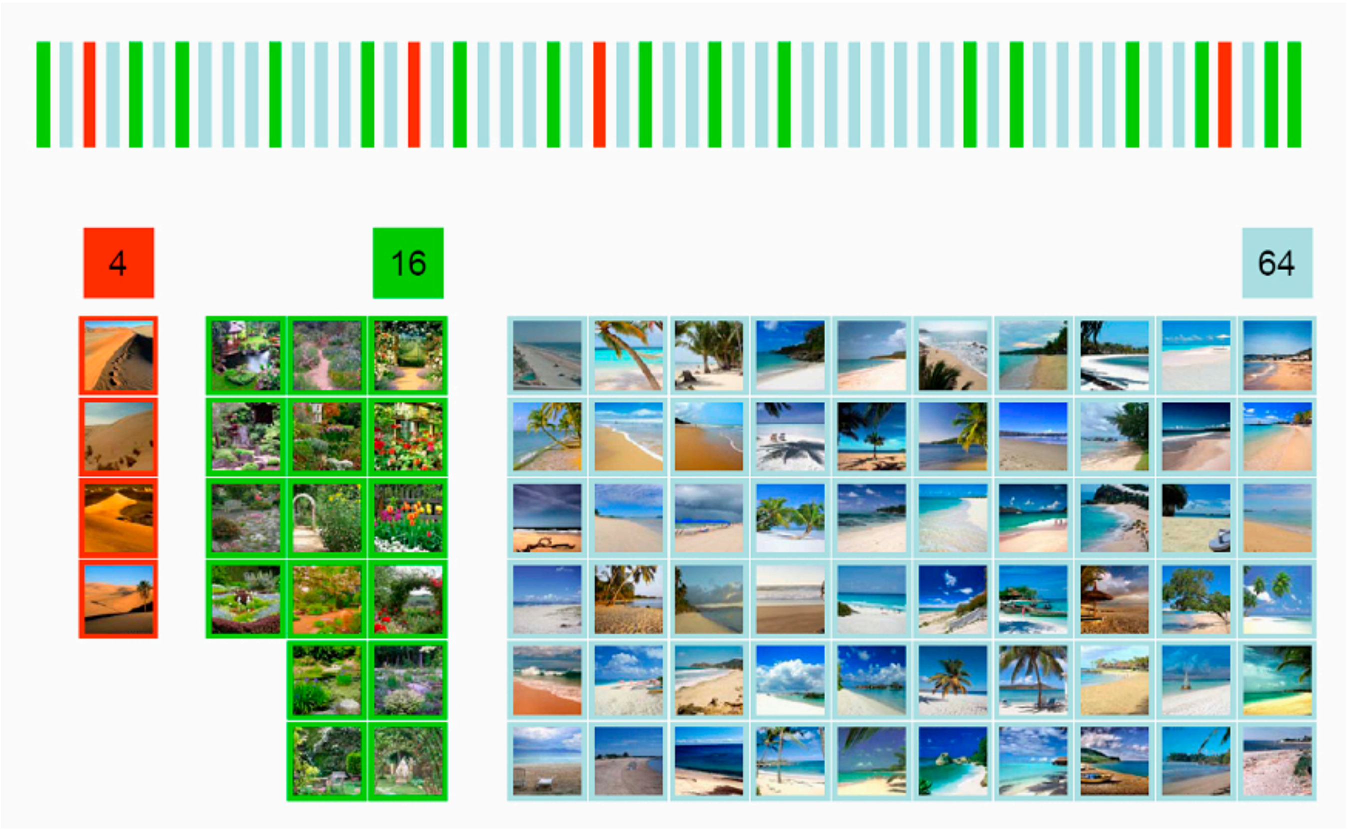
?

Methods – The Study Stream

128 unique semantic categories of natural images

2912 natural images shown in the stream (3 seconds each, 800 msec ISI)

Number of exemplars per category: 4, 16, or **64 !**



N= 24 observers

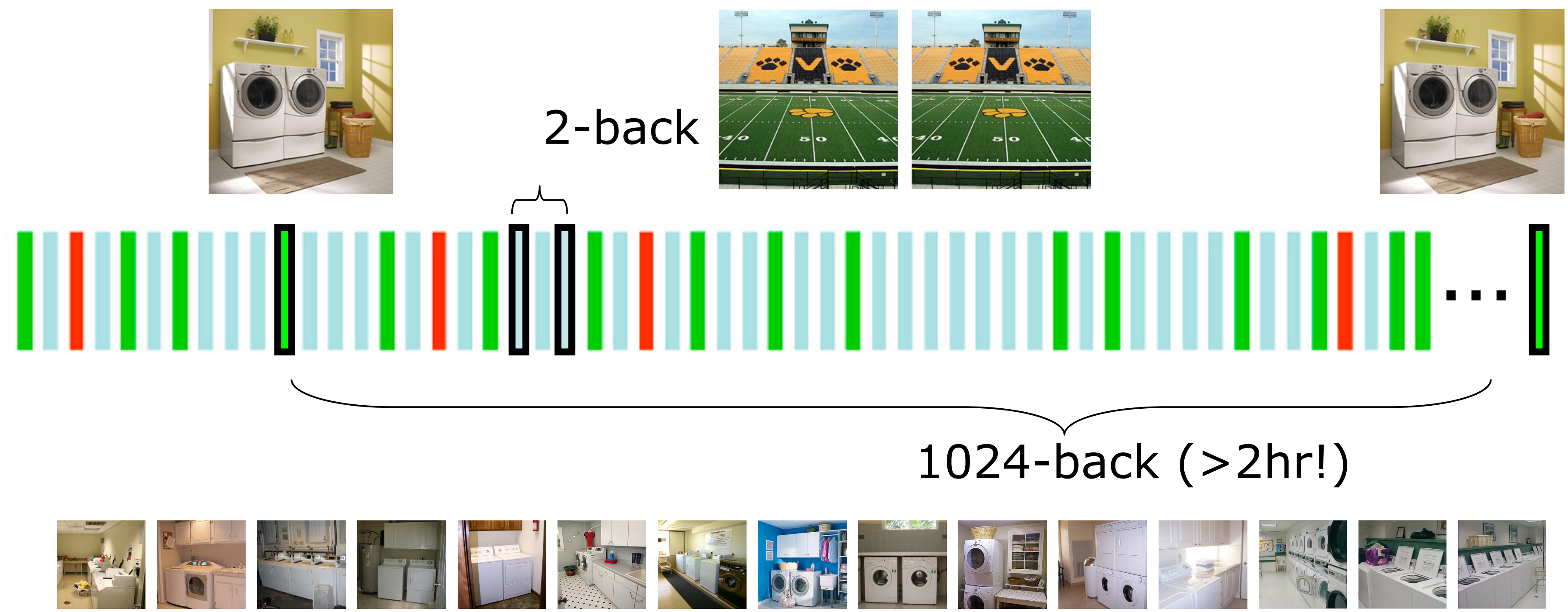
Methods – The Study Stream

Online Task: **Detect Exact Repeats**

Repeats could be 2 to 1024 back in the stream

Repeats could be from categories with 4, 16, or 64 exemplars

7% of images in the stream were repeats (192 / 2912)



Methods – The Memory Test

Followed by 224 **2-alternative forced choice tests**

Novel

Exemplar

None of the tested categories were n-backed

Test Pairs were always the same for all subjects

Any effect of interference is due to the additional exemplars

Objects & Scenes: Is it fair to compare?

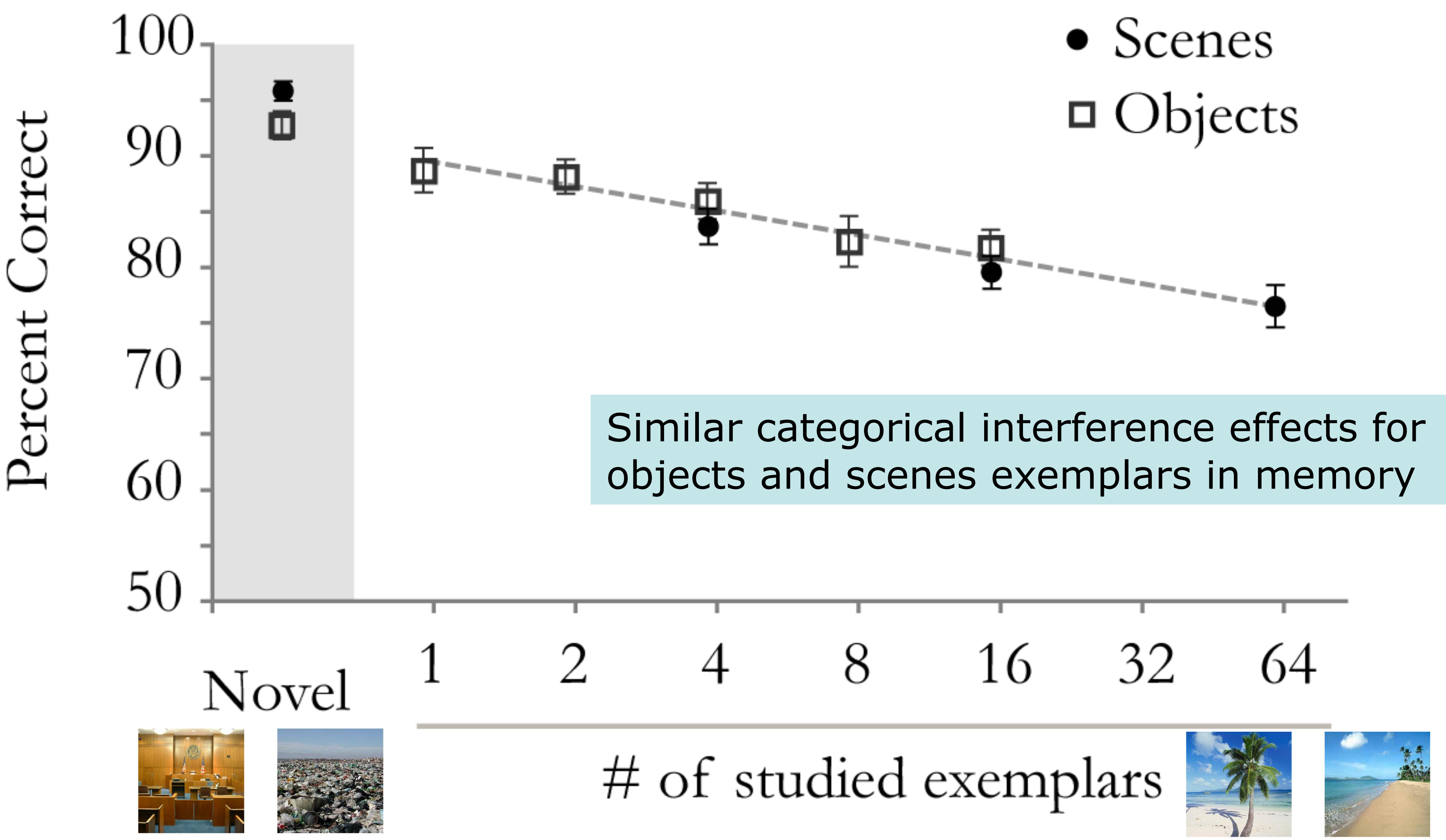




You can make each test item and foil **arbitrarily hard**

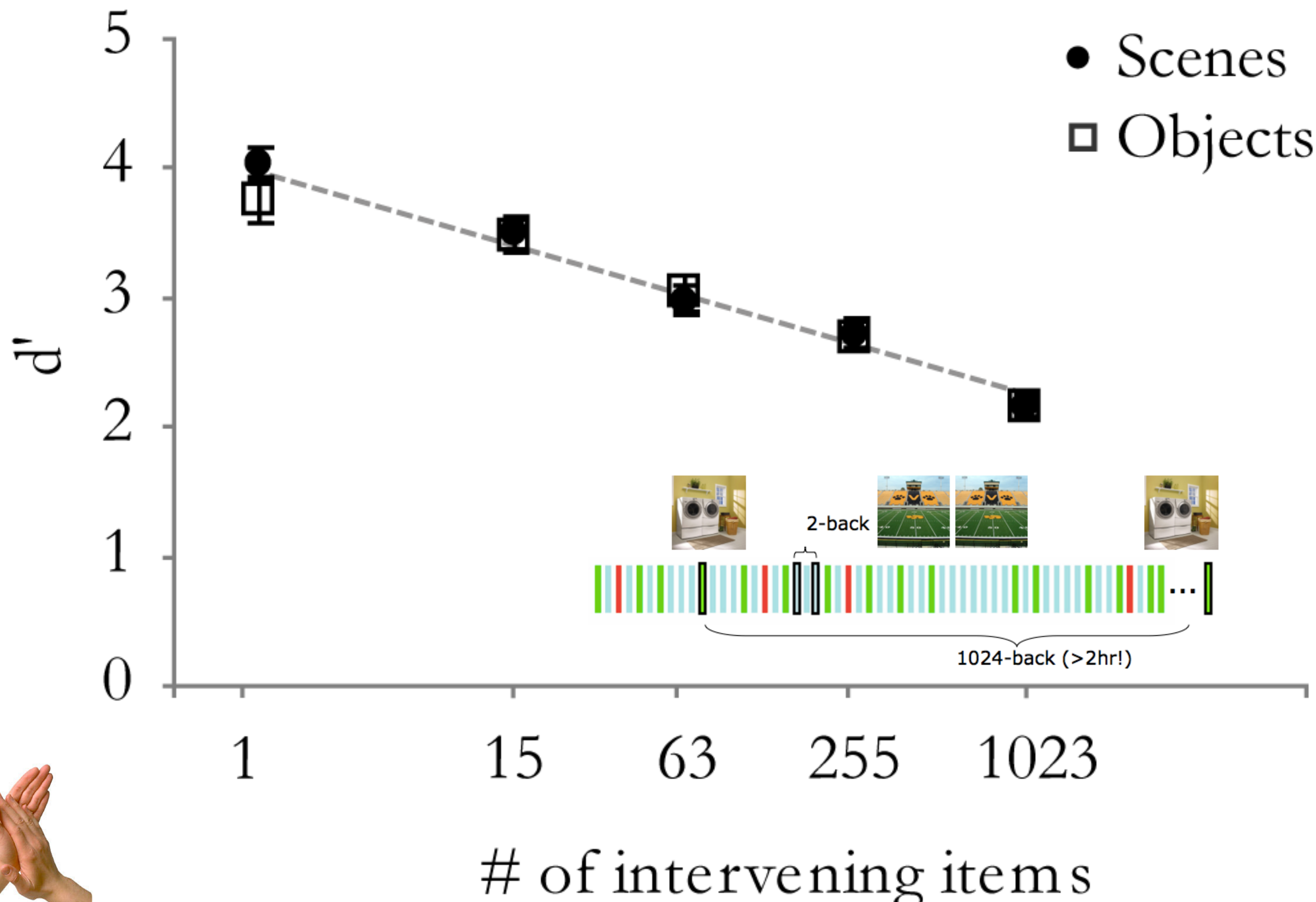
We tried to span the categories with our exemplars and sampled the test item and foil uniformly

Recognition Memory Comparison

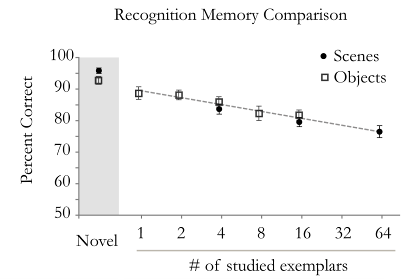


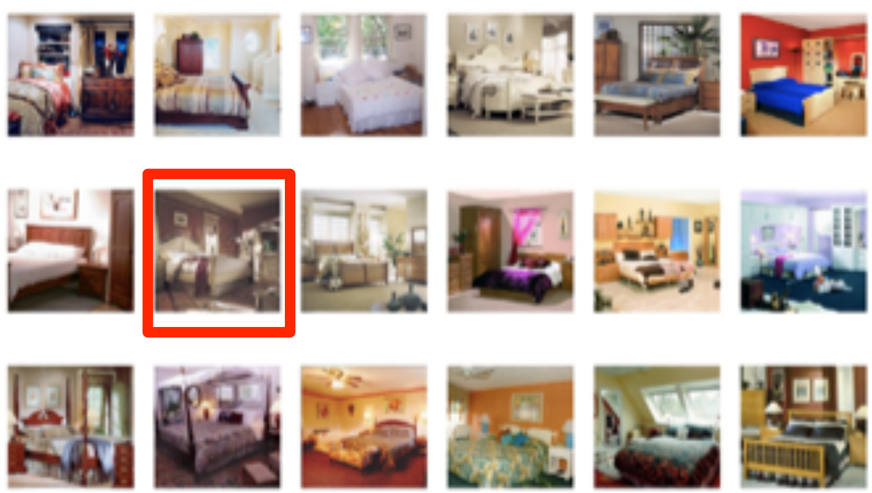
Konkle, Brady, et al. (2010), *J. Exp. Psychology: General* Konkle, al. (2010), *Psychological Science*

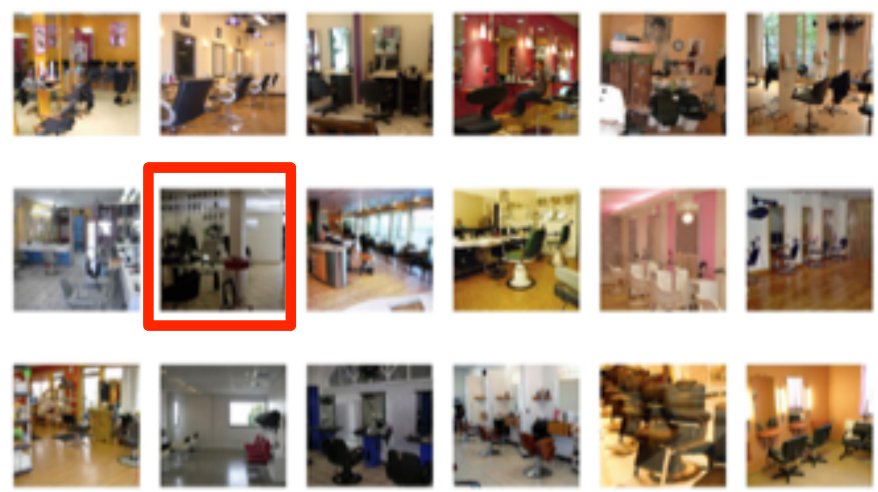
Repetition Detection Comparison



Scene and object categories may be treated as entities at a similar level of abstraction in human long term memory







Human Memory: Summary

Massive Memory I

Visual LTM can store a large number of items

with <u>surprising fidelity</u>

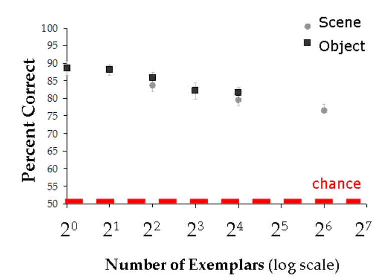
PNAS 2008

Massive Memory II & III

High memory for object and scene exemplars despite visual interference

JEP:G 2010

Scene and object exemplars are on average equally well remembered in long term memory



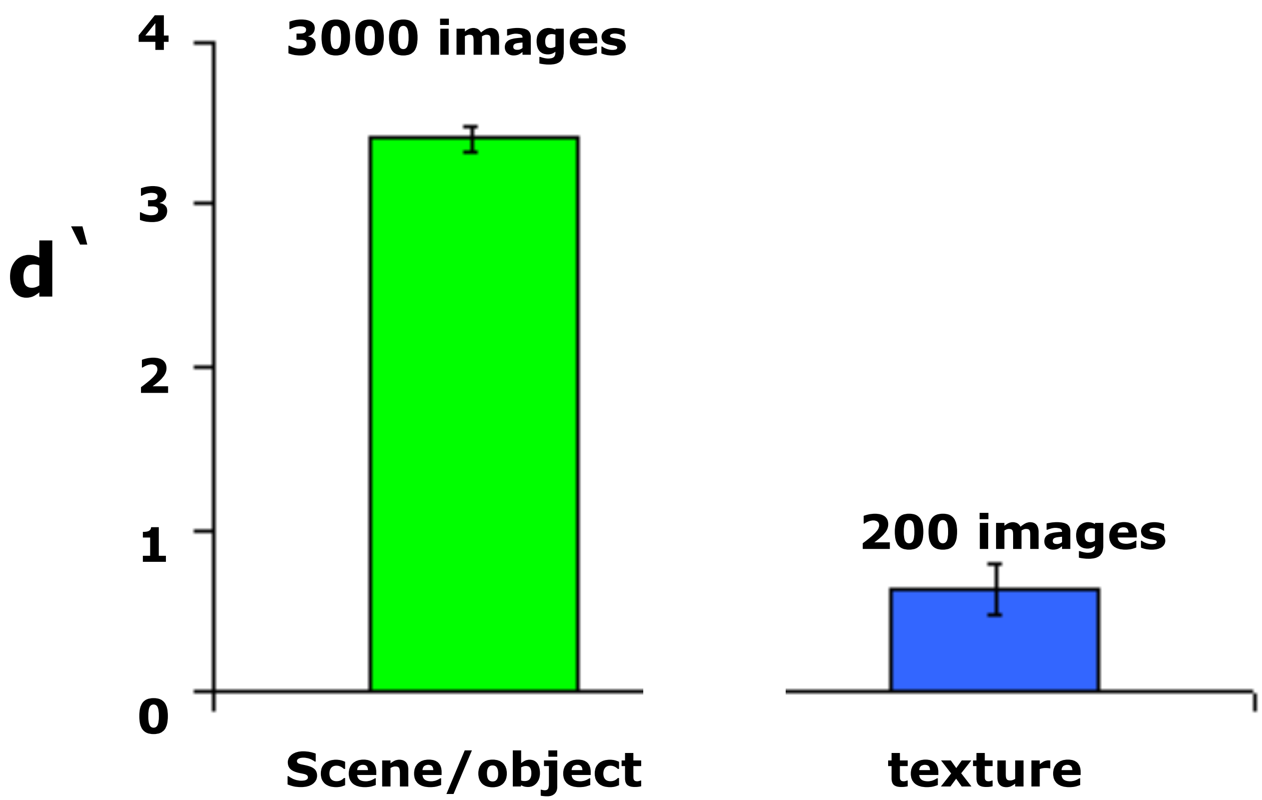
Psych Science 2010

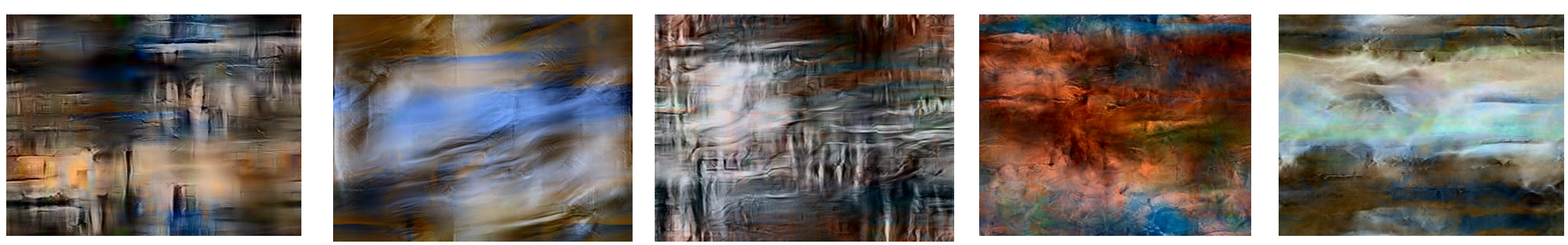
Timothy Brady

Talia Konkle

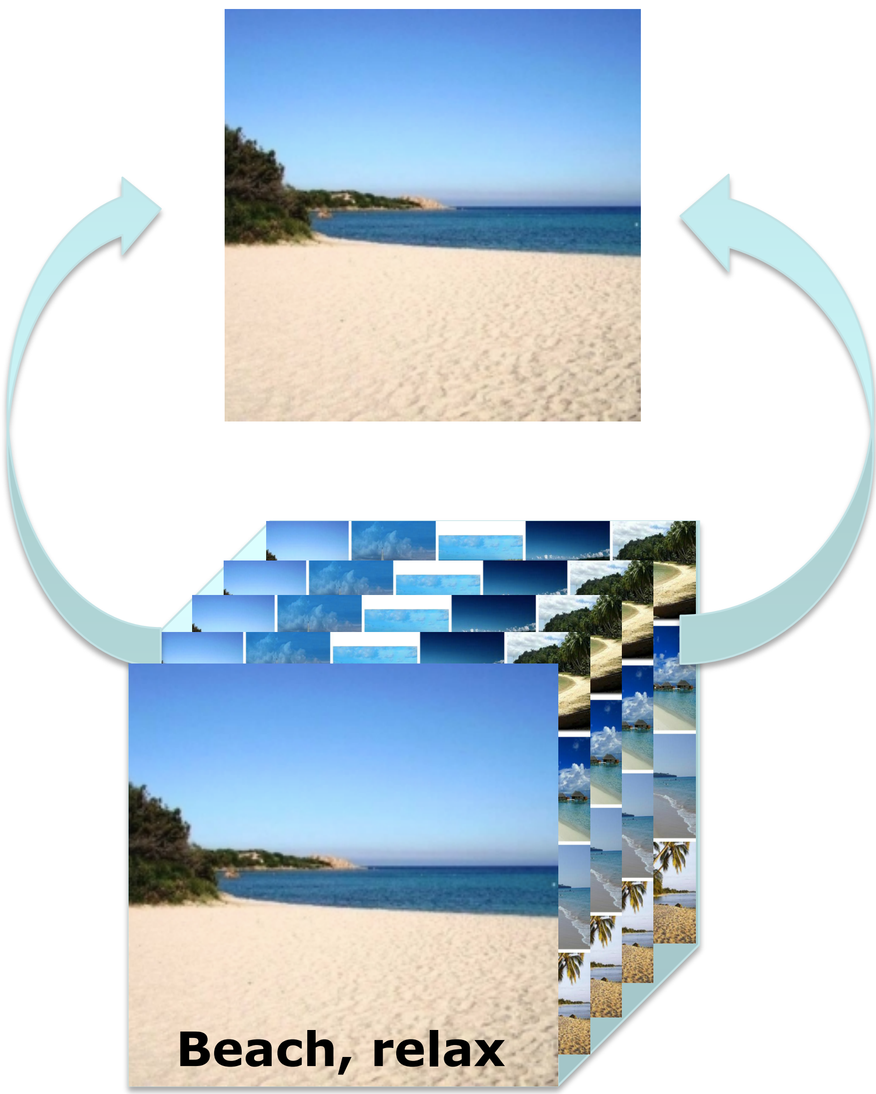
George Alvarez

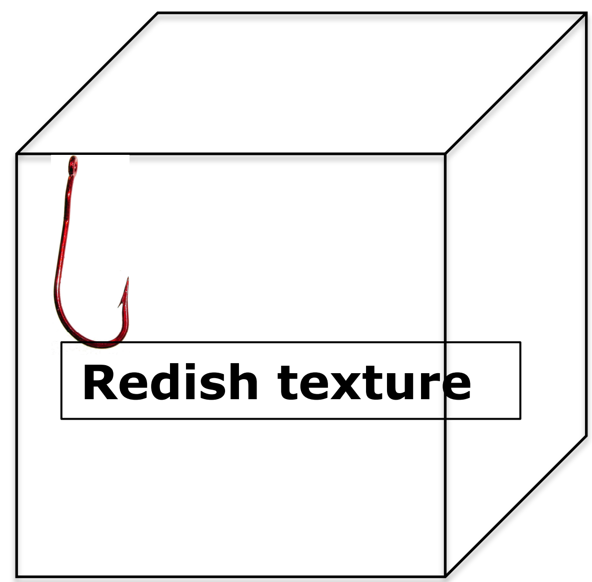
Recognition is Reconstruction from Memory



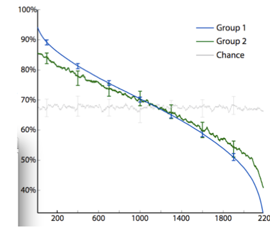
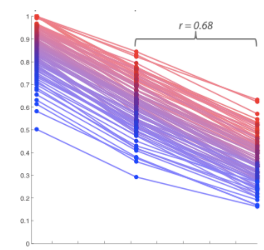


Recognition is Re-collection & Re-construction from Memory





Predicting Memorability

Human Memory	High capacity and visual details fidelity for exemplars of known categories/concepts	
Memory Game I	Is memorability consistency across different observers?	
Memory Game II	How does memorability evolve over time?	
Computer Vision	Can computer vision methods predict memorability?	
Memory Game III, IV, V …	Is memorability a general property of information?	

Welcome to the

Visual Memory Game

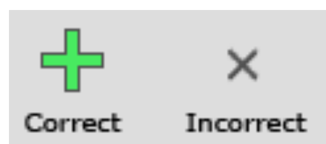
A stream of images will be presented on the screen for 1 second each.

Your task:

Clap your hands (press a key) anytime you see an image you saw before.

Be attentive, repeats may be separated by many images !

Whenever you press a key, you will get feedback:



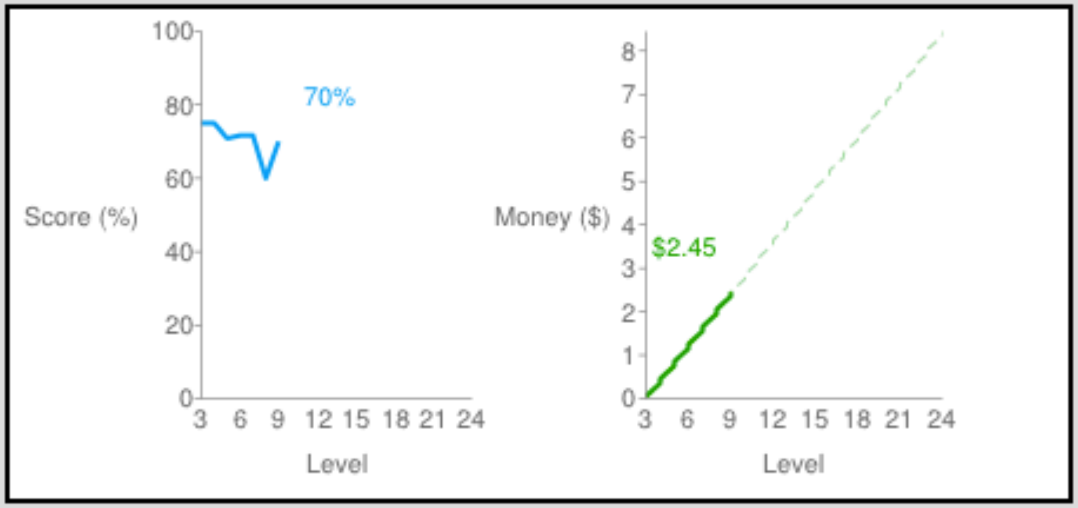
You may exit the game at any time and you will be paid in proportion to your progress at that time

Start Game!

Level 9 out of 30 complete!

Rest time remaining: 4:39

(game will automatically end if you do not press 'Start next level' before rest time is up)



Start next level!

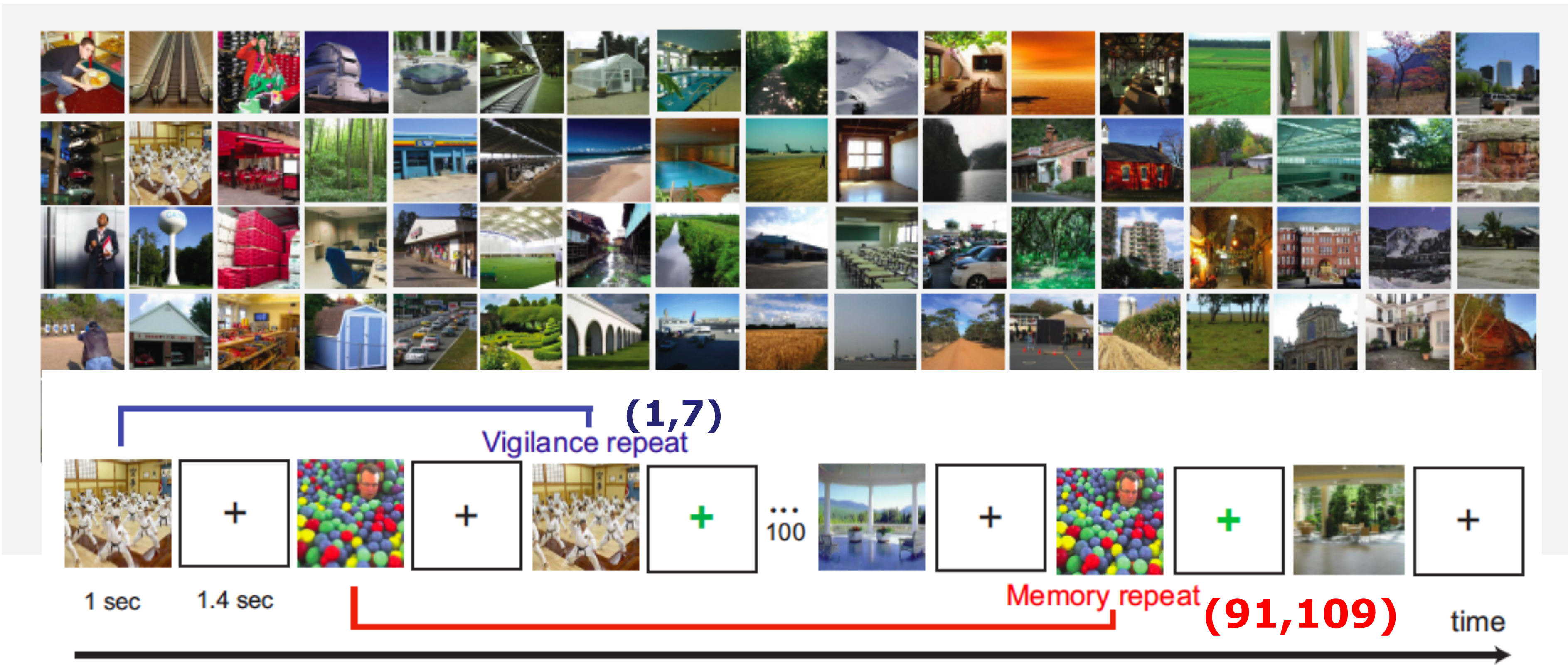
Exit Game


Sce
gories:
Krista
Ehinger
7 APR 2007
Xiao et al (2010), CVPR;   Ehinger et al (2011)

SUN database
280,000
210,000
140,000
70,000
0
Date
131072 Images
908 Scene categories
249522 Segmented objects
3819 Object categories
Benchmark
Scenes index
Objects index
Download
MIT CSAIL
Scene categories(908) hierarchy
Abbey (495)
Access road (47)
Air base (16)
Airfield (38)
Airlock (54)
Airplane cabin (116)
Airport airport (77)
Airport entrance (40)
Airport terminal (1152)
Airport ticket counter (82)
Alcove (66)
Alley (328)
Amphitheater (328)
Amusement arcade (229)
Amusement park (770)
Anechoic chamber (251)
Apartment building outdoor (535)
Apse indoor (169)
Apse outdoor (75)
Aquarium (177)
Aquatic theater (59)
Object categories(3819)
Wall (20213)
Window (16080)
Chair (7971)
Floor (7227)
Sky (6328)
Ceiling lamp (6268)
Person (6202)
Building (6043)
Trees (5785)
Ceiling (5284)
Tree (4956)
Car (4240)
Door (4135)
Cabinet (3102)
Plant (3095)
Table (2999)
Painting (2784)
Person sitting (2696)
Curtain (2525)
Abbey 495 images 35 annotated 561 objects
Access road 47 images 27 annotated 513 objects
Air base 16 images 10 annotated 150 objects
Airfield 38 images 10 annotated 85 objects
Airlock 54 images 10 annotated 114 objects
Airplane cabin 116 images 11 annotated 258 objects
Airport airport 77 images 14 annotated 227 objects
Airport entrance 40 images 12 annotated 213 objects
Airport terminal 1152 images 99 annotated 1675 objects
Airport ticket counter 82 images 11 annotated 168 objects
Alcove 66 images 29 annotated 433 objects
Alley 328 images 77 annotated 1032 objects
Amphitheater 328 images 22 annotated 389 objects
Amusement arcade 229 images 25 annotated 340 objects
Amusement park 770 images 22 annotated 179 objects
Anechoic chamber 251 images 15 annotated 102 objects
Apartment building outdoor 535 images 77 annotated 2076 objects
Apse indoor 169 images 12 annotated 133 objects
Apse outdoor 75 images 11 annotated 95 objects
Aquarium 177 images 14 annotated 160 objects
Aquatic theater 59 images 10 annotated 294 objects
Aqueduct 369 images 19 annotated 208 objects
Arcade 5 images 5 annotated 142 objects
Arch 221 images 15 annotated 152 objects
Archaelogical excavation 26 images 10 annotated 153 objects
Archive 149 images 10 annotated 158 objects
Arena basketball 36 images 6 annotated 97 objects
Arena football 5 images 5 annotated 75 objects
Arena hockey 40 images 4 annotated 65 objects
Arena performance 22 images 1 annotated 29 objects
Arena rodeo 2 images 2 annotated 73 objects
Arena soccer 13 images 2 annotated 12 objects
Armory 61 images 5 annotated 55 objects
Army base 9 images 3 annotated 59 objects
Arrival gate indoor 11 images 4 annotated 66 objects
Arrival gate outdoor 170 images 36 annotated 586 objects
Art gallery 297 images 51 annotated 880 objects
Art school 141 images 14 annotated 192 objects
Art studio 314 images 71 annotated 1149 objects
Artists loft 55 images 12 annotated 154 objects
Assembly line 169 images 12 annotated 223 objects
Athletic field indoor 11 images 7 annotated 134 objects
Athletic field outdoor 119 images 6 annotated 73 objects
Atrium home 20 images 8 annotated 156 objects
Atrium public 131 images 13 annotated 303 objects
Attic 375 images 48 annotated 779 objects
Auditorium 346 images 36 annotated 841 objects
Auto factory 265 images 16 annotated 209 objects
Auto mechanics indoor 45 images 10 annotated 109 objects
Auto mechanics outdoor 17 images 8 annotated 121 objects
Auto racing paddock 63 images 4 annotated 89 objects
Auto showroom 52 images 6 annotated 138 objects
Backstage 20 images 4 annotated 49 objects
Backstairs 18 images 10 annotated 113 objects
Badlands 467 images 13 annotated 53 objects
Badminton court indoor 220 images 14 annotated 199 objects

Visual Memory Game

Phillip Isola



- Continuous repeat detection task
- ~ **10,000** unique images sampled from 900 scene categories (Standing, 1973; Brady et al., 2008)
- **2222** target images (memory repeats) whose repeats occurred ~ 91-109 after the first presentation

- Vigilance repeats every 1-7 images
- Each game level has 120 images
- N= 650 AMT workers
- ~ 80 scores per target images

Isola et al (2011). *IEEE Proc. Computer Vision & Pattern Recognition (CVPR)*

Large difference in image memorability

Memorable
~ 90%

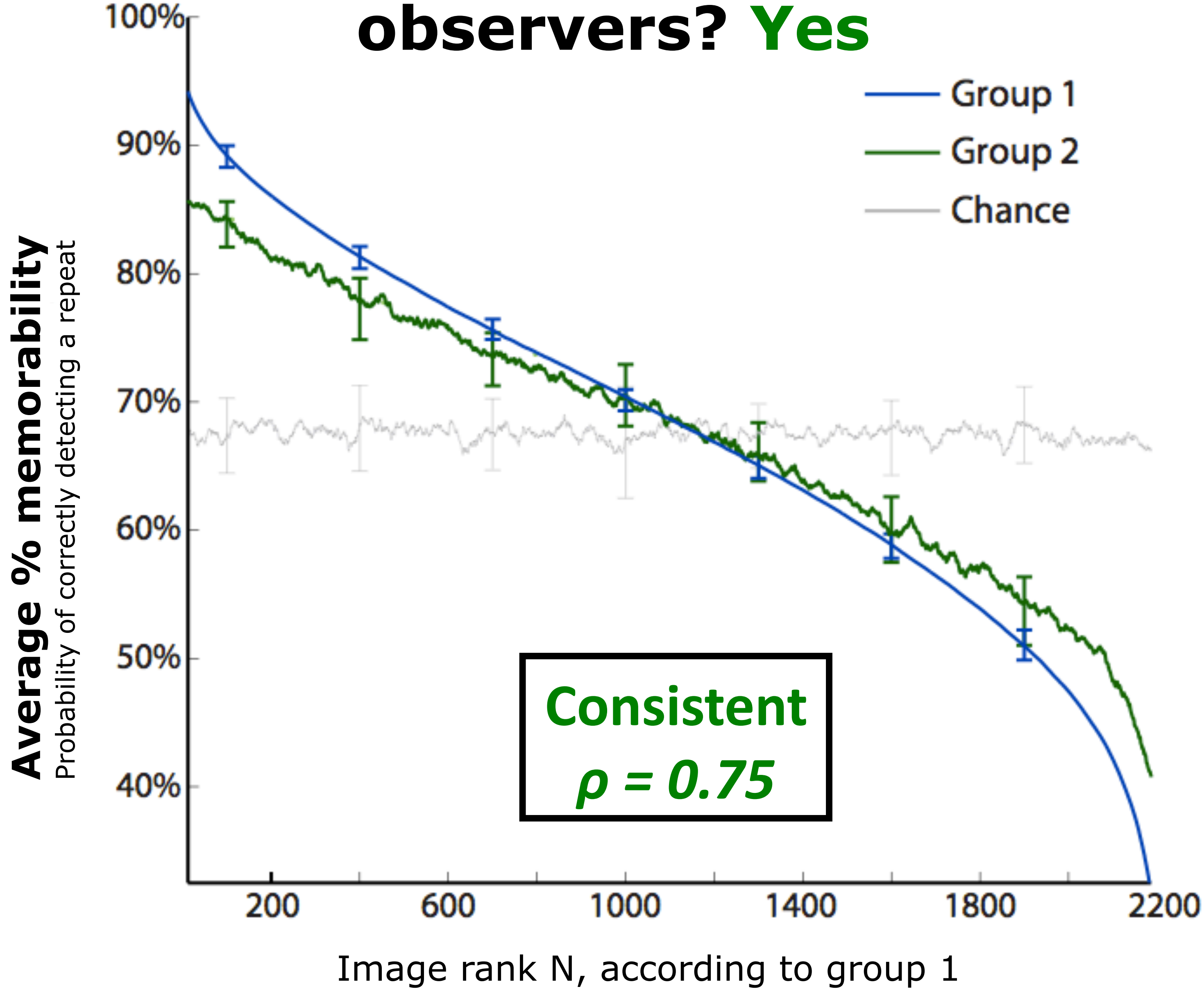
Average
~ 67%

Forgettable
~40%

Mean HIT rate: 67.5% SD: 13.5%
Mean False alarm rate: 10.7% SD: 7.6%

2222 target images

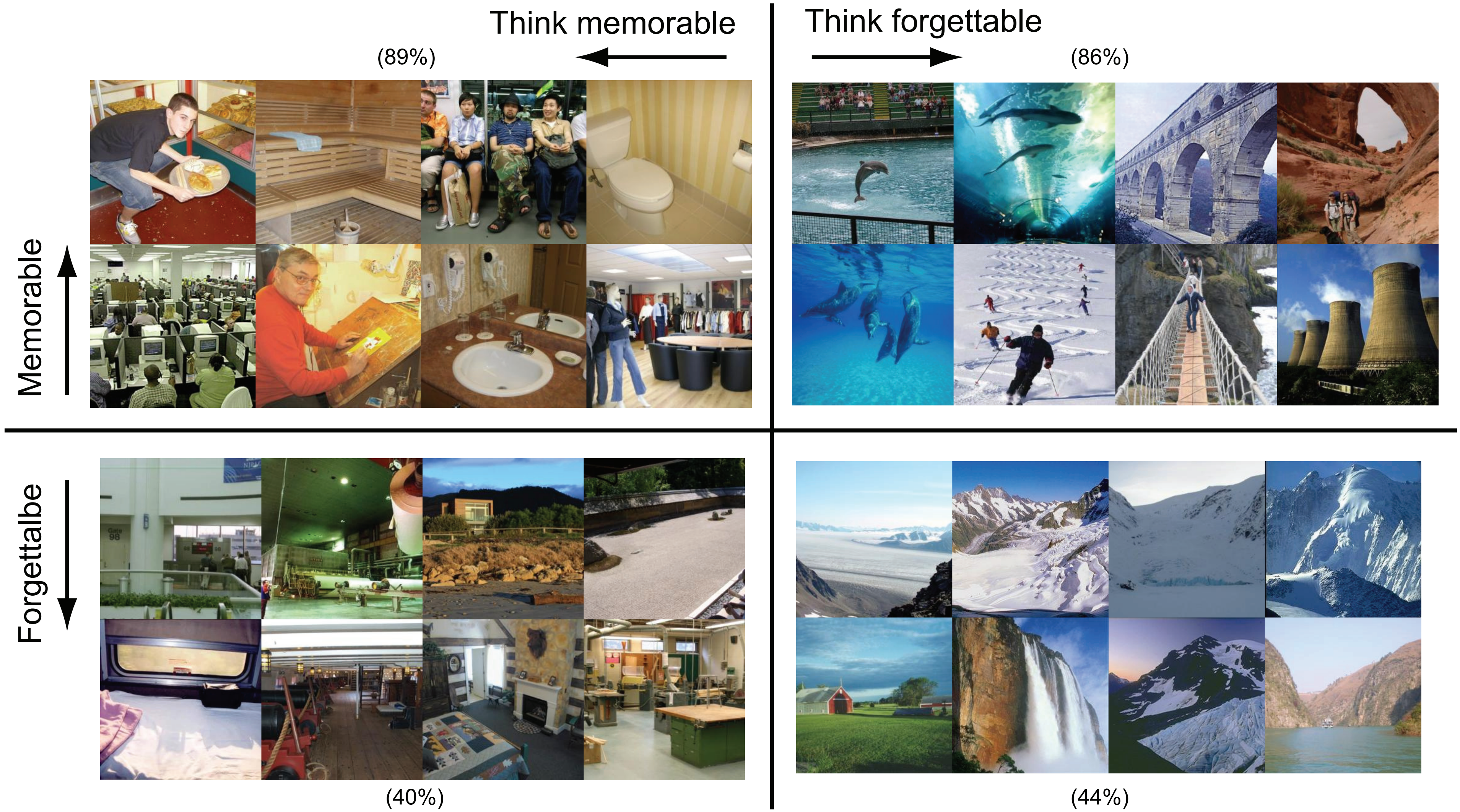
Is memorability consistent across different observers? Yes



chance level rank calculated by randomly ordering the images on the x-axis

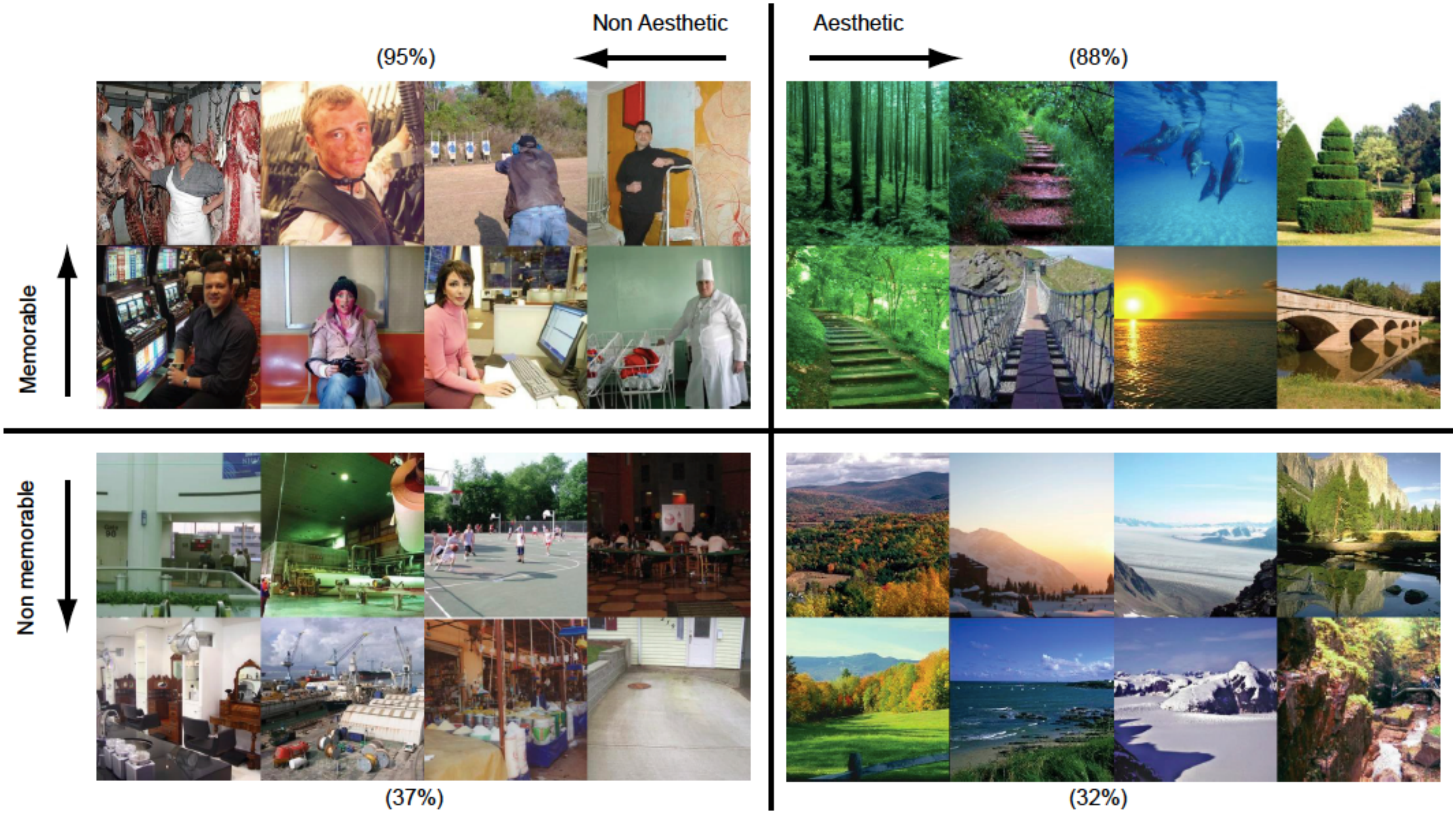
~ 80 scores per image

Subjective judgments do not predict image memorability



Isola et al (2011). *Neural Information Processing Systems (NIPS)*

Image memorability is distinct from image aesthetic



Isola et al (2011). *Neural Information Processing Systems (NIPS)*

Aesthetic judgments

a) most aesthetic

b) least aesthetic

Interestingness judgments

a) most interesting

b) least interesting

Predicting Memorability

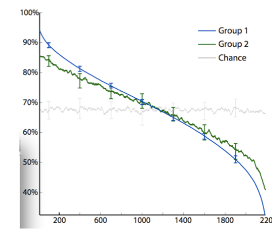
Human Memory

High capacity and visual details fidelity

for exemplars of known categories/concepts

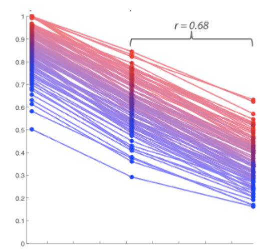
Memory Game I

High consistency across observers. Memorability is a singular attribute



Memory Game II

How does memorability evolve over time?



Computer Vision

Can computer vision methods

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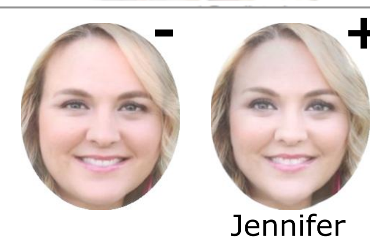
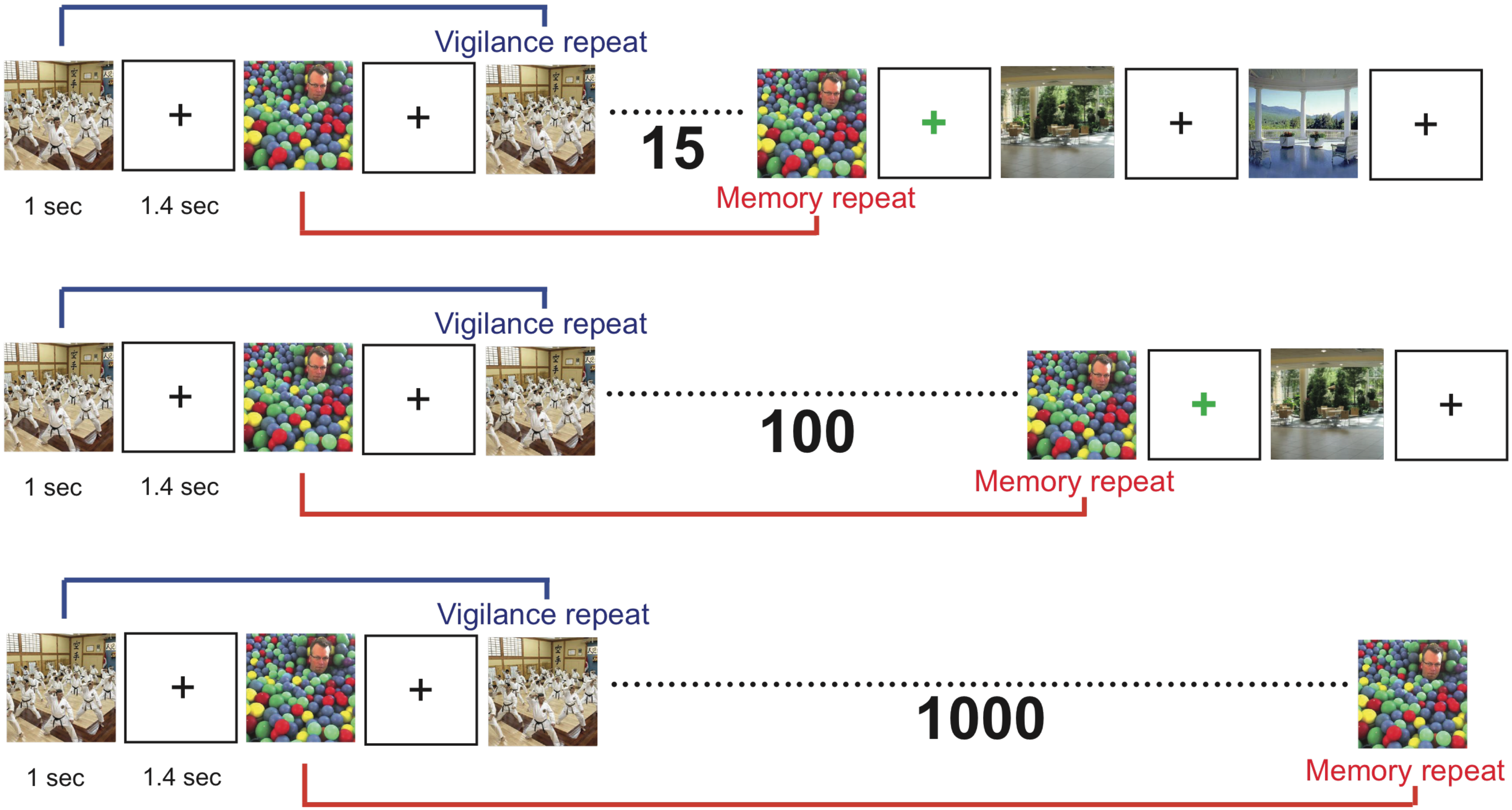
Memory Game III, IV, V …

Is memorability a general property

of information?

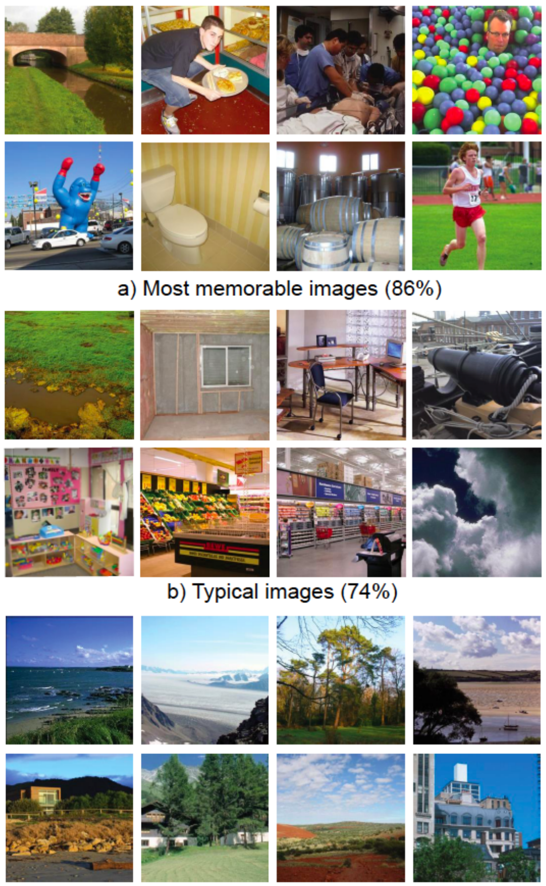


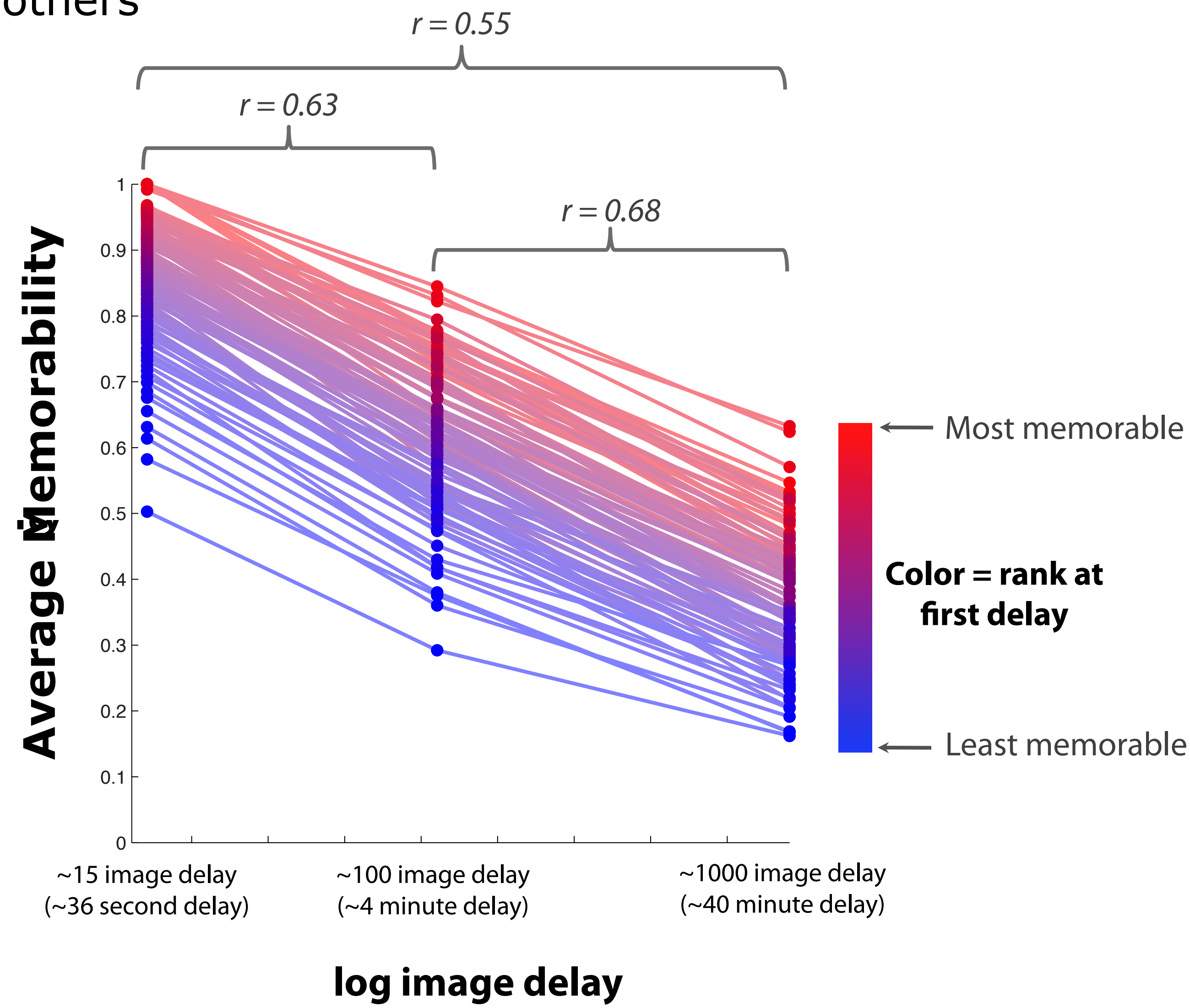
Is memorability stable across time?



When do memorability differences arise?

At stage of encoding: Some images (features) are encoded in less sufficient detail than others


a) Most memorable images (86%)
b) Typical images (74%)
c) Least memorable images (34%)



Isola et al. (submitted).

Intrinsic memorability

Stable characteristic of image across observer, randomized sequence, and time delay.

Sizeable differences between different images.

Memorability differences arise at the **perceptual encoding stage:** Some images (features) are encoded in less sufficient details than others <u>at the first glance</u>

→ May tell us about what visual information is deemed important by our recognition system !

Predicting Memorability

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High capacity and visual details fidelity

for exemplars of known categories/concepts

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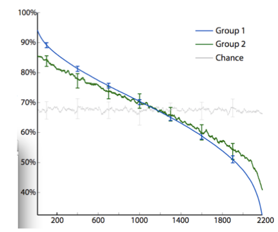
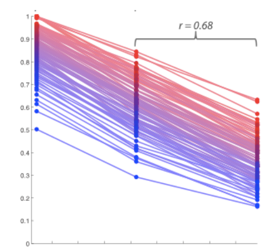
High consistency across observers.
Memorability is a singular attribute



Memory Game II

Memorability ranks are conserved

across time



Computer Vision

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Jennifer

Which feature types predict memorability?

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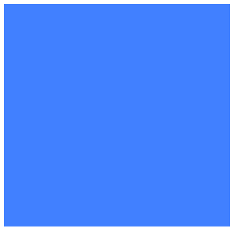


1) Simple scalar stats?

brightness, number of objects, mean hue

"Aquarium"

2) Scene category?

e.g. Aquarium, broadleaf forest, art studio

3) Object content?

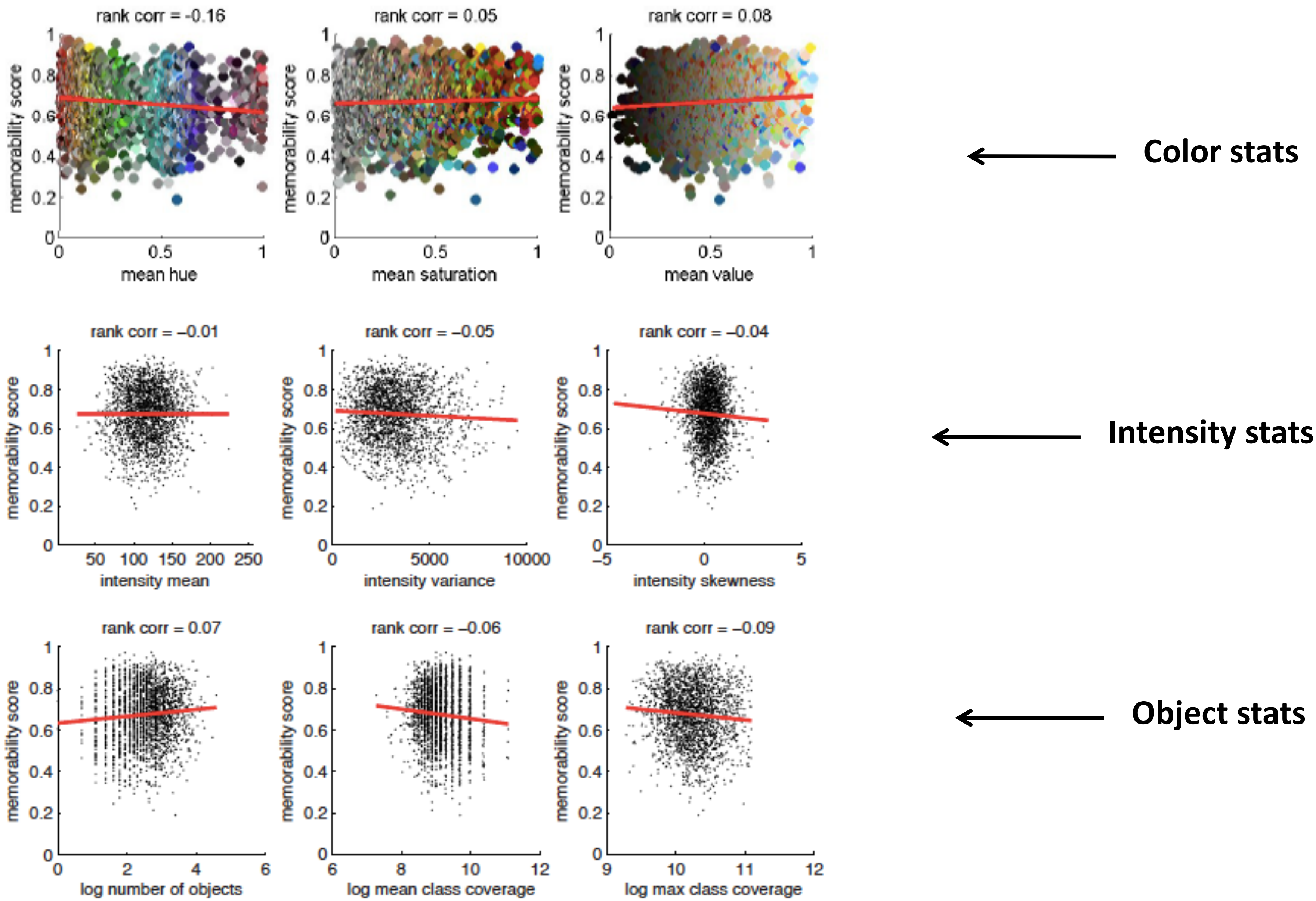
number, size, and rough position of each object class

"Funny, peaceful, eye contact"

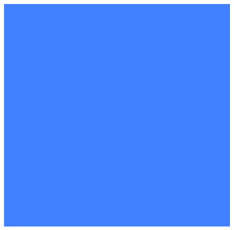
4) Attributes?

actions, emotions, focus, subjective properties

Simple, scalar summary statistics do not correlate well with memorability



Which features types predict memorability?



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brightness, number of objects, mean hue

$\rho < 0.16$

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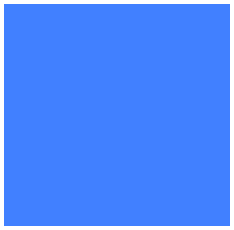
Scene features

→ “aquarium”

Categories from Xiao et al. CVPR, 2010

Which features types predict memorability?



1) Simple scalar stats?

brightness, number of objects, mean hue

ρ < 0.16

"Aquarium"

2) Scene category?

e.g. Aquarium, broadleaf forest, art studio

ρ = 0.37

3) Object content?

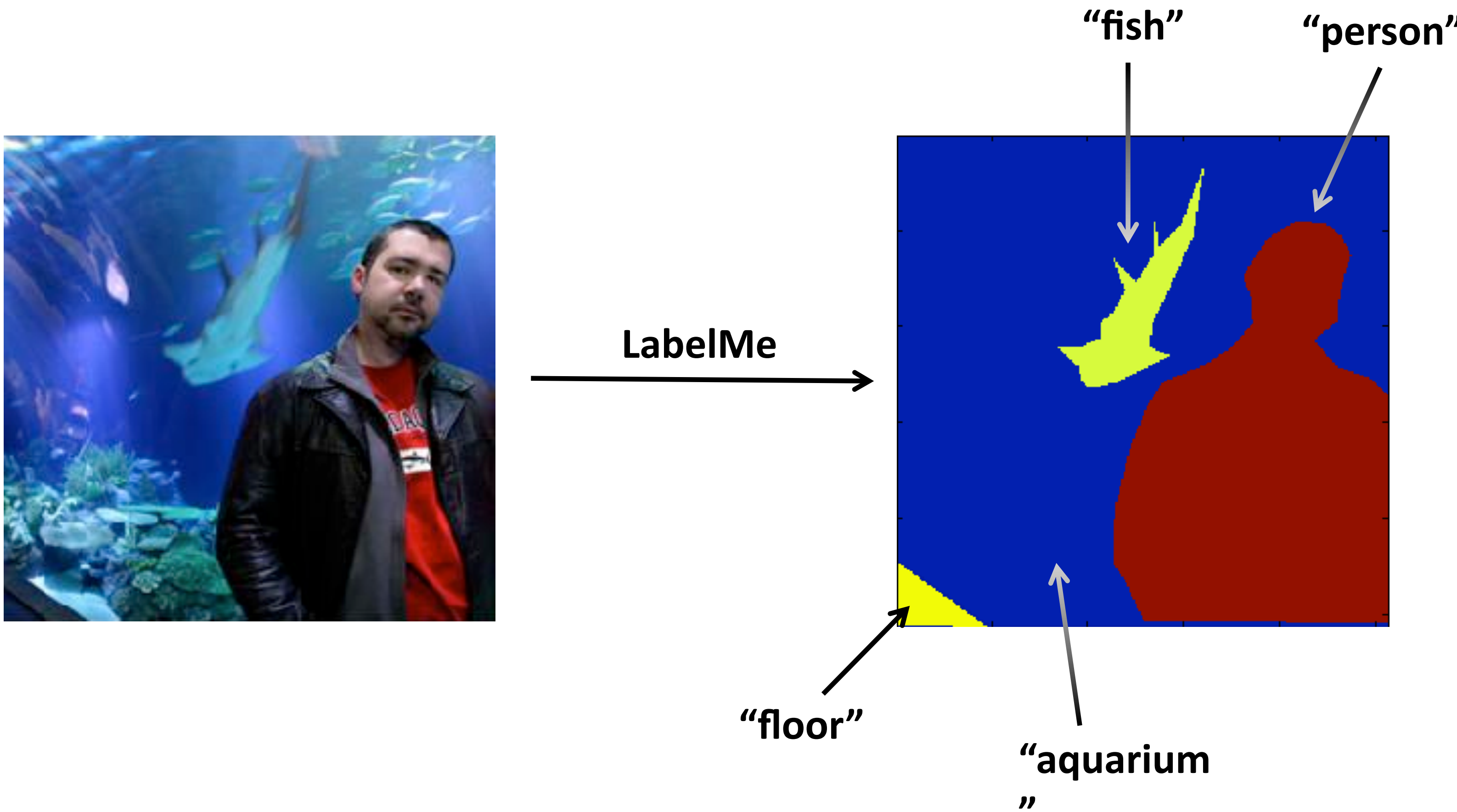
number, size, and rough position of each object class

"Funny, peaceful, eye contact"

4) Attributes?

actions, emotions, focus, subjective properties

Object features



Segmentations from Choi et al. CVPR, 2010

Segmentation statistics

Object counts

“the image contains 4 object classes with 1 appearance each"

ρ = 0.05

Object areas

“the image contains 1 object class that covers 40898 pixels, 1 object class that covers 21041 pixels, …"

ρ = 0.05

Multiscale object areas

“in the first quadrant, the image contains 1 object class that covers 12000 pixels, …"

ρ = 0.20

Sensitive to coarse position! (can tell difference between sky and close up face.)

Object semantics

Just a bag of words

Object label presences

“the image contains the object classes person, aquarium, fish, and floor"

ρ = 0.43

Labeled object counts

“the image contains 1 person, 1 aquarium, …"

ρ = 0.44

Labeled object areas

“the image contains persons covering 40898 pixels, aquarium covering 21041 pixels, …"

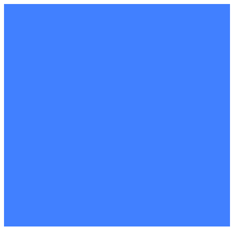
ρ = 0.47

Labeled multiscale object areas

“in the first quadrant, aquarium covers 12000 pixels and fish covers 4000 pixels, …"

ρ = 0.48

Which features types predict memorability?



1) Simple scalar stats?

brightness, number of objects, mean hue

$\rho < 0.16$

"Aquarium"

2) Scene category?

e.g. Aquarium, broadleaf forest, art studio

$\rho = 0.37$

3) Object content?

number, size, and rough position of each object class

$\rho = 0.48$

"Funny, peaceful, eye contact"

4) Attributes?

actions, emotions, focus, subjective properties

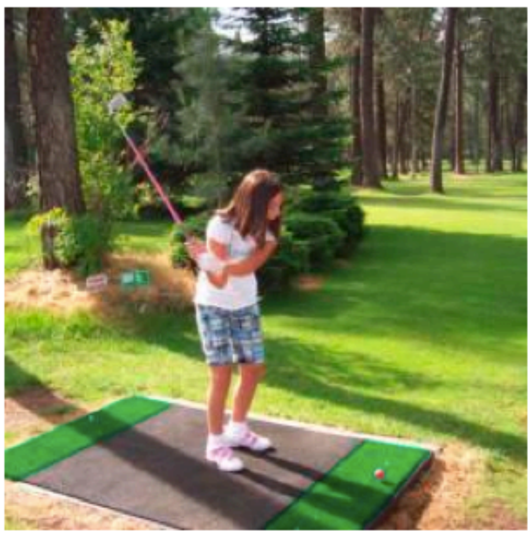
Attributes

Devi Parikh

Image rating

Please rate the image on the properties listed on the right.

Please provide a rating for ALL properties as accurately as possible.



Spatial layout:

Small / enclosed space ◯ ◯ ◯ ◯ ◯ Large / open space
Perspective view ◯ ◯ ◯ ◯ ◯ Flat view
Empty space ◯ ◯ ◯ ◯ ◯ Cluttered space
Mirror symmetry (about central-vertical line) ◯ ◯ ◯ ◯ ◯ No symmetry

Aesthetic:

Pleasant scene ◯ ◯ ◯ ◯ ◯ Unpleasant scene
Unusual / strange scene ◯ ◯ ◯ ◯ ◯ Routine / mundane scene
Dull colors ◯ ◯ ◯ ◯ ◯ Bright colors
Expert photography ◯ ◯ ◯ ◯ ◯ Poor photography

Content:

Clear Sky ◯ ◯ ◯ ◯ ◯ Cloudy sky
Blue sky ◯ ◯ ◯ ◯ ◯ Sunset sky
Photograph of one main object ◯ ◯ ◯ ◯ ◯ Photograph of whole scene
Zoomed into a scene or object ◯ ◯ ◯ ◯ ◯ Wide view
Top down view of scene or object ◯ ◯ ◯ ◯ ◯ Side view

Phillip Isola

~ 100 Attributes

Devi Parikh

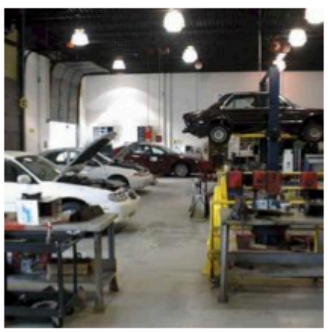
(a) ↑attractive

(b) ↑funny

(c) ↑makes-sad

(d) ↑qual. photo

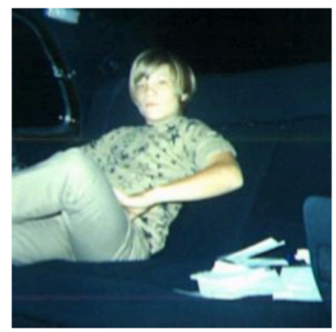
(e) ↑peaceful



(f) ↓attractive

(g) ↓funny

(h) ↓makes-sad



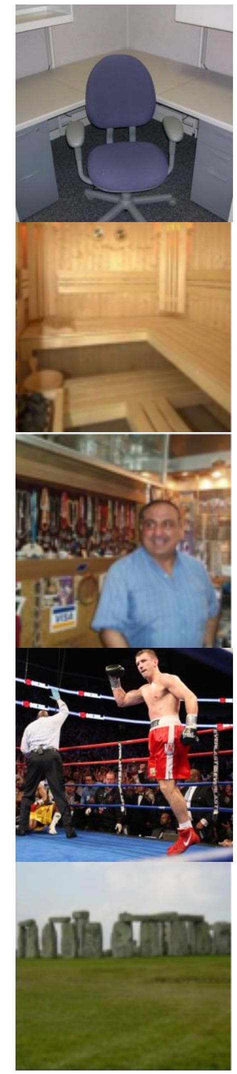
(i) ↓qual. photo

(j) ↓peaceful

Isola, Parikh, Torralba, and Oliva, NIPS 2011

What are the attributes of picture memorability?

- **Focus**: single subject/object, close up
- **Setting**: enclosed space, indoors
- **Subject**: people, faces, emotions, interactive and animate objects
- **Dynamics**: active, moving scenes
- **Other**: famous places, unusual scenes



Isola, Parikh, Torralba, and Oliva, NIPS 2011

Which features types predict memorability?

1) Simple scalar stats?

brightness, number of objects, mean hue

$\rho < 0.16$

“Aquarium”

2) Scene category?

e.g. Aquarium, broadleaf forest, art studio

$\rho = 0.37$

3) Object content?

number, size, and rough position of each object class

$\rho = 0.48$

“Funny, peaceful, eye contact”

4) Attributes?

actions, emotions, focus, subjective properties

$\rho = 0.51$

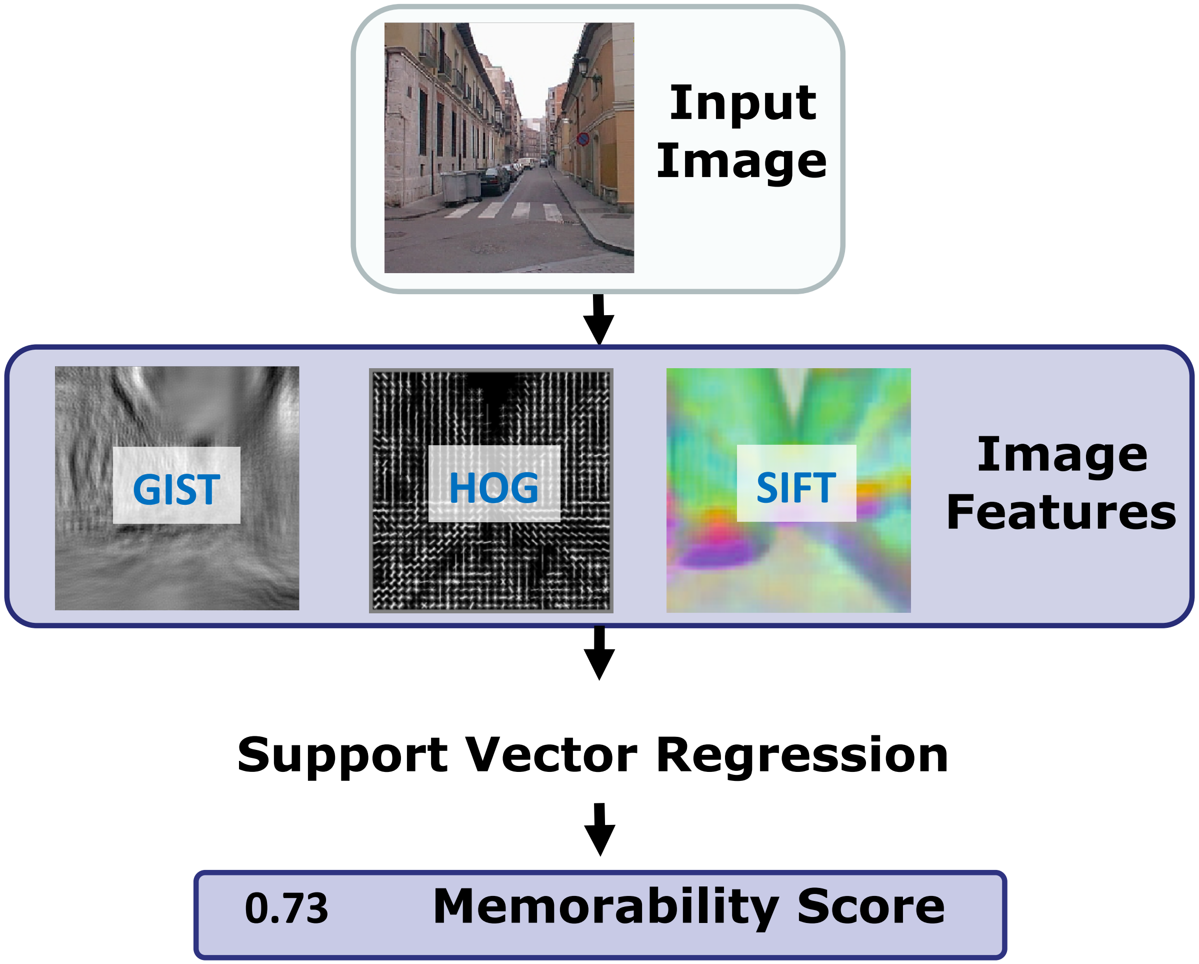
Human consistency: $\rho = 0.75$

Phillip Isola

Can we estimate memorability?

Jianxiong Xiao

Aditya Khosla

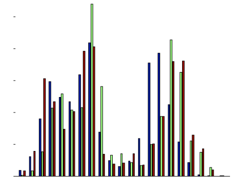


The result of the regression will be a function that will take as input the features of an image and will output an estimate of the image memorability. Trained on one half of images, one half of subjects, Tested on left out half of images, left out half of subjects, Non-linear kernels

Global image features

Simple baseline. Distribution of intensities and colors.

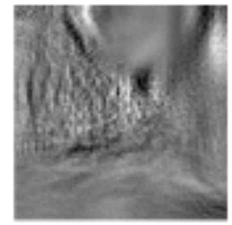
Pixel histograms



ρ = 0.22

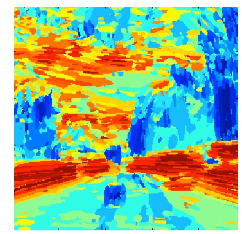
Local multiscale gradients.

GIST
Gist



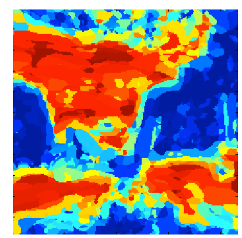
ρ = 0.38

SIFT
Scale-invariant feature transform



ρ = 0.41

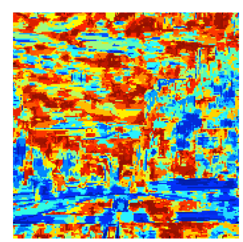
HOG
Histogram of oriented gradients



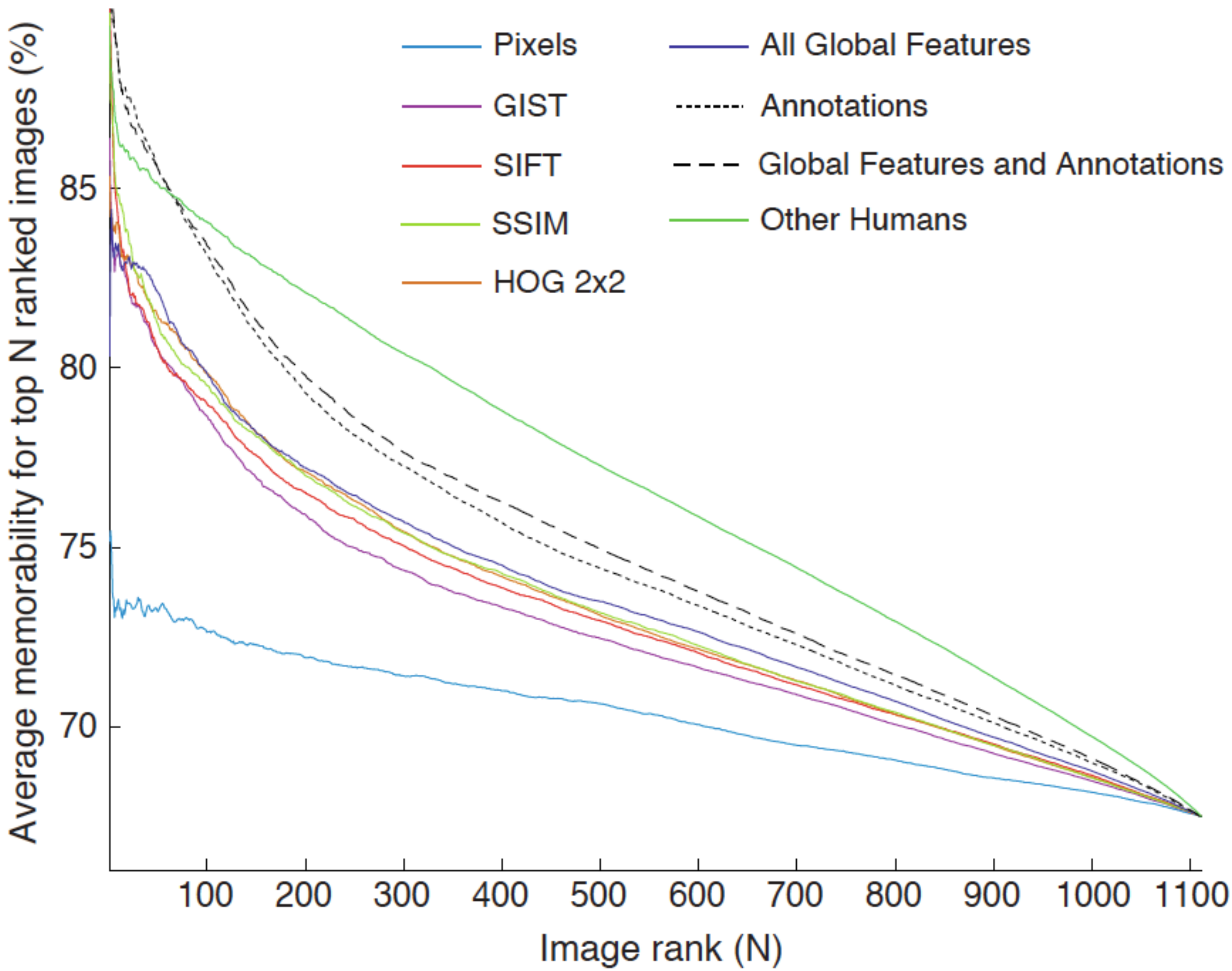
ρ = 0.43

How similar is each part of image to every other part of image?

SSIM
Self-similarity



ρ = 0.43


Pixels
GIST
SIFT
SSIM
HOG 2x2
All Global Features
Annotations
Global Features and Annotations
Other Humans
Average memorability for top N ranked images (%)
85
80
75
70
100
200
300
400
500
600
700
800
900
1000
1100
Image rank (N)

Human consistency

$\rho = 0.75$

a) Most memorable images (86%)

b) Typical images (74%)

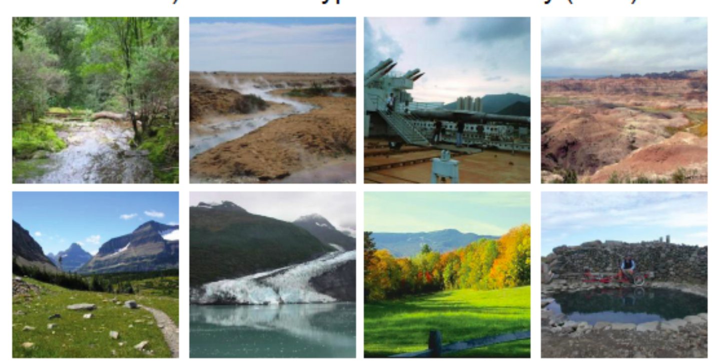
c) Least memorable images (34%)

Prediction by global features

$\rho = 0.46$

a) Predicted most memorable (87%)

b) Predicted typical memorability (68%)



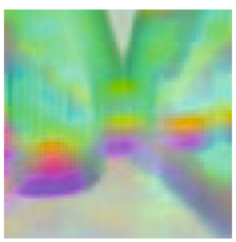
c) Predicted least memorable (52%)

Can we estimate image memorability?

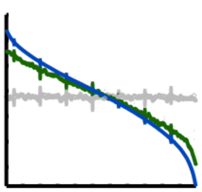
0) Human guessing?
asking people how memorable an image is
ρ = -0.02

1) Simple scalar stats?
color, brightness, number of objects, mean hue
ρ < 0.16

2) Object content?
number, size, and rough position of each object class
ρ = 0.48



3) Computer Model?
SIFT, HOG, GIST and SSIM
ρ = 0.46
0.50



4) Human objective estimation?
consistency across human subjects in memory game
ρ = 0.75

Isola et al (2011). *IEEE Proc. Computer Vision & Pattern Recognition (CVPR); (in revision), PAMI*

Predicting Memorability

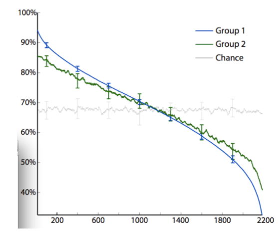
Human Memory

High capacity and visual details fidelity

for exemplars of known categories/concepts

Memory Game I

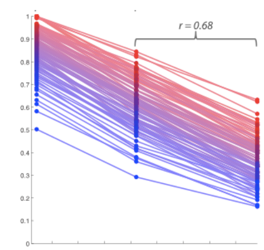
High consistency across observers.
Memorability is a singular attribute



Memory Game II

Memorability ranks are conserved

across time



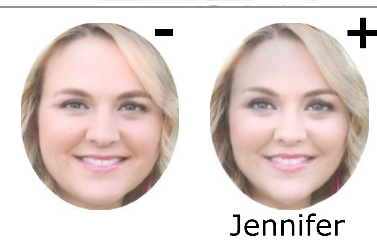
Computer Vision

State of the art computer vision
features can predict memorability

Memory Game III, IV, V …

Is memorability a general property

of information?



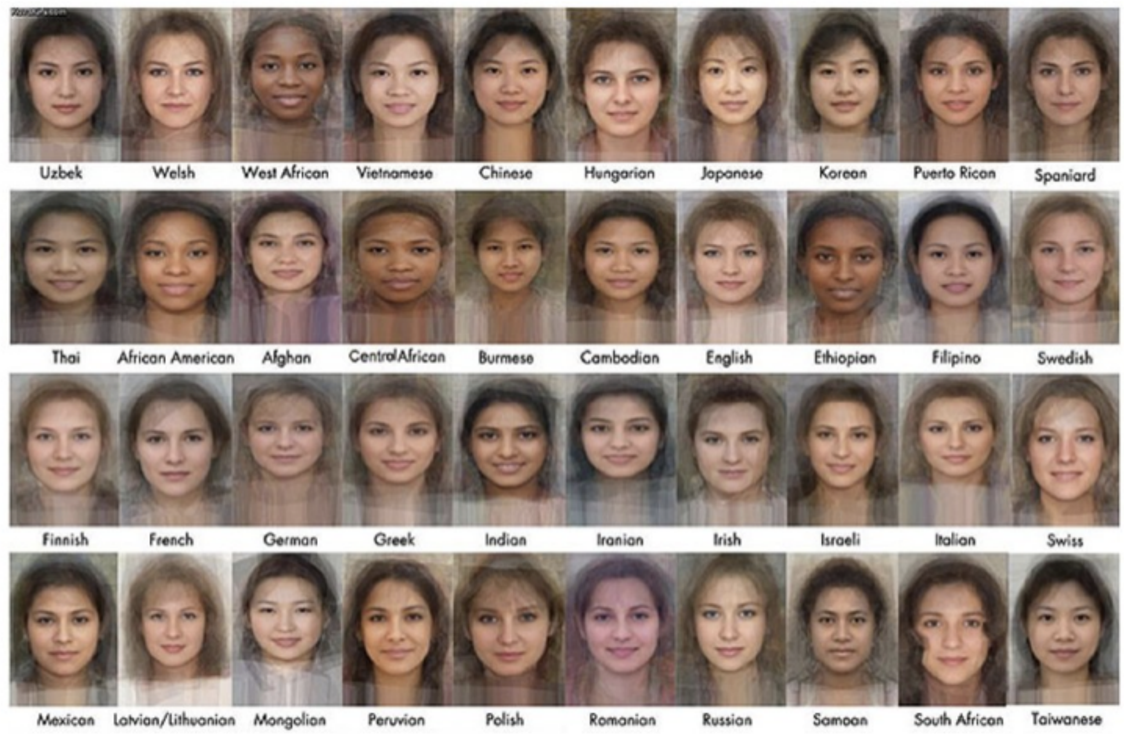
BUSINESS INSIDER | Tech | Finance | Politics | Strategy | Life | Entertainment | All | Search

What The Average Person Looks Like In Every Country

GUS LUBIN | FEB. 10, 2011, 9:50 AM | 1,187,204 | 106

South African Mike Mike travels around the world taking pictures of faces and combining them in hi-tech composites. He calls the ongoing project The Faces Of Tomorrow.

You can compare all the women on the right.



Courtesy of The Faces Of Tomorrow

http://www.businessinsider.com/faces-of-tomorrow-2011-2?op=1

Wilma Bainbridge

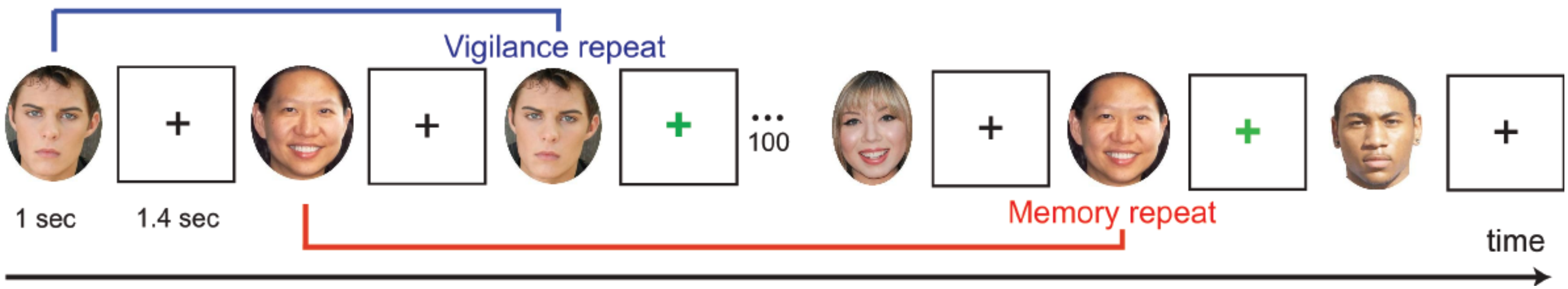
Memorability of Faces

Phillip Isola

Novel dataset: faces selection based on randomly generated first+last names following the distribution of the US census

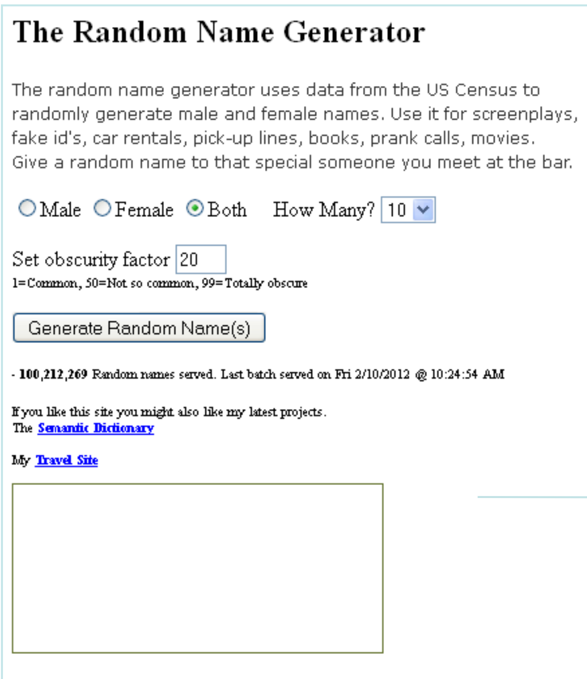
Bainbridge, Isola, Oliva (in press). The intrinsic memorability of face images. Journal Experimental Psychology: General

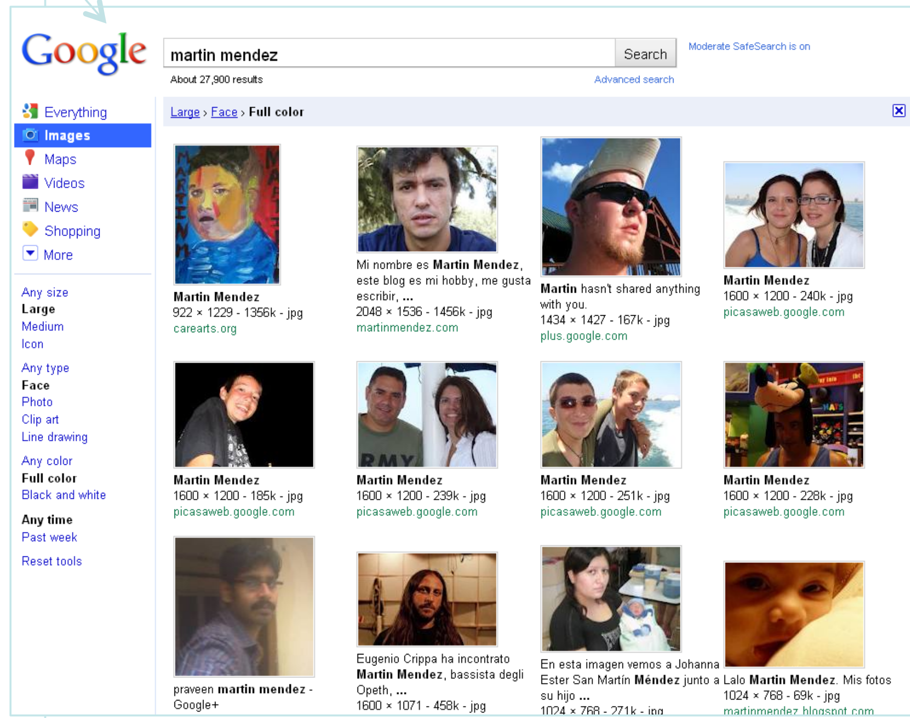
Face Memory Game



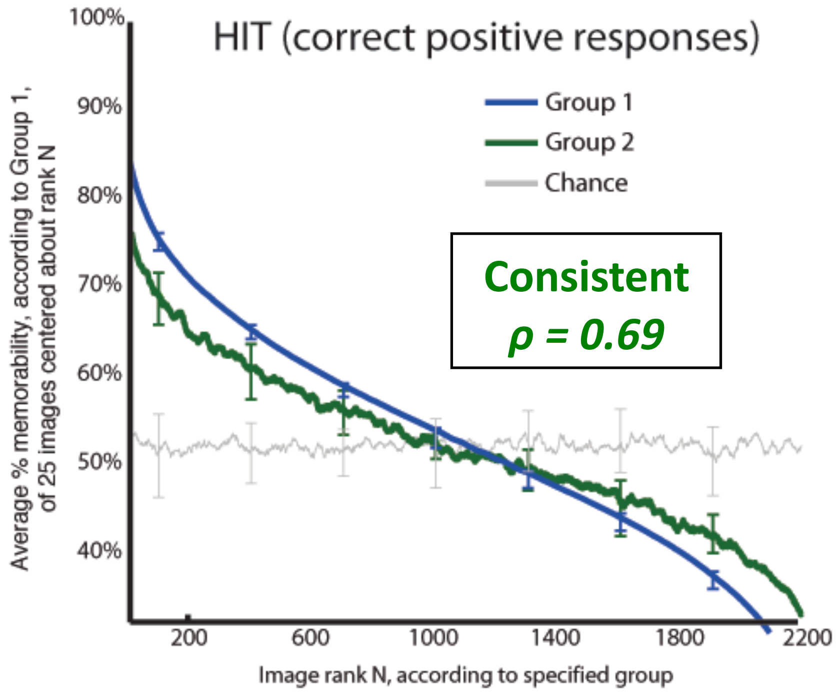
~10,000 unfamiliar faces, 2222 targets with ~ 80 memorability scores

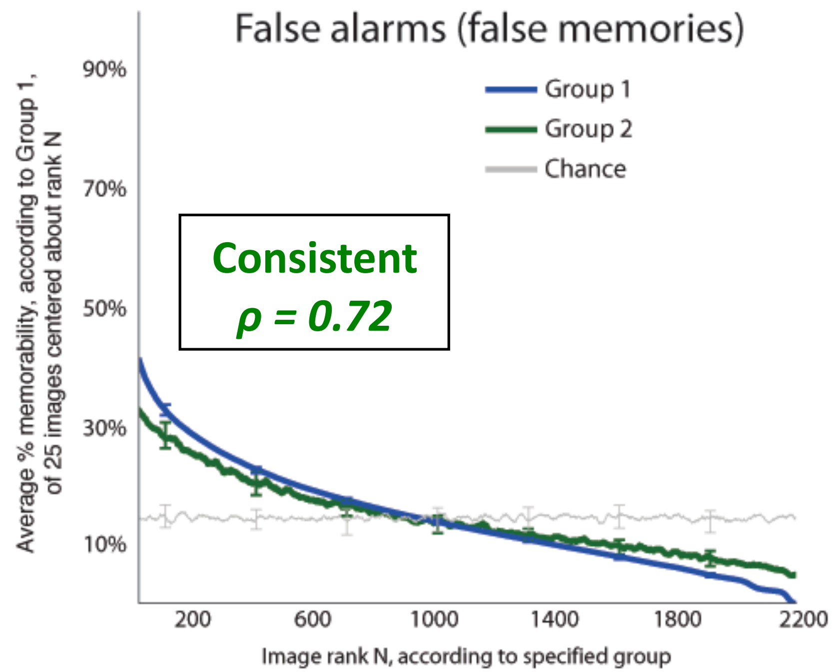
Database creation





High human consistency for both correct detection and errors (false positive)





- HR: M = 51.6%, SD = 12.6, FAR: M = 14.4%, SD = 8.7
- Average 81.7 workers per target image

Bainbridge, Isola, Oliva (in press). The intrinsic memorability of face images. Journal Experimental Psychology: General

Rate attributes about the person in the image

Based on your own opinions, please rate this person on the following attributes on a scale of **1 = NOT AT ALL**, and **9 = EXTREMELY**.

{Note-- By making judgements about these images, you are participating in a study being performed by the cognitive scientists in the MIT Department of Brain and Cognitive Science. If you have questions about this research, please contact Dr. Oliva at oliva@mit.edu. Your participation in this research is voluntary. You may decline further participation, at any time, without adverse consequences. Your anonymity is assured; the researchers who have requested your participation will not receive any personal information about you.}

Friendly [?] (vs unfriendly) Not at all … Extremely 1 2 3 4 5 6 7 8 9	**Uncertain** [?] (vs confident) Not at all … Extremely 1 2 3 4 5 6 7 8 9	**Happy** [?] (vs unhappy) Not at all … Extremely 1 2 3 4 5 6 7 8 9
Memorable [?] (vs forgettable) Not at all … Extremely 1 2 3 4 5 6 7 8 9	**Emotional** [?] (vs unemotional) Not at all … Extremely 1 2 3 4 5 6 7 8 9	**Typical** [?] (vs atypical) Not at all … Extremely 1 2 3 4 5 6 7 8 9
Interesting [?] (vs boring) Not at all … Extremely 1 2 3 4 5 6 7 8 9	**Normal** [?] (vs weird) Not at all … Extremely 1 2 3 4 5 6 7 8 9	**Familiar** [?] (vs unfamiliar) Not at all … Extremely 1 2 3 4 5 6 7 8 9
Mean [?] (vs kind) Not at all … Extremely 1 2 3 4 5 6 7 8 9	**Humble** [?] (vs egotistic) Not at all … Extremely 1 2 3 4 5 6 7 8 9	**Sociable** [?] (vs introverted) Not at all … Extremely 1 2 3 4 5 6 7 8 9
Emotionally Stable [?] (vs emotionally unstable) Not at all … Extremely 1 2 3 4 5 6 7 8 9	**Attractive** [?] (vs unattractive) Not at all … Extremely 1 2 3 4 5 6 7 8 9	**Irresponsible** [?] (vs responsible) Not at all … Extremely 1 2 3 4 5 6 7 8 9
Aggressive [?] (vs calm) Not at all … Extremely 1 2 3 4 5 6 7 8 9	**Unintelligent** [?] (vs intelligent) Not at all … Extremely 1 2 3 4 5 6 7 8 9	**Caring** [?] (vs cold) Not at all … Extremely 1 2 3 4 5 6 7 8 9
Uncommon [?] (vs common) Not at all … Extremely 1 2 3 4 5 6 7 8 9	**Untrustworthy** [?] (vs trustworthy) Not at all … Extremely 1 2 3 4 5 6 7 8 9	**What number is this: 5?** 1 2 3 4 5 6 7 8 9

If this is your ***first time*** doing this HIT, please answer these basic demographic questions about yourself:

Gender Male Female

Age <20 20-30 30-45 45-60 60+

Race White Black East Asian South Asian Hispanic Middle Eastern Other

Please answer all questions before submitting the HIT. Thank you!

Submit HIT

Which attributes make a face memorable?

True memories
(high HIT, low FA):

Irresponsible
Unhappy
Unintelligent

Familiarity
(high HIT, high FA):

Kind
Trustworthy
Atypical

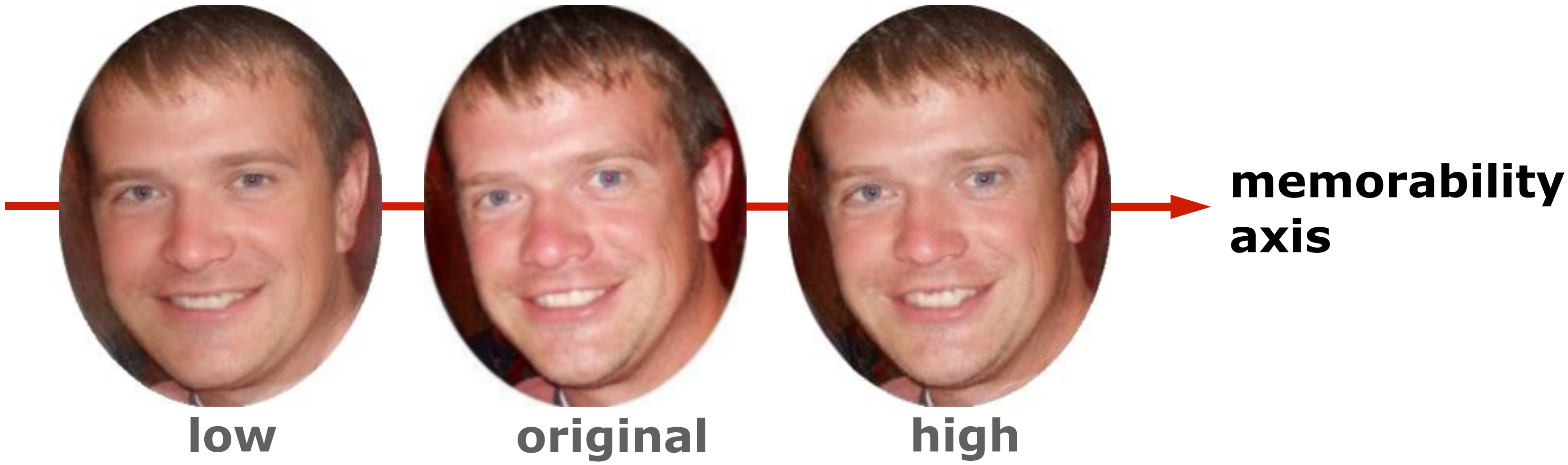
Bainbridge, Isola, Oliva (in press). The intrinsic memorability of face images. Journal Experimental Psychology: General

Can we manipulate memorability?

Modifying face memorability

Antonio Torralba
MIT

Aditya Khosla
MIT



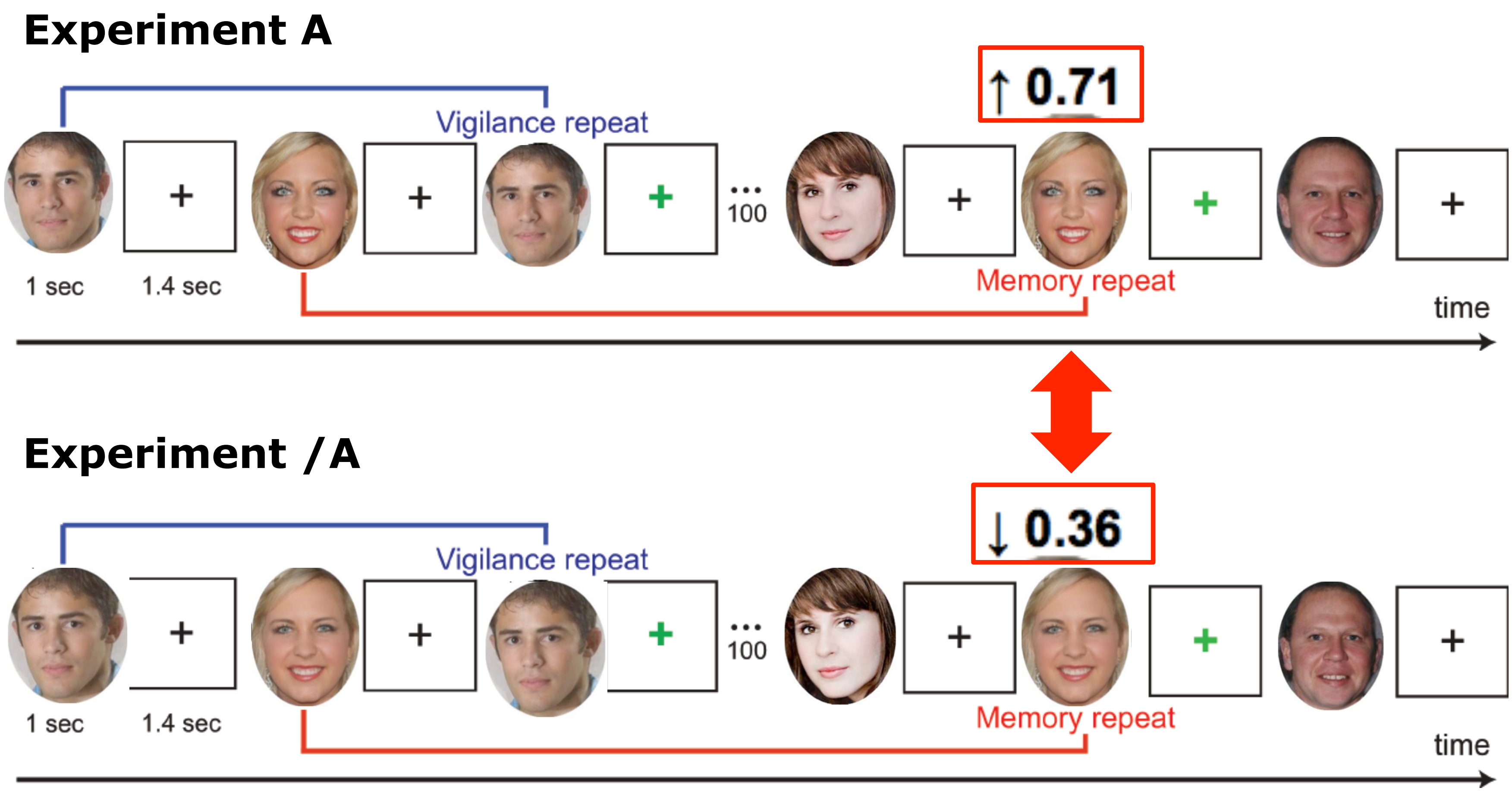
Goal

- Modify faces to be more/less memorable while keeping identity, and other attributes intact

Problem

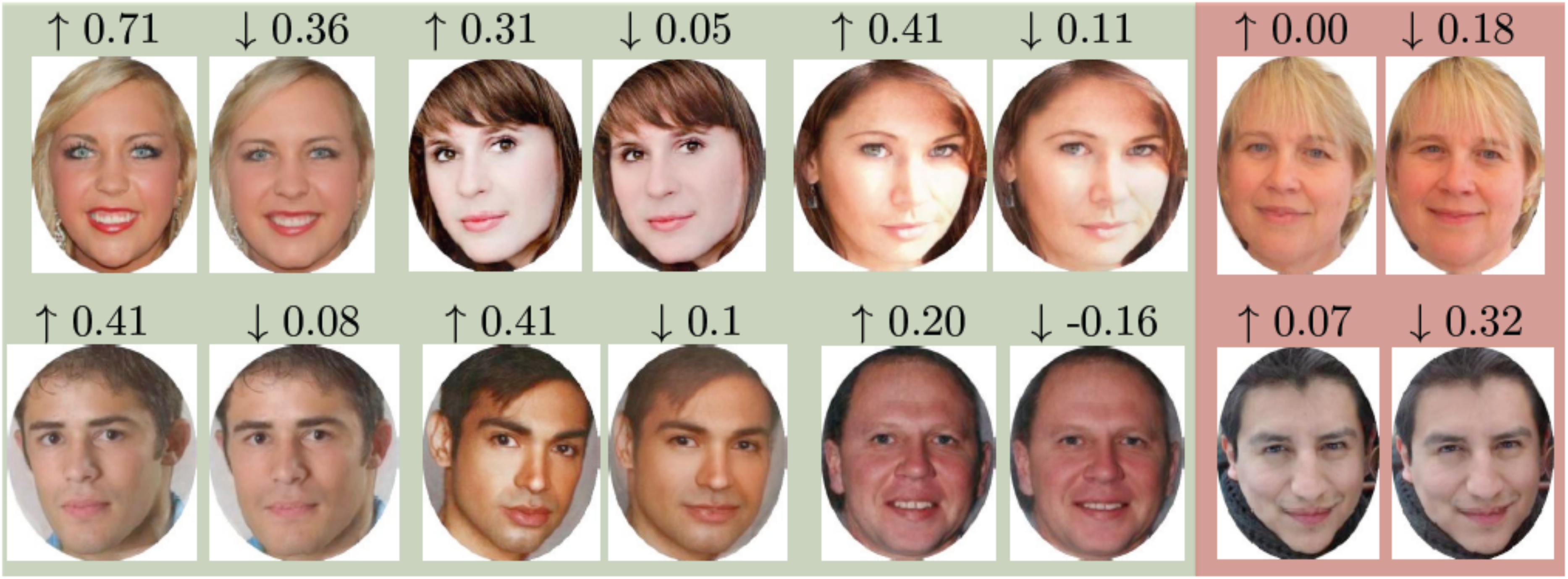
- Features such as HOG/SIFT significantly outperform AAM based features for memorability prediction

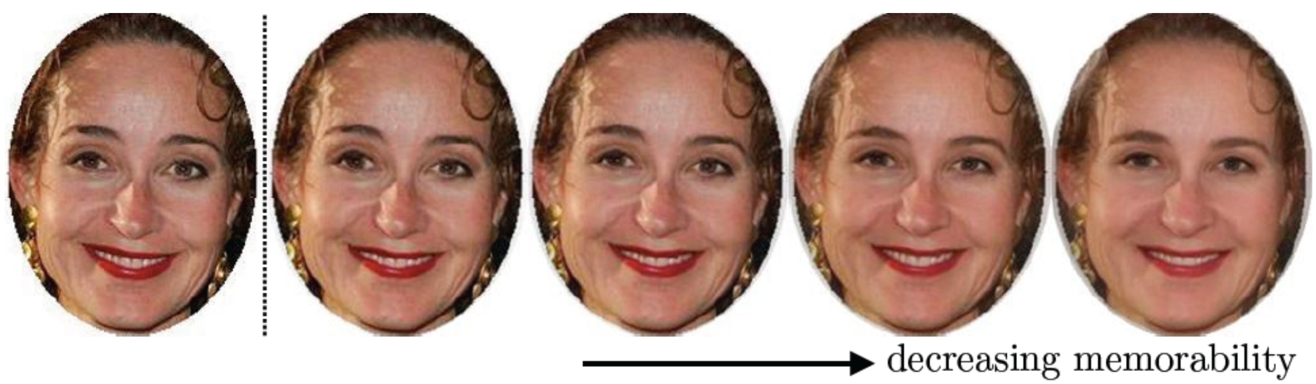
Testing Memory of Memorable & Forgettable face photographs



Two complementary Face memory experiments with 400 faces of different identities, with either a memorable or forgettable version of each identity (fillers are faces with random modification)

Modifying Face Memorability: Results





Zoya Bylinskii
MIT

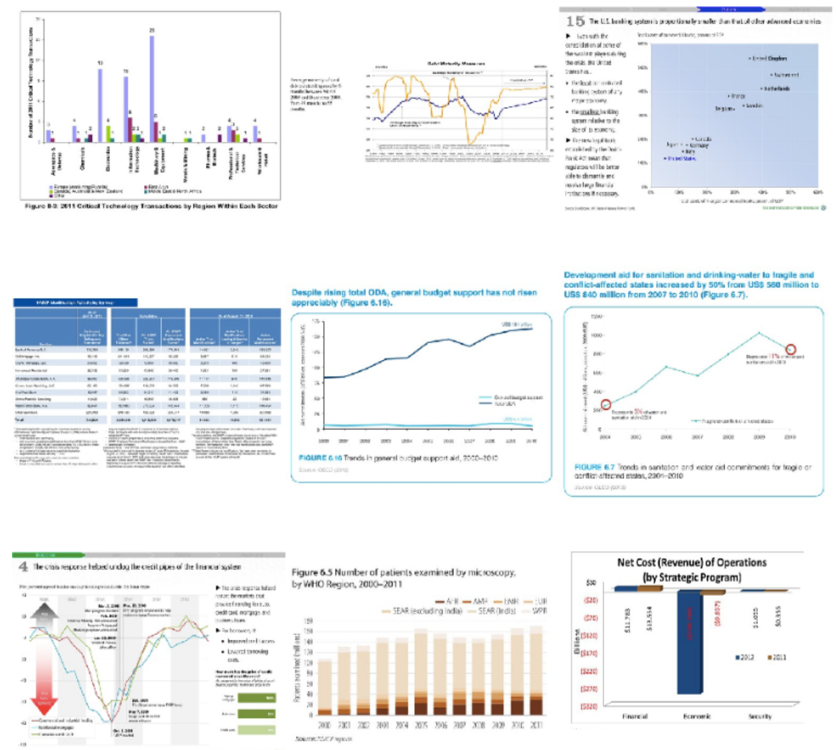
Memorability of Visualizations

Hanspeter Pfister
Harvard

Michelle Borkin
Harvard

Memorable

Forgettable



Consistency for HIT: ρ = 0.83; False Alarms: ρ = 0.78

Borkin, Vo, Bylinskii, Isola, Sunkavalli, Oliva & Pfister (in press). What makes a visualization memorable? IEEE Transactions on Visualization and Computer Graphics.

Zoya Bylinskii
MIT

Fine-grained memorability

Only exemplars of the same category

Memorable

Forgettable

Each class has > 400 exemplars in a Visual Memory Game.

Very high human consistency for HIT and False Alarms for instances of the same class

Memorability

- Memorability is an **intrinsic** feature of the stimulus, **reproducible** across a diverse population and for diverse types of (visual) information

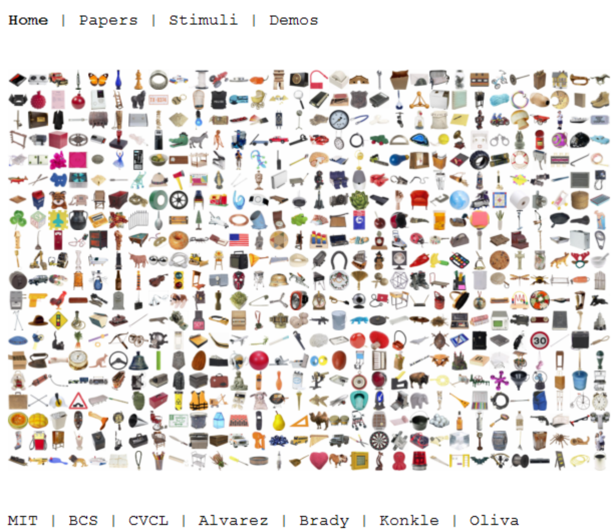
- Memorability is a **new task for computer vision** and can be used as a **metric** for quantifying/sorting information and present users with meaningful memorable (or forgettable) information

- Memorability provides a **tool** to investigate the cognitive and neural basis of **human memory**, and augment memory capacity

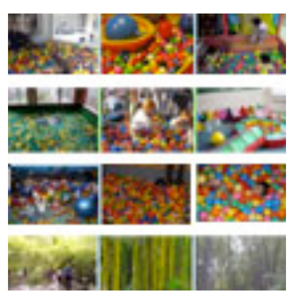
- <u>As a common factor across disciplines</u>, *memorability* may become a fairly general **quantification of the utility** of visual information.

Datasets

Massive memory website
cvcl.mit.edu/MM



SUN: Scene Understanding
http://groups.csail.mit.edu/vision/SUN/



Scene Memorability Dataset

http://web.mit.edu/phillipi/Public/
WhatMakesAnImageMemorable/

http://web.mit.edu/phillipi/
UnderstandingMemorability/

10k US Adult Face dataset
(available december 2013)