



## Credible Images: Human Perspectives and Perceptions

Eric Kessels “24 Hours of Flickr”

[1]

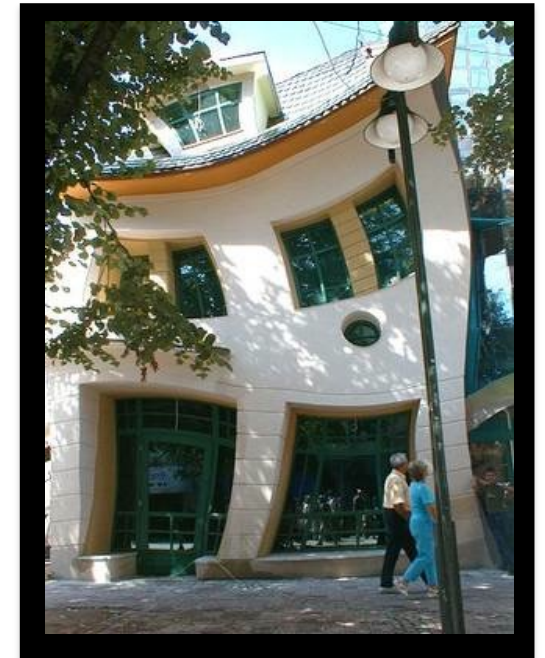
*Dr Sabrina Caldwell*

*School of Computing ✦ The Australian National University*

*JPEG Stake in Fake Media*

*Workshop #2 ✦ 25 March 2021*

## Real or Fake?







Ford 'doctors' photos of  
Shelby 1000 lifting off  
Ground 42/46  
[2]



## Real or Fake?





Ford 'doctors' photos of  
Shelby 1000 lifting off



Ground 42/46

[2]

Brookesia micra, Madagascar 46/41



[3]



## Real or Fake?







Ford 'doctors' photos of  
Shelby 1000 lifting off  
Ground 42/46  
[2]

Brookesia micra, Madagascar 46/41



[3]



[4]

✓ White shark and kayak,  
photo by Thomas Peschak  
44/39



## Real or Fake?



## Real or Fake?



Ford 'doctors' photos of  
Shelby 1000 lifting off  
Ground **42/46**  
[Web-2]



Brookesia micra, Madagascar **46/41**



[3]



[4]

✓ White shark and kayak,  
photo by Thomas Peschak  
**44/39**



[5]



✗ Photoart  
by  
Erik Johansson,  
Sweden  
**48/40**





## Real or Fake?



Ford 'doctors' photos of  
Shelby 1000 lifting off  
Ground 42/46  
[2]

Brookesia micra, Madagascar 46/41



[3]



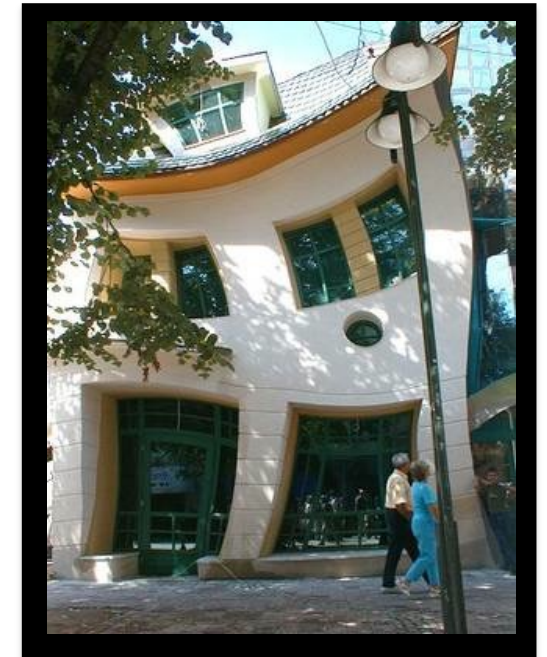
[4]

✓ White shark and kayak,  
photo by Thomas Peschak  
44/39



[5]

✗ Photoart  
by  
Erik Johansson,  
Sweden  
48/40



[6]

✓ Kryzywk Domek,  
Poland  
25/62

## Statistic from 2014

**Over 160 million cameras produced every year (includes smartphones)**

[7]

Per day:

**Snapchat - 3.5 billion** [8]

**Facebook – 300 million** [9]

**Instagram – 95 million** [10]

**Flickr now – 25 million** [11]

~rounded up – about 4 billion images uploaded to the Internet every day via these sites

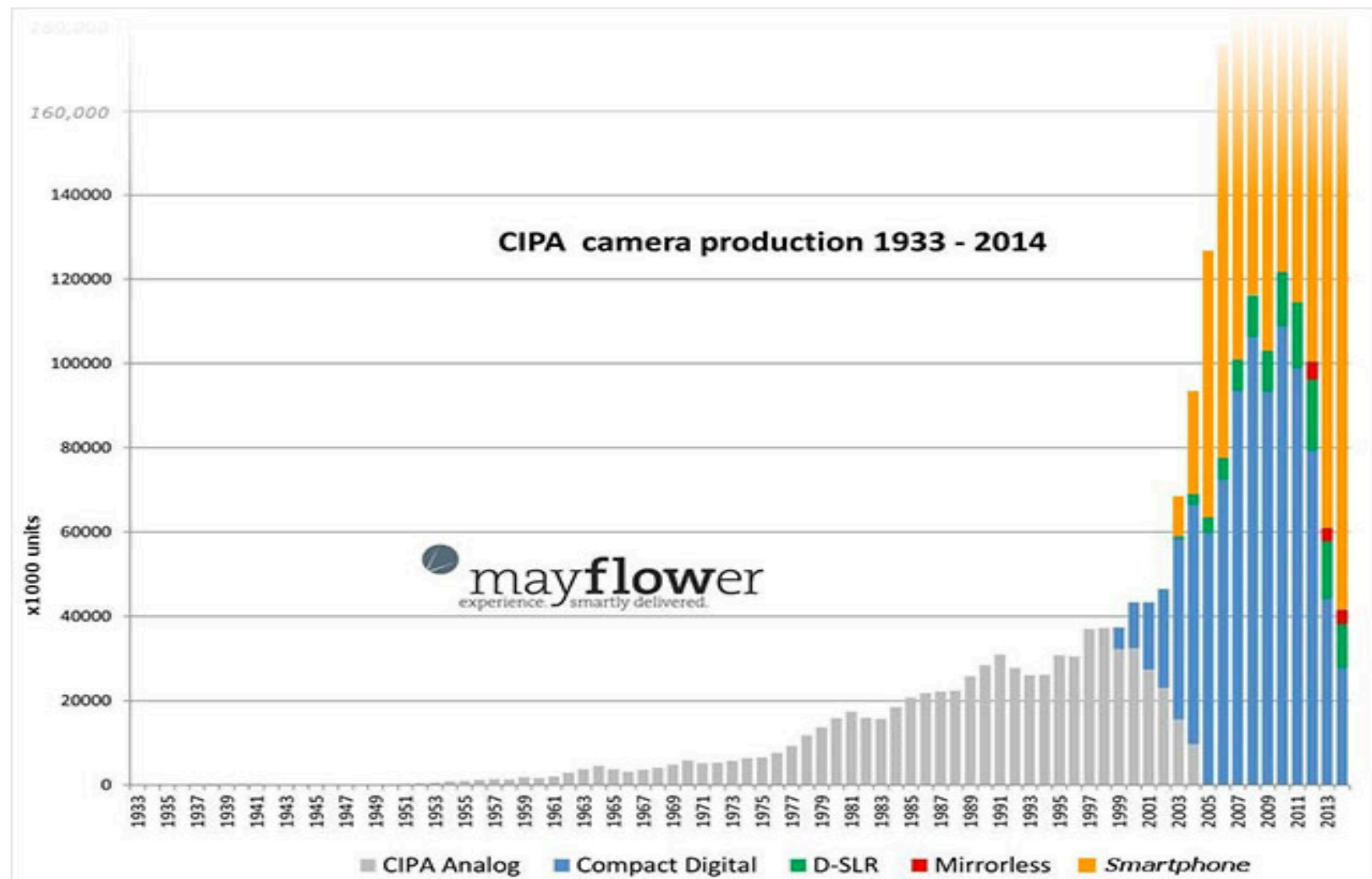




Image manipulation available to anyone with image editing software...



Photoshop  
Elements

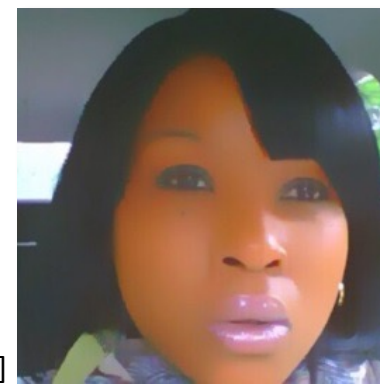


Adobe  
Photoshop

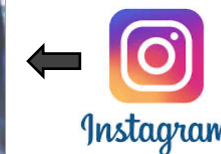


MS Windows  
Paint

Or even just a modern digital camera or smartphone ...

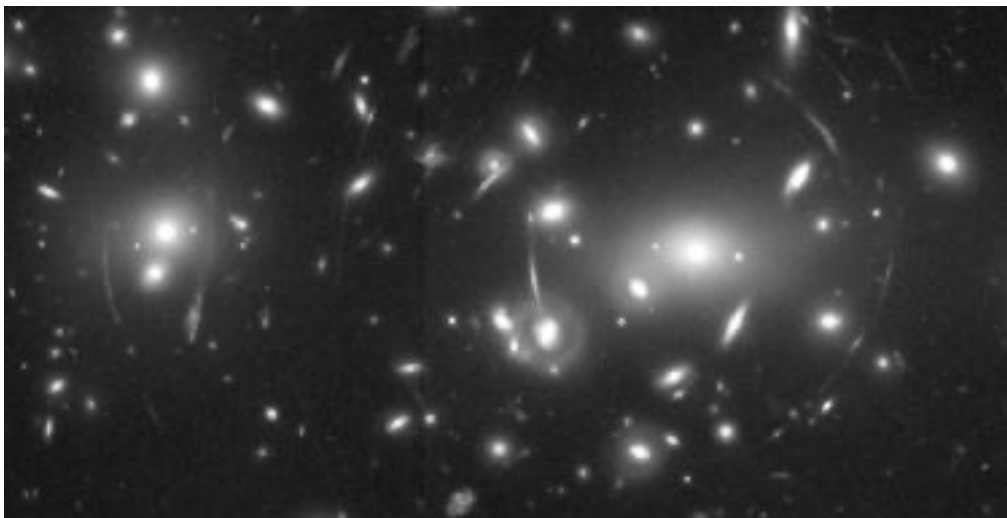


[12]



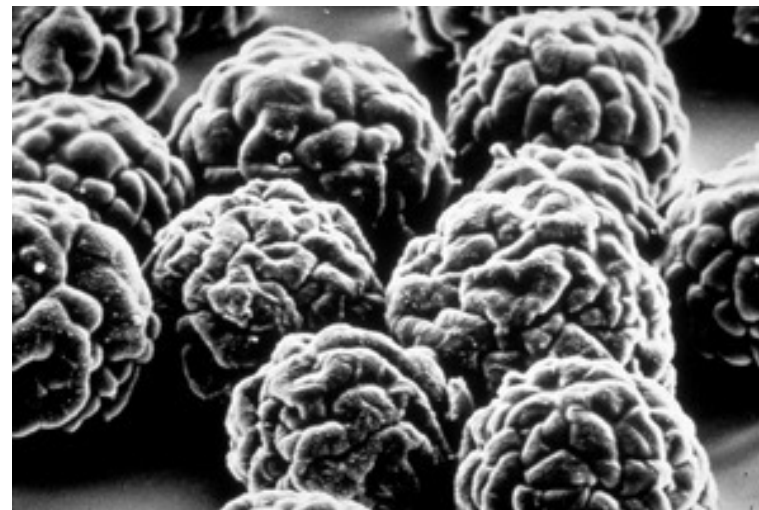
There are many methods of capturing and processing photographs that REQUIRE manipulation for us to learn new knowledge.

### *Science and medicine*



[13]

Abell 2218, Hubble telescope



[14]

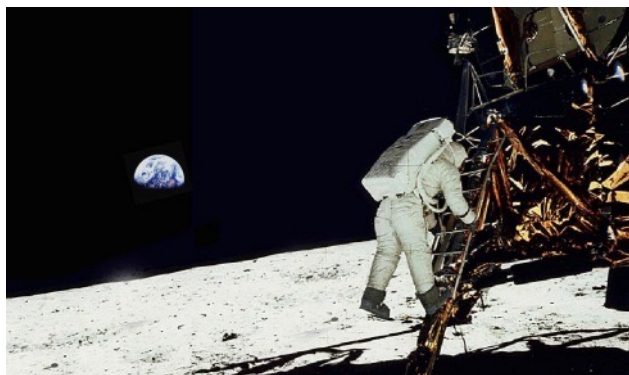
Wild poliovirus photographed through microscope



And manipulating images is fun, but photographs have an important role to play in society too...



Young man on motorbike, 1951, Shanghai



[15]

Moonwalk 1967

## History

[16]



9/11 terrorist attack on US world trade center



[17]

1985 'Feed the World' concert



Ancient Xi'an terracotta soldiers



*Sometimes people manipulate photos to influence our opinions, feelings and thoughts. That is acceptable when we know we are viewing art, but...*

April 2012 – Russian Patriarch from the Moscow Patriarchate - case of the disappearing watch. Watch may have been an expensive, \$30,000 Breuget watch



Arrest mug shot of O.J. Simpson 6/94 used 'as is' on Newsweek cover, altered on Time cover.



[Cloned] “smoke billows from burning buildings destroyed during an overnight Israeli air raid on Beirut’s suburbs August 5, 2006. Many buildings were flattened during the attack. REUTERS/Adnan Hajj”



“Qinghai-Tibet Railway opening green passageway for wild animals” Liu Weiying  
Photograph manipulated to imply antelopes living in harmony with the new rail system.



## La edad oscura digital

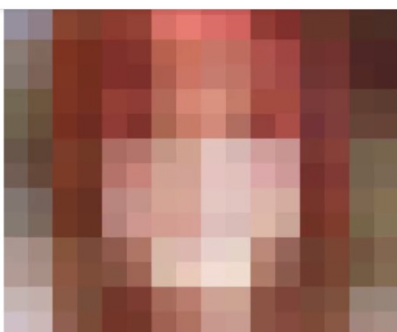


We don't have enough information to tell if the photos we are seeing are representative or created or somewhere in between.

["dark ages..."](https://search.creativecommons.org/photos/9a7234d1-ffc3-43df-bd3e-c162b8611405) by [hans s](#) is licensed under CC BY-ND 2.0  
<https://search.creativecommons.org/photos/9a7234d1-ffc3-43df-bd3e-c162b8611405>

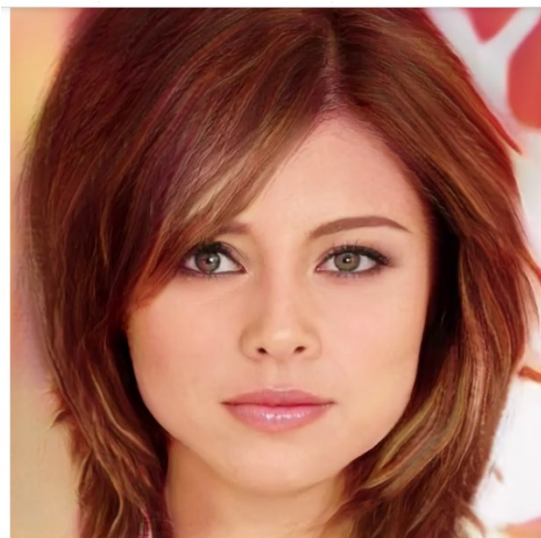
At what point do we have to start  
*proactively asserting*  
the veracity of our images?

## Artificial Intelligence and GAN Fabrications



Nvidia

10 million revisions  
18 days

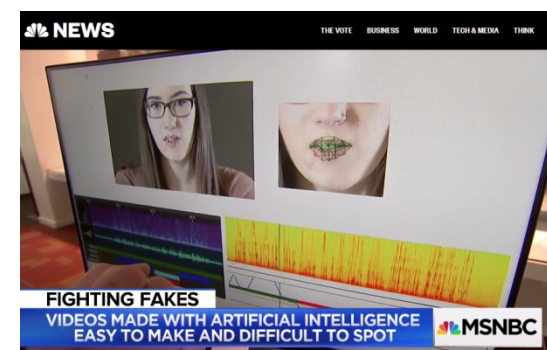


To create the final image in this set, the system generated 10 million revisions over 18 days.

[18]



[19]



Artificial Intelligence and 'Deep Fake' videos

3 main arguments  
I hear for '*Image  
credibility is NOT  
important*'



[20]

*Fading Away* by Henry Peach Robinson (1869) – one of the earliest composite images - made with 5 photographs

"Photos have always been manipulated. Look at Henry Peach Robinson's photo "Fading Away" or the posed American Civil War photos of Mathew Brady or Shackleton's Antarctic photos."

"Any photograph is subjective from the moment the photographer frames it up in her viewfinder."

"Come on Sabrina, what is reality, anyway?"







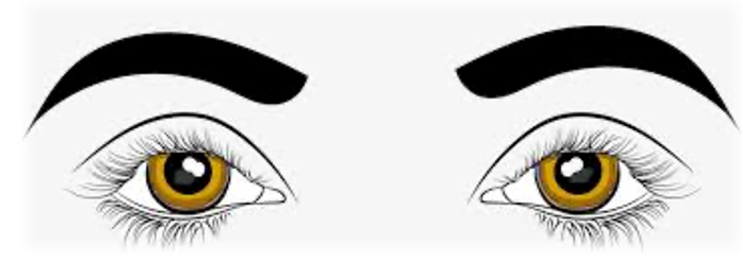






## Human perspectives

- The Three Arguments (already covered)
- ‘Photos as ‘Science vs Art’
- Snap survey on significance of image manipulation



## Human perceptions

- Accuracy (partly covered already)
- Spotting manipulations in photographs
- Uncertainty and Logic
- Conscious vs Unconscious perceptions revealed by AI (Classification Neural Network)



## Table 3-3: Mean values of all snap survey respondents

		Mean (out of 10)	SD	Likert representation
Q1	How easy is it for you to tell if a digital photograph is manipulated?	4.74	1.9	Difficult
Q2	How much do you care if the digital photograph you are looking at has been manipulated?	6.10	2.3	Care somewhat
Q3	How much do you think it matters in society if many digital photographs are manipulated?	6.58	2.5	Significant
Q4	How concerned are you that there is currently no authentication process for digital photographs?	6.15	2.4	Concerned somewhat

[21]

n=107

Rotation

Photos as Science vs Art ...



Brightness adjustment

'Airbrushing' Cropping

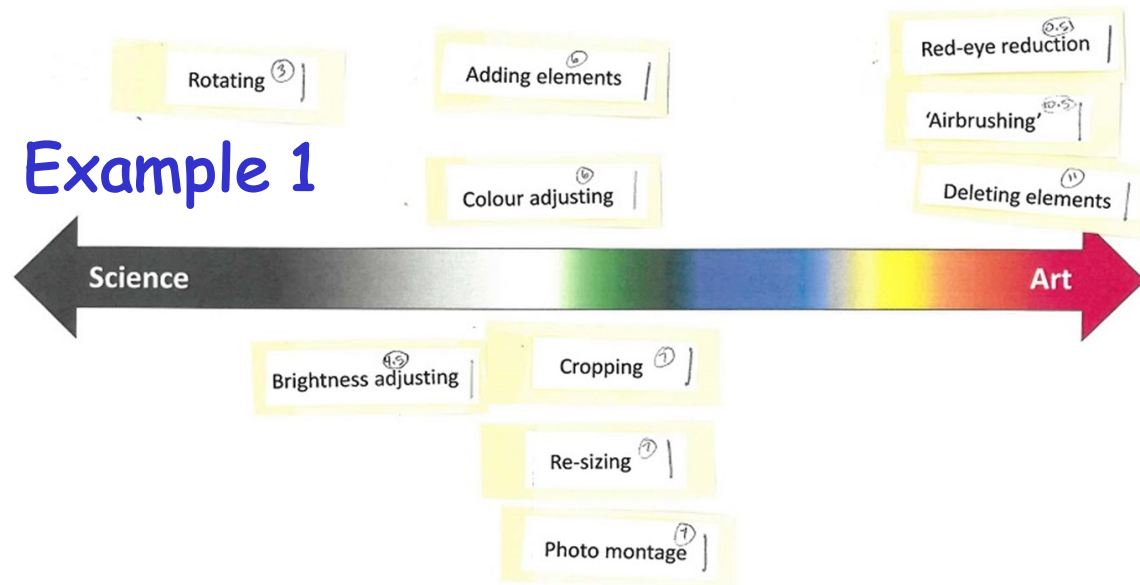
Deleting elements

Red-eye reduction

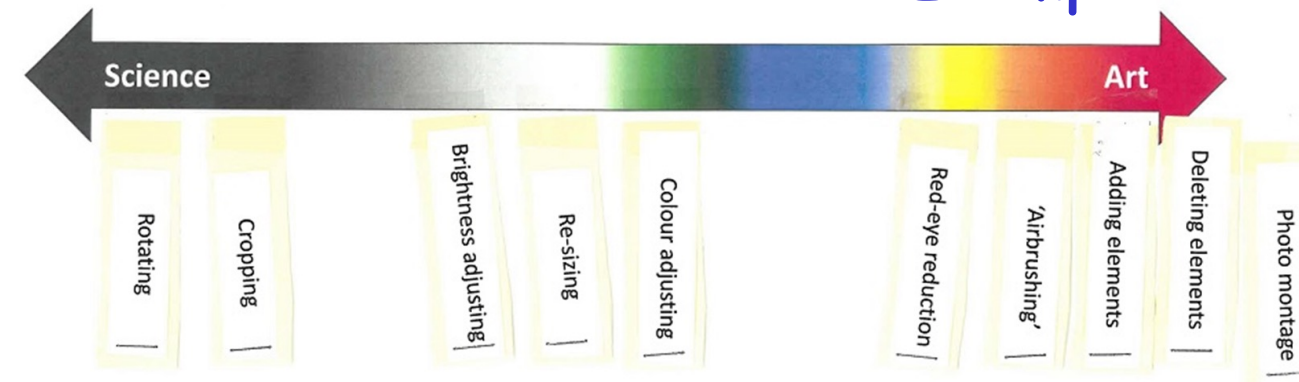
Re-sizing Colour adjustment

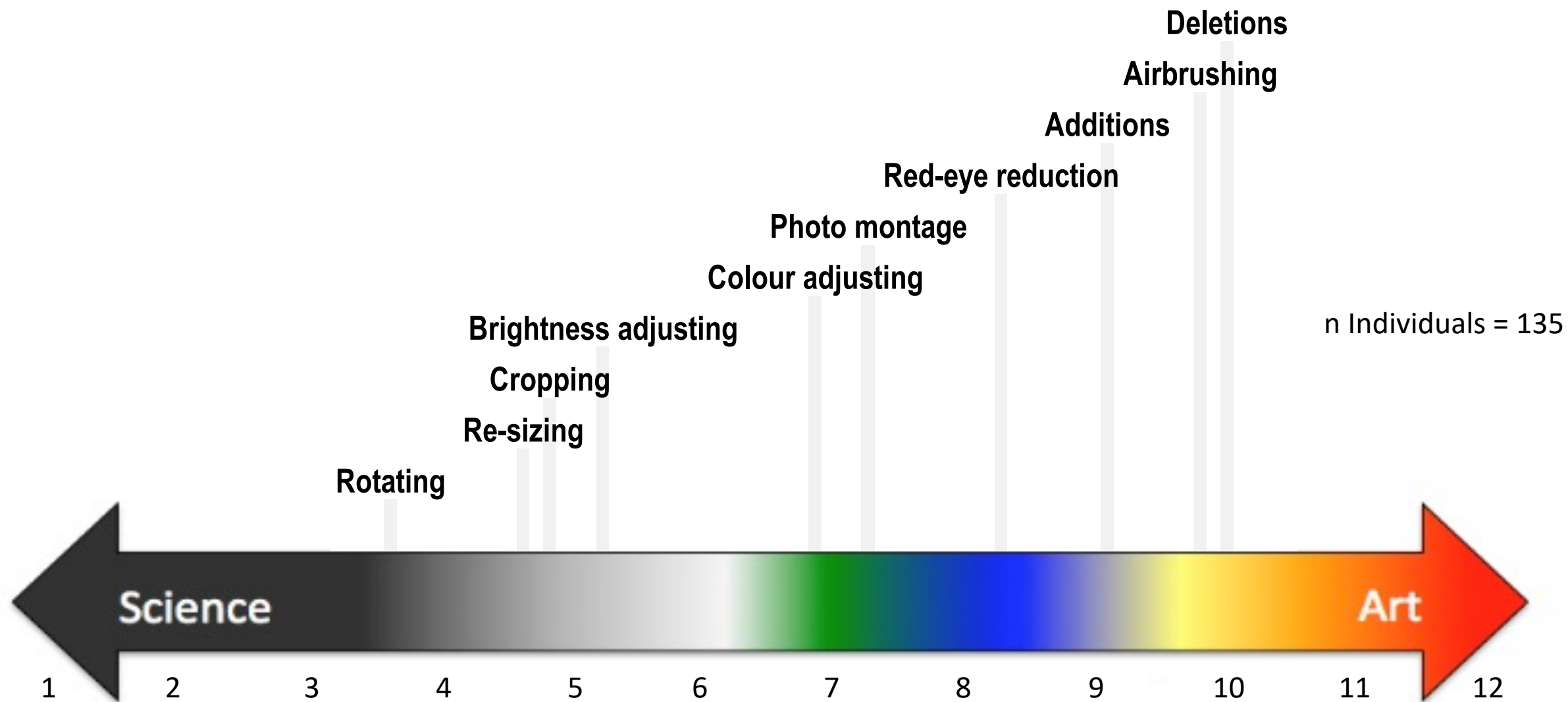
Photo Montage Adding elements

Example 1



Example 2

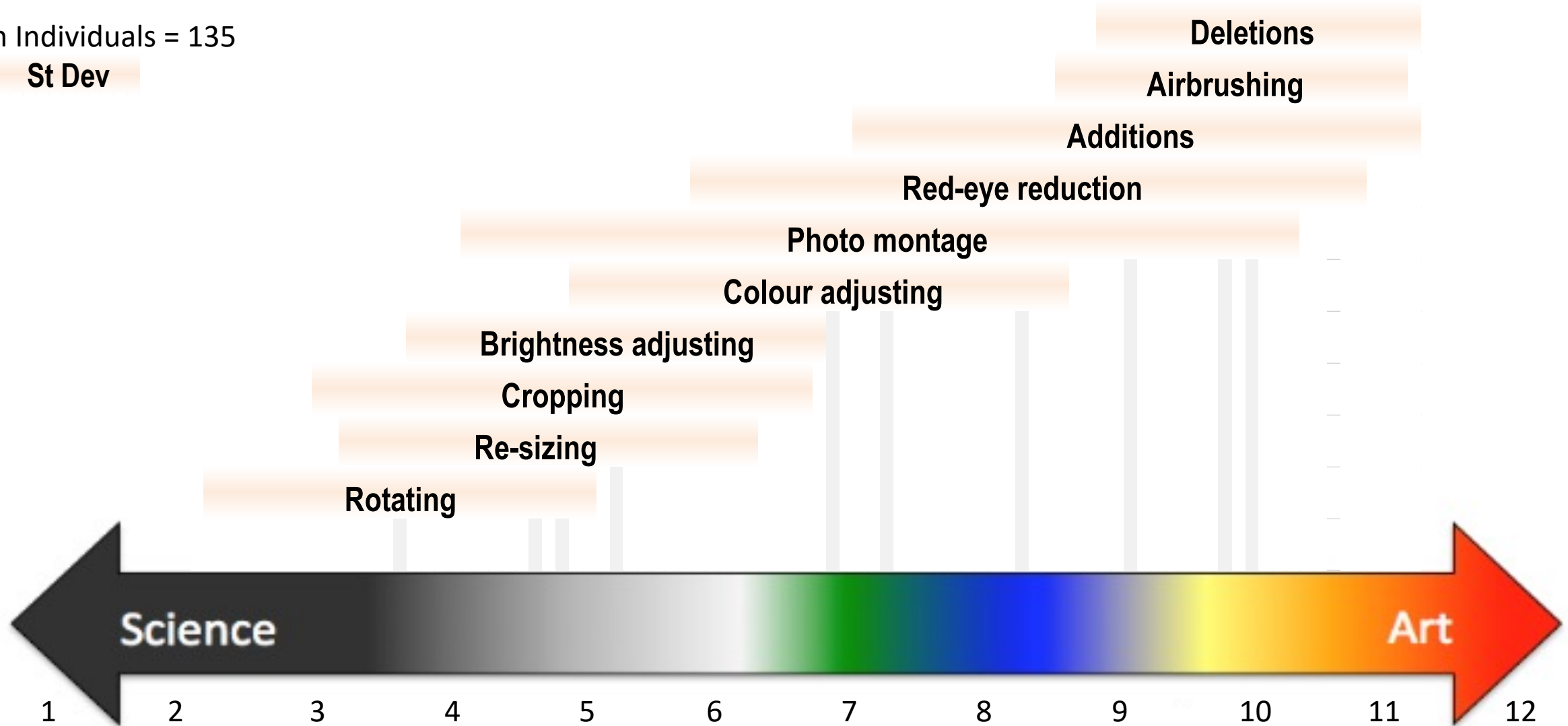






n Individuals = 135

St Dev



## Imperfect understandings: a grounded theory and eye gaze investigation of human perceptions of manipulated and unmanipulated digital [22] images

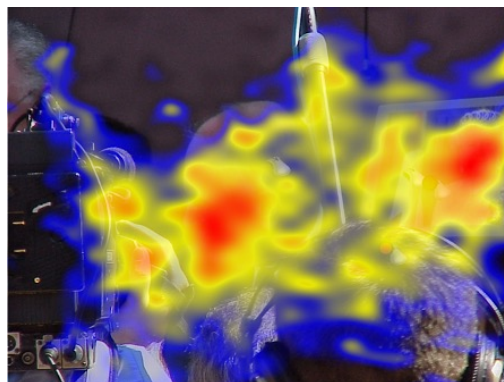


- We focus on salient features of an image to discern its meaning<sup>5</sup>, and
- Some characteristics of images, especially luminance attract our eye gaze.<sup>6</sup>
- But can we tell if the image we are looking at is manipulated or unmanipulated?

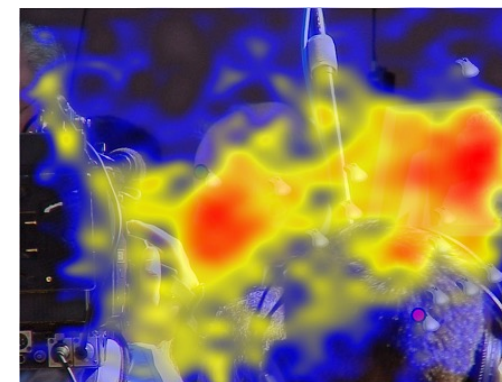




**A**



**B**



**C**

Key: Red - most viewed, yellow - less viewed, blue - least viewed.

A) Image 11 as presented in manipulated form B) Participants stating: unmanipulated C) Participants stating: manipulated.

Image	n	Stated: manipulated (correct)					Stated: unmanipulated (incorrect)					Sig (p<.05)	
		Mean Fixa- tion	SD	Mean $\Sigma$ Duration (secs)	SD	n	Mean Fixa- tion	SD	Mean $\Sigma$ Duration (secs)	SD	n	Fixa- tion	Dura- tion
3	63	63.4	24.43	15.39	8.29	42	56.7	25.64	15.14	8.32	21	0.329	0.908
8	67	27.0	18.07	7.66	6.08	39	28.6	23.10	8.11	6.43	28	0.765	0.772
9	67	30.2	20.72	9.60	7.56	54	29.0	17.42	8.76	6.45	13	0.837	0.689
10	20	9.3	4.35	7.75	6.68	7	3.1	2.42	2.32	2.49	13	0.009	0.002
→ 11	37	38.5	19.09	8.34	4.77	21	25.1	12.03	5.45	3.67	16	0.014	0.045
12	35	54.5	18.82	13.02	6.65	25	32.1	15.21	6.91	5.11	10	0.001	0.008
13	34	30.1	19.32	8.24	5.97	13	30.6	18.17	8.69	5.92	21	0.941	0.836
14	36	17.0	9.40	7.54	7.93	12	12.3	6.64	4.28	2.79	24	0.143	0.192

[21]

# Logic

Participants often used their pre-existing experience and beliefs about the subject matter of the image – *sometimes the logic was good, sometimes not...*

- ✗ There aren't any lizards that small
- ✗ The lizard couldn't have been on the match when it burnt or would have been killed
- ✗ Matches aren't black

- ✓ The girl in the front isn't smiling like the others
- ✓ The lighting on the girl in the front is wrong

- ✗ The cow must have been cold
- ✓ I'm from a farm; I know how much a cow weighs
- ✗ In Russia we can train them to do that

Logic used out loud by %

18%

13%

20%



Uncertainty expressed  
out loud by %

30%

23%

28%

[21]

# Uncertainty

Lack of confidence often expressed as **overt guessing**, or the use of words like 'perhaps,' 'maybe' 'I think,' 'I believe,' 'not sure,' 'doesn't look right.' etc.

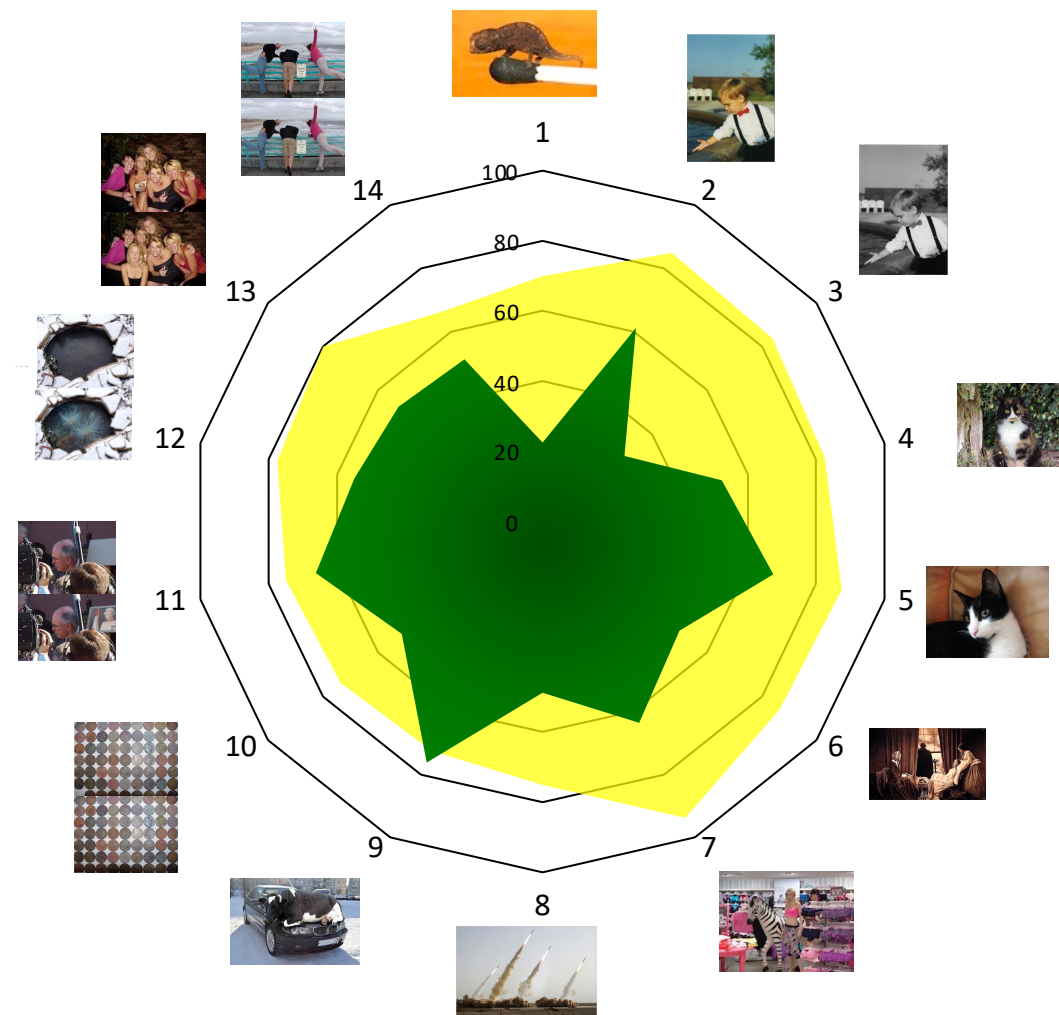


Can we tell if an image is real?

Are we confident in our decision?

Are we right?

Yellow area = confidence  
Green area = accuracy



n=80



2008 Iran missile launch...

...was really like this:



Only 11 participants out of 70 valid responses were able to identify the cloned missile correctly even after being told that one of the missiles had been cloned into the photo.

However!

Using a classification supervised neural network it was possible to accurately discern the right answer from the eye gaze patterns of the experiment participants.

75.1% eye gaze accuracy compared to 15.7% accuracy via verbal response.

Feature set: count of fixations and sum of durations of eye gaze

[23]

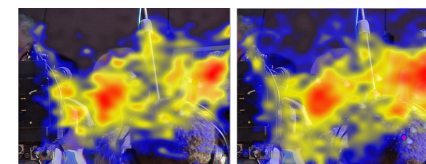
Wow, this is a really big problem!  
Who is trying to solve it?



The New York Times



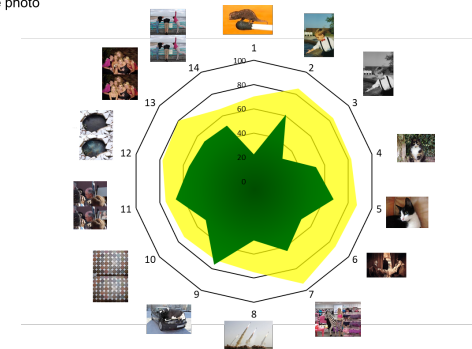
CC-BY-NC-ND



Eye gaze of experiment participants who said the photo is not altered

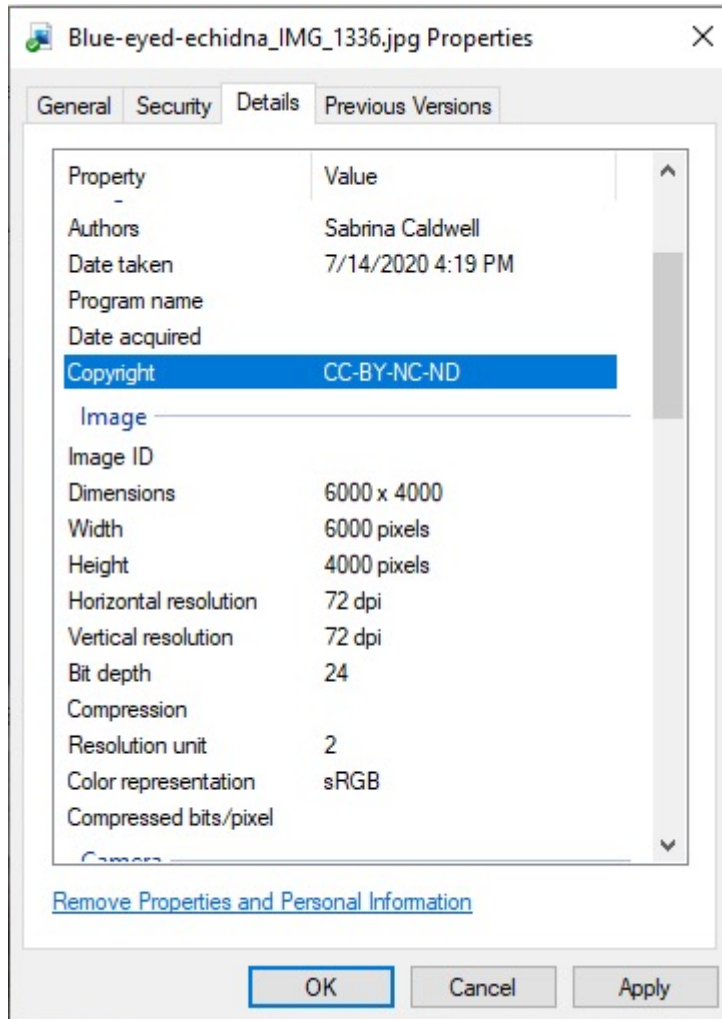
Eye gaze of experiment participants who said the photo is altered

Researchers





## Is metadata the answer? Partially...



Echidna, photo by Sabrina Caldwell  
CC-BY-NC-ND

...we also need

- ***visible* metadata**
- **more provenance**
- **new file formats**
- **networks of trust**
- **new ways of doing things**

**Securing Image Credibility is a thorny socio-scientific issue (SSI). Skills needed to address it:**

[23]

**Complexity:** perceive and reason through the complexity inherent to SSIs.

**Inquiry:** ability to recognise information that is not available regarding an issue as well as the ability to consider ways in which that information may be generated.

**Perspective-taking:** ability to analyse an issue and potential solutions from the perspectives of different stakeholders.

**Skepticism:** ability to identify potential sources of bias that may influence information or the presentation of information about an issue or potential solutions.

**Affordances & Limitations of Science:** ability to determine how scientific knowledge and processes may contribute to resolution of SSI and recognise dimensions of the issue that cannot be addressed by science.

(<sup>[24]</sup> Newton and Zeidler 2020)

## References not otherwise noted

- [1] <https://www.erikkessels.com/24hrs-in-photos>, consulted 24 March 2021.1319.
- [2] <https://www.motortrend.com/news/shopped-photos-of-shelby-1000-popping-wheelie-are-fake-184379/>, consulted 24 March 2021.
- [3] Glaw, F., et al. (2012). Rivalling the World's Smallest Reptiles: Discovery of Miniaturized and Microendemic New Species of Leaf Chameleons (Brookesia). Northern Madagascar.
- [4] <https://www.thomaspeschak.com/kayak-great-white-sharks->, consulted 24 March 2021.
- [5] <http://www.toxel.com/inspiration/2009/03/13/photo-manipulations-by-erik-johansson/>, consulted 24 March 2021.
- [6] <http://krzywydomek.info/about-krzywy-domek/about-us.html>, consulted 24 March 2021.
- [7] Michael Zhang, (2015) <http://petapixel.com/2015/04/09/this-is-what-the-history-of-camera-sales-looks-like-with-smartphones-included//>, consulted 24 March 2021.
- [8] <https://expandedramblings.com/index.php/snapchat-statistics/>, consulted 24 March 2021.
- [9] <https://zephoria.com/top-15-valuable-facebook-statistics/>, consulted 24 March 2021.
- [10] <https://www.wordstream.com/blog/ws/2017/04/20/instagram-statistics>, consulted 24 March 2021.
- [11] <https://expandedramblings.com/index.php/flickr-stats/>, consulted 24 March 2021.
- [12] Bossip (Producer), (2014, 29 July 2016). Carfilter. Retrieved from <http://bossip.com/1079593/pure-deception-a-shocking-gallery-of-filter-sorcery/9/>
- [13] Crouch, W. (1995) Gravitational Lens in Bell 2218.
- [14] Global Polio Eradication Initiative (2010) Wild poliovirus photographed through microscope.
- [15] <https://www.nasa.gov/apollo11-gallery>, consulted 24 March 2021.
- [16] [https://nydailnews.com/new-York/man-shot-iconic-9\\_11-photo-doomed-fire-truck-ariticle-1.2786008](https://nydailnews.com/new-York/man-shot-iconic-9_11-photo-doomed-fire-truck-ariticle-1.2786008) , consulted 24 March 2021.
- [17] <https://www.radiox.co.uk/features/was-live-aid-the-greatest-gig-ever/>, consulted 24 March 2021.
- [18] <https://www.nytimes.com/interactive/2018/01/02/technology/ai-generated-photos.html>, consulted 24 March 2021.
- [19] <https://www.nbcnews.com/video/first-read-minute-1214598723984?v=railb&>, consulted 24 March 2021.
- [20] Robinson, H. (1860). On Printing Photographic Pictures from Several Negatives. The British Journal of Photography, 94.
- [21] Caldwell, Sabrina. (2017) Framing digital image credibility: image manipulation problems, perceptions and solutions. Print.
- [22] Caldwell, Sabrina, Tom Gedeon, Richard Jones, Leana Copeland. Imperfect understandings: a grounded theory and eye gaze investigation of human perceptions of manipulated and unmanipulated digital images. Conference Proceedings. 3<sup>rd</sup> International Conference on Human Computer Interaction, Barcelona Spain July13-1, 2015 Paper 308. (Best Paper)
- [23] <https://thelede.blogs.nytimes.com/2008/07/10/in-an-iranian-image-a-missile-too-many/>, consulted 24 March 2021.
- [24] Newton, Mark H. and Dana Zeidler (2020) Developing socioscientific perspective taking. International Journal of Science Education 42:8, 1302-1319.