Animal Behavior and Cognition
ABC 2025,12(2): 258-270
DOI: https://doi.org/10.26451/abc.12.02.05.2025

Using Online Media To Study Animal Cognition: Domestic Cat Responses To Reflective Images

Kim Youngbean and Philip Johns*

Yale-NUS College, Singapore

*Corresponding author (Email: youngbean@u.yale-nus.edu.sg, yncjpm@nus.edu.sg)

Citation – Kim, Y., & Johns, P. (2025). Using online media to study animal cognition: Domestic cat responses to reflective images. *Animal Behavior and Cognition, 12*(2), 258-270. https://doi.org/10.26451/abc.12.02.05.2025

Abstract – In the mirror test of visual self-recognition, if an animal responds to its reflection as its own, rather than how it would respond to a novel individual, the animal may have the capacity to recognize itself in mirrors. Previous studies have offered little information about self-recognition of domestic cats. Here we explore two phenomena that may shed light on whether cats recognize their own reflections or reflective images by gleaning data from social media. We examine TikTok videos where pet owners show cats reflective images with augmented reality (AR) filters; and YouTube videos where cats interact with mirrors. Behavioral sequence analysis revealed little support that cats understand reflective images. Few TikTok cats responded to augmented reality images, and their responses may have been triggered by other cues, such as human touch. In YouTube videos, cats fell into five behavioral clusters, two which were aggressive, and two which were curious. Even curious cats showed little evidence that they have the prerequisite conditions to be tested for mirror self-recognition. We consider whether distinct clusters may indicate that cat personality influences how cats respond to their reflections. We discuss the utility of social media for addressing questions of animal cognition.

Keywords – Mirror self-recognition test, Self-recognition, Felis catus, Cat, Social media, Citizen science

A classic assessment of visual self-recognition is the mirror self-recognition (MSR) test, which involves an animal's reaction to its reflection, and to its modified reflection, e.g., by putting a mark on an animal's face (Gallup 1970; see de Waal 2008; de Waal 2019). If animals recognize their reflections, they should not treat the reflection as another animal, e.g., by displaying aggressive or fearful behaviors. After animals habituate to mirrors and their social reactions have been replaced by self-directed behaviors, e.g., by comparing their movement to their reflections', they should respond to modifications to their reflections, e.g., by exploring novel dots of paint. Some species "pass" the mirror test, including chimpanzees (*Pan troglodytes*) (Gallup, 1970, Povinelli et al., 1997), dolphins (*Tursiops truncatus*) (Reiss & Marino, 2001), elephants (*Elephas maximus*) (Plotnik et al., 2006), and certain corvid species (*Corvus corax, Cyanopica cyanus)* (Vanhooland et al., 2023). Other species like dogs (*Canis lupus*) may use mirrors to acquire spatial information (Howell & Bennett, 2011, Howell et al., 2013). Habituation to mirrors and the pairing of the visual stimuli (mirror image) with somatosensory stimuli further increases evidence of some species passing the mirror test, such as rhesus monkeys (*Macaca mulatta*) (Chang et al., 2017) and mice (*Mus musculus*) (Yokose et al., 2024).

Interpreting the results of the mirror test can be challenging, and the relationship between passing the MSR test, self-recognition, self-awareness, theory of mind, and the evolution of cognition, is controversial, and depends on which species is tested and on the specific protocol (e.g., Anderson & Gallup, 2015; de Waal, 2008, 2019; Gallup, 1982; Heschl & Burkart, 2006; Kopp et al., 2021; Povinelli et al., 1997). For example, some species of fish also show signs of passing the mirror test (Kohda et al., 2022) despite lack of dexterity and their evolutionary divergence from humans, making us question the fundamental definition of self-awareness. Individual variation in performance within species further complicates results; even in studies of elephants and chimpanzees, only about half of the tested subjects pass the MSR test (Plotnik et al., 2006; Swartz, 1991)

Researchers may interpret signs of self-awareness in varying ways (see de Waal, 2019) as to where the subject lies on a scale of evolution or development. De Waal (2019) advocates a gradualist evolutionary perspective of self-recognition, given variation across species in social responses and self-directed behaviors, regardless of whether the species "passes" the MSR test. De Waal (2019) also emphasizes the potential for a developmental theory of MSR, where animals may go through different stages of replacing social reactions to mirrors with self-directed behaviors, the latter which is a prerequisite for animal subjects of MSR tests.

Popular consensus is that domestic cats (*Felis catus*) do not recognize themselves in mirrors; rather that they habituate to their reflections (e.g., de Waal, 2019; Gallup, 1982; see also Nosowitz, 2013; Wetsman, 2019). This claim seems perfectly reasonable. However, we are aware of little formal research related to visual self-recognition in domestic cats. The entirety of one cited work is, "Dogs and cats, especially younger ones, have a brief interest in their reflection, in which they probably also think they see a congener. Dogs are often afraid of it, cats become curious and go look behind the mirror" (Kraus, 1949, p. 5). We know of no others. We wish to explore how cats react to their reflections and potentially to see where they lie on some gradient of self-awareness.

Social media provides an ever-growing cache of videos recording animal behaviors, including cat behaviors. Although social media is comprised largely of *ad libitum* observations (Altmann, 1974; Brereton et al., 2022), and thus can be prone to biases, it is useful for recording uncommon occurrences (Bungum et al., 2022; Loong et al., 2021; Nelson & Fijn, 2013) and events involving companion animals (e.g., Boydston et al 2018). Two types of videos on social media, TikTok (http://www.tiktok.com) and YouTube (www.youtube.com), may provide rough analogues to the MSR test and, therefore, information on how cats respond to reflective images, and possibly regarding a switch from social reactions to self-directed behaviors. The first is a popular Instagram and TikTok trend that emerged in 2019-2020. This involved pet owners showing their cats both theirs and their cats' images in cellphone screens while using an augmented reality (AR) filter that changes phone images and videos the owners' faces, in real time, in this case to resemble a cat (Figure 1). In some cases, owners would open and close their mouths in an exaggerated way, without talking, evidently to change the human image on the screen for their cats to see. Conveniently, cat owners simultaneously recorded their cat's reactions or lack thereof to the owners' AR filtered face. The second represents videos that cat owners uploaded to YouTube videos of their felines' reactions to mirrors without any human intervention.

Here we explore cats' reactions to reflective images, based on data gleaned from TikTok and YouTube videos. These videos lack experimental treatments and controls. We do not know, for example, whether the cats in TikTok videos have habituated to reflective images or perform self-directed behaviors. Nor do we know how they react to images without the human present, or without AR manipulation. Therefore, we cannot tell how much the cats' reactions might be due to a violation of expectations *per se* (see Margoni et al., 2024). Similarly, we do not know how much previous exposure to mirrors the cats in YouTube videos have had. Therefore, these videos do not test MSR directly. However, they provide insight into behaviors congruent to different stages of self-recognition, such as social responses, mirror inspection and testing behaviors (Suarez et al., 1986), which we can interpret partly in the context of mirror self-recognition, albeit with limitations.

In the AR filtered TikTok videos, we can observe any change in the cats' behaviors in response to the AR manipulation. If cats understand the reflective nature of phone screens, then we predict that they would explore the differences between their reflective image on the cellphone screen and some expectation, comparable to how a chimp or an elephant reacts to a mark on its face. In the TikTok videos, the human's face undergoes manipulation while behind the cat's own image. If cats understand the reflective nature of cell phone images and use reflections to spatially navigate their surroundings, we expect them to look at the phone screen, then to look at the human behind them in response to changes in the AR filtered phone image, such as when the human moves its mouth. In the YouTube videos, if cats recognize their own reflections, we expect them to exhibit self-directed behavior instead, such as self-investigation, rather than social reactions. If cats in either kind of video respond with aggressive or fearful behaviors as they would to another strange cat – such as by charging the mirror, through piloerection, or by displaying a bushy tail – or by trying to peer behind the mirror as though it were a door or window, then we conclude cats probably did not show self-directed behaviors and therefore do not pass the prerequisite for a traditional MSR test.

Figure 1

Screen Captures of Behavior Sequence in Video with Cat and Human with Augmented Reality Filter

Note. The placement of the human's chin in the second (upper right) screen capture, and the movement of the human's mouth in the third and fourth (lower two) screen captures. After TikTok post by user @funny_goe 2019-11-11.

Methods

We found TikTok videos of cats reacting to AR filters by searching publicly available content for terms like "cat face filter" (see Appendix A1). We found appropriate YouTube videos by using search terms like "cat mirror" (see Appendix A2). We analyzed 145 TikTok videos showing cats interacting with owners' AR filtered faces (posted between 2019-2020) and 57 YouTube videos showing cats interacting with mirrors (posted between 2012-2020). The search for each kind of video was exhaustive as of June 2020. From these videos we generated ethograms of cat behaviors (Tables 1 and 2), which were largely concordant with the one from Stanton et al. (2015; see Appendix B, Figure B1 for notable behaviors).

We described behavioral sequences in both TikTok and YouTube videos using BORIS v.7.9.8 (Friard & Gamba, 2016; www.boris.unito.it), including only those behavioral transitions that occurred more frequently than chance (p < .05 from 10,000 permutations). We further grouped YouTube videos into clusters based on the frequencies of cat behaviors, using a correlation distance matrix and ClusterVis (Metsalu & Vilo, 2015), a PCA-based clustering tool that incorporates several R packages (R Core Team 20221). We assessed the ability of clusters to explain variation in cat behaviors with the R package PERMANOVA (https://cran.r-project.org/package=PERMANOVA), using 1000 permutations. TikTok videos included relatively few behaviors per sequence, and we therefore excluded them from cluster analysis.

Table 1

Ethogram Used to Analyze Tiktok Videos

Title	Definition
human hug	Human is hugging the cat at the start of the video.
human contact	Human is not hugging but in contact with the cat at the start of the video.
human no contact	Human is not in contact with the cat at the start of the video.
human mouth	Human opens and closes mouth.
ears flinch	Cat flicks its ear(s).
ears back	Cat's ears are flattened against its head.
whiskers forward	Cat's whiskers fan out and are drawn forward.
whiskers back	Cat's whiskers are retreated back.
head towards	Cat turns head towards the screen.
head against	Cat turns head away from the screen.
head to human	Cat turns head towards human.
look around	Cat turns head from side to side.
eyes close	Cat closes eyes.
eyes widen	Cat widens eyes.
eyes towards	Cat's eyes gaze towards the screen.
eyes away	Cat's eyes turn away from the screen.
eyes to human	Cat's eyes point to the human.
eyes around	Cat changes gaze side to side several times.
pupils dilate	Cat's pupils are dilated.
pupils contract	Cat's pupils are narrowed.
yawn	Cat yawns.
bite	Cat bites human.
lick	Cat licks itself or human.
groom	Cat grooms itself.
rub	Cat rubs itself on human.
struggle	Cat struggles against human.
paw against	Cat puts its forelegs forward to push human away.
punch	Cat punches human.
filter on	The cat filter for human is applied.
human appear	Human appears in the video.
camera move	Camera moves to change the angle it is shooting.
exit	Cat exits the video.
enter	Cat enters the video.

Note. Names and descriptions of 33 events, including 4 human behaviors, 24 cat behaviors, and 5 events related to the video itself.

Table 2

Ethogram Used to Analyze YouTube Videos

Title	Definition
attack	Cat scratches the mirror using claws.
bushytail	The hair on the tail stand up.
charge	Cat launches itself at mirror with extended forelegs and attempts to combat.
crane neck	Cat cranes its neck sideways while its gaze is fixed on the mirror.
crouch	Slow, forward locomotion in a crouched position while directed towards mirror.
ears back	Ears are held at the rear of the head.
growl	Low-pitched, throaty rumbling sound made usually with the cat's mouth closed.
hiss	Cat makes drawn-out hissing sound.
in sight	Mirror is within the cat's field of vision.
look back	Cat (attempts to) looks behind the mirror.
meow	Cat makes a calm meow.
out of sight	Mirror is out of the cat's field of vision.
paw	Cat pats mirror with forepaws. Claws are usually retracted.
piloerection	The cat arches its back and raises hair on its body.
punch	Cat strikes at the mirror.
rear	Cat stands on its hind legs with forelegs reaching out or upwards.

retreat	Cat backs away from mirror.
sidestep	Cat jumps sideways from one position to another, ending with four feet on the ground.
snarl	Cat makes full-throated loud call with mouth wide open.
stalk	Cat lifts its forepaw as if to punch the mirror.
stand	Cat stands on hind legs with its forepaws off the ground.
turn back	Cat turns away from mirror.
turn towards	Cat turns towards mirror.

Note. Names and descriptions of 23 cat behaviors.

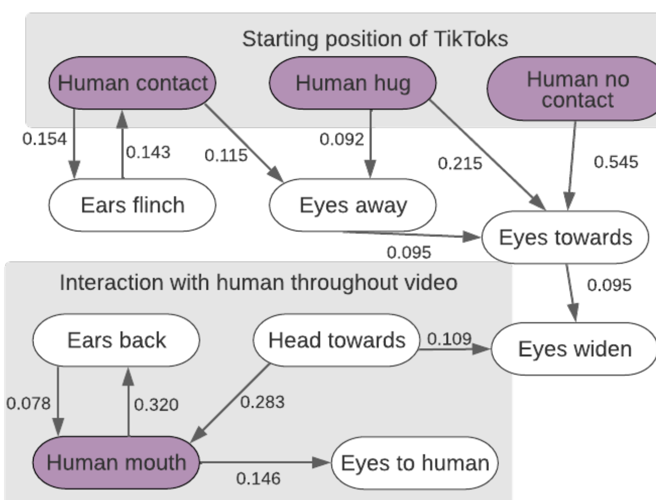
Results

Augmented Reality (AR) TikTok Videos

TikTok videos started with cats in one of three positions relative to humans (Figure 2, upper box), two of which involved human contact. The human's image is altered by the AR filter from beginning to the end of all the videos. Depending on the starting position, cats looked towards the phone image (Figure 2) up to 54.5% of the time. (Note Figure 2 refers to behavioral transitions and not TikTok videos; behaviors may have occurred more than once per video). Cats responded to the phone image (Figure 2, Head towards, lower box) in 84/145 videos (57.9% total), and among the 106 total individual occurrences where the cats responded to the phone image, in 28.3% the humans on screen moved their mouth, thus changing the AR appearance (Figure 2, Human mouth). Overall, the AR appearance changed in 17/145 (11.7%) of videos. The cat reacted to the AR image with ear movement 32.0% of the time, but 14.6% of cat reactions to the AR image entailed the cat looking back at the human, i.e., Human mouth to Eyes to human (Figure 2). However, we only saw the complete sequence, Heads towards to Human mouth to Eyes to human, where we can surmise that the cat reacted first to the phone, and then reacted to the AR image by looking at its human, in 2/145 (1.4%) of videos.

Figure 2

Behavioral Sequences of Cats and Owners in TikTok Videos



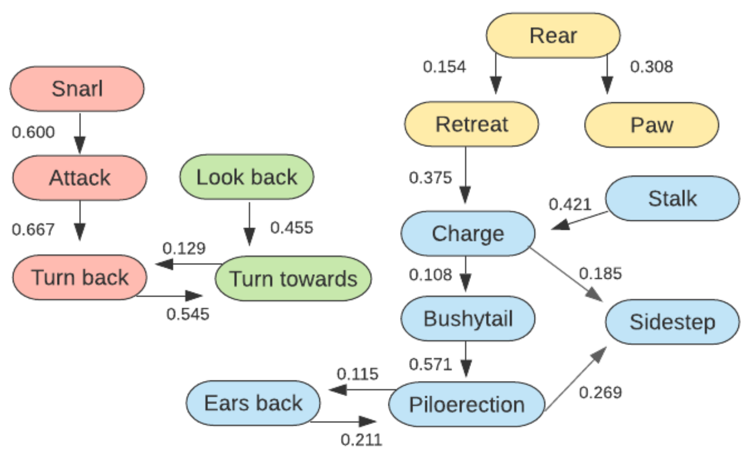
Note. Human behaviors (filled ovals) include contact, hug, and moving the mouth such that the AR filtered image changes ("Human mouth"). Cat behaviors (open ovals) include flicking ears ("Ears flinch") flattening ears ("Ears back"); looking away from ("Eyes away") or towards ("Eyes towards") the phone screen; turning head towards the screen ("Head towards") or moving gaze towards the human ("Eyes to human"). See Table 1 for ethogram details.

Mirror Response YouTube Videos

No humans were visible in the YouTube videos where cats reacted to mirror reflections. Cats often responded fearfully or aggressively (Figure 3; Snarl to Attack; Stalk to Charge to Bushytail to Piloerection to Sidestep). However, some cats repeatedly reared and pawed the mirror, but not aggressively (Figure 3; Rear to Paw). And some cats would try look behind the mirror then back at it (Figure 3; Look back to Turn towards), in a sequence consistent with Kraus (1949). This latter sequence would sometimes switch to (12.9%) or from (54.5%) an aggressive sequence (Figure 3).

Figure 3

Behavioral Sequences of Cats Exposed to Mirrors in YouTube Videos



Note. Sequences are colored according to clusters in Figure 4. See Table 2 for ethogram and Appendix B, Figure B1 for notable behaviors.

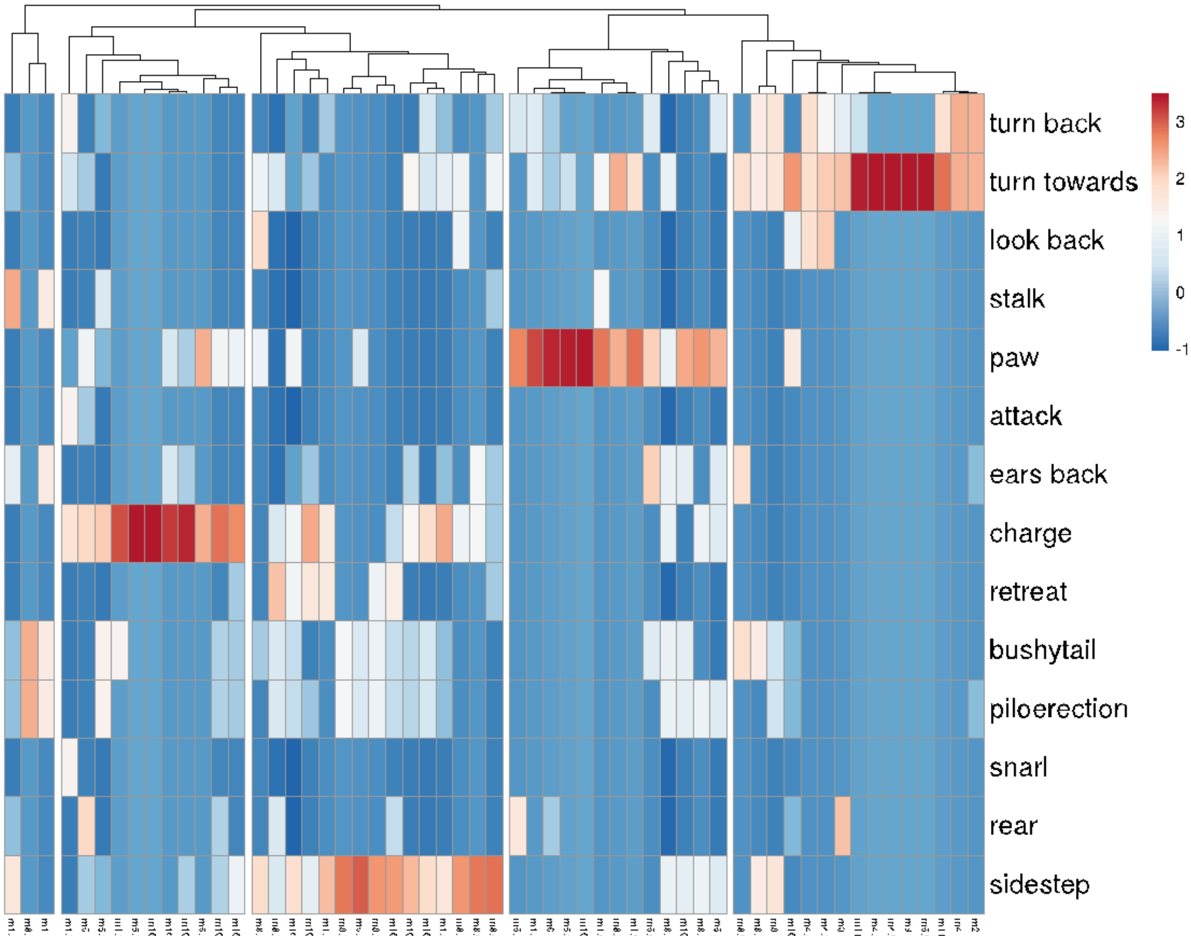
Including only significant behaviors revealed by sequential analysis, we found five likely clusters of cat behaviors among YouTube videos (Figure 4), Each cluster was characterized by high frequencies of one or a few behaviors (red bands in Figure 4); e.g., Turn towards (15/57), Paw (13/57), Charge (11/57), Sidestep (15/57), and one other cluster that had no obvious high frequency behaviors (3/57). In two clusters, cats appeared curious (Turn towards and Paw; 49.1% of YouTube cats); cats approached their reflection and either tried to look behind the mirror or pawed at the mirror, without piloerection or other signs of aggression. Two clusters included aggressive behaviors (Charge and Sidestep; 45.6%). These five clusters explained 47.1% of the variation among significant YouTube cat behaviors (PERMANOVA $F_{4,52} = 11.57$, $p < .001$) and 39.6% of the variation among all YouTube cat behaviors (PERMANOVA $F_{4,52} = 8.51$, $p < .001$).

Discussion

Behavioral sequence analyses offered little evidence that cats understand reflective images – or have the prerequisite behaviors to be eligible for the MSR test. Only 1.4% of the TikTok videos included cats who first turned to the phone image, then apparently responded to the AR filter by turning to their owners, although a larger proportion (14.6%) already facing the phone turned to their owners. We urge caution with even these low frequencies for several reasons. Some videos seem to show cats responding to other cues, such as the owners' touch, e.g., when an owner's chin touched the cat's head. Owners could also have encouraged cats with unconscious or surreptitious cues offscreen, i.e., they could have goosed their cats. In this way the TikTok videos may be subject to a kind of Clever Hans effect (Sebok & Rosenthal,

Figure 4

Heatmap of Cat Behaviors Recorded in YouTube Videos



Note. Cats fell into five clusters, each typified by high frequencies of some behaviors. Labels under heatmap refer to individual videos (Appendix A2). See Table 2 for ethogram and Appendix B, Figure B1 for notable behaviors.

1981), where cats respond to other cues from their owners than to the phone screens, per se (but see Schmidjell et al., 2012). Despite entire YouTube channels devoted to entertaining cats, little study on feline perception of digital screens exists. This lack of background information adds to the challenge of identifying how cats perceive phone screens amidst the other stimuli.

We found clusters of cat behavior sequences in the YouTube cat responses to mirrors. Nearly half the cats fell into clusters involving aggressive behaviors, which has not been reported previously. This aggression is similar to the first stage of social reaction that many animals who demonstrate MSR go through when first exposed to mirrors, but no further (Suarez et al., 1986). About half the cats fell into clusters involving exploratory behaviors, one of which, Turn towards, in which cats peered behind mirrors, was consistent with the pattern described by Kraus (1949). Curiosity does not by itself mean cats exhibit self-recognition, but it is consistent with the physical inspection of the mirror exhibited by other species in the process of replacing their social reactions to mirrors with self-directed behavior (Plotnik et al., 2006). Notice that cats often displayed social reactions to mirrors, while some species that do not exhibit social reactions at all, including elephants and dolphins (Plotnik et al., 2006, Reiss, 2001).

It is difficult to disentangle the patterns we see from potential confounding factors and biases. The behavioral sequences of individual cats can vary greatly, which required us to find clusters of cats with similar behavioral sequences or behavioral frequencies. Individual variation among cats performing cognitive tasks is itself worth investigating (Thornton & Lukas, 2012). For example, the clustered nature of cat responses may suggest that cat personality, or something like it, influences how cats react to mirrors. Because we gleaned data from pre-existing videos, our analysis cannot determine whether the clusters reported here correlate with measured cat personalities (Litchfield et al., 2017) or other categories of behavioral responses (e.g., Vitale et al., 2019). Variation among cats in their responses to mirrors may also reflect confounds or correlates with cat demographic components, like prior exposure to mirrors, cat age, or cat sex. We cannot tease out these confounds from our current analysis. It is intriguing to consider the possibility that repeated exposure might cause some cats to alter how they respond to their reflections. A more detailed longitudinal study might reveal repeatable sequences of behavioral responses, perhaps going from aggression to curiosity, or to other patterns of behaviors. Pet owners may also be motivated to make videos that "go viral" and post a disproportionately large number of videos that show cats responding to mirror images. We do not know how frequently videographers chose not to post mundane content where cats ignore or do not respond to mirrors. This motivation to post viral can obviously skew our sample.

Although some cats on social media display behaviors consistent with mirror-induced self-directed behaviors, such as grooming themselves in front of mirrors or seeming as if they had just discovered that they have ears (Mimothekitten, 2018), there are other explanations, including general curiosity about novel individuals or images. Indeed, the ways some of the curious cats in YouTube videos investigated their reflections, by pawing at them or trying to peer behind the mirrors, indicate cats did not understand how mirrors work. But even humans can be prone to the "mirror fallacy" (Heschl & Burkart, 2006). Like Rufus T Firefly in the movie *Duck Soup*, where Groucho Marx's character initially fails to ascertain whether he is looking at himself in a mirror or his brother Harpo's character's imitations of his behavior, we too sometimes explore what is – and is not – our own reflection (Shoemaker, 1994; Zunshine, 2018). Our observation of cats switching between behavioral patterns might indicate similar exploration.

Our analysis of data gleaned from the internet can be viewed as a "next-gen" natural history study (Tosa et al., 2021), in this case of cats on social media, where we extrapolate patterns from observable variation in cat behavioral responses. Even with the limitations of gleaning data from social media, this study analyzed over 200 cats, which points to the potential power of citizen cognitive science (e.g., Smith et al., 2021; Stewart et al., 2015), which may be comparable to other "big team" research projects such as the ManyDogs Project (ManyDogs Project et al., 2023). Furthermore, social media videos provide continuous recordings and the ability to revisit recorded events, which can provide advantages over other sampling methods (Brereton et al., 2022). The TikTok videos also suggest a general means of addressing MSR tests with cell phones, computer cameras, and AR filters, which could allow for very careful manipulation of reflective images. That is, AR manipulations allow researchers to place any kind of mark anywhere on an animal's image, without the confounding effects of paint that animals might detect, and without anesthetization. Using these kinds of filters with consumer grade technology like cellphones, and with the participation of citizen scientists, provides the potential for very large sample sizes along with careful experimental manipulations and controls. The limitation of the citizen science approach, and of gleaning data from social media, is that the data collection methods may not be well standardized and may vary between individual contributors. Therefore, data gleaning might best be viewed the way people view other observational natural history studies, as a preliminary step in exploring hypotheses, the results of which contribute to designing carefully controlled experiments that could test the findings. Even with the limitations of social media, our study revealed distinct clusters of curious and aggressive cat responses to mirrors, which had not been previously reported, and which may correlate to cat personalities or demographics.

Acknowledgements

We would like to thank Dr. Wannes Dupont for translating the work from Kraus (1949).

Funding: This research was done in partial fulfillment of the requirements for Kim Youngbean's Independent Reading and Research module at Yale-NUS College. This work was supported in part by the Ministry of Education through the Yale-NUS College start-up grant R-607-265-226-121, and through Yale-NUS's Centre for International and Professional Experience's Summer Research Program.

Conflict of Interest: The authors have no competing financial or non-financial interests that are directly or indirectly related to this study.

References

Altmann, J. (1974). Observational study of behaviour: sampling methods. *Behaviour, 49*, 227-267. https://doi.org/10.1163/156853974x00534

Anderson, J.R., & Gallup, G. G. Jr. (2015). Mirror self-recognition: a review and critique of attempts to promote and engineer self-recognition in primates. *Primates, 56*, 317-326. https://www.doi.org/10.1007/s10329-015-0488-9

Boydston, E. E., Abelson, E. S., Kazanjian. A., & Blumstein, D. T. (2018). Canid vs. canid: insights into coyote–dog encounters from social media. *Human–Wildlife Interactions, 12*(2), 233–242.

Brereton, J. E., Tuke, J., & Fernandez, E. J. (2022). A simulated comparison of behavioural observation sampling methods. *Scientific Reports, 12, 3096*. https://doi.org/10.1038/s41598-022-07169-5

Bungum, H. Z., Tan, H. Y. M. M., Borker, A., Hsu, C. D., Johns, P. (2022). Multiple reproductive females in family groups of smooth-coated otters. *Ethology*. https://doi.org/10.1111/eth.13263

Chang, L., Zhang, S., Poo, M. M., Gong, N. (2017). Spontaneous expression of mirror self-recognition in monkeys after learning precise visual-proprioceptive association for mirror images. *PNAS*, *114*, 3258-3263. https://doi.org/10.1073/pnas.1620764114

Friard, O., Gamba, M. (2016). BORIS: a free, versatile open-source event-logging software for video/audio coding and live observations. Methods in Ecology and *Evolution*, *7* 1325–1330. https://doi.org/10.1111/2041-210X.12584

Gallup, G. G. Jr. (1970). Chimpanzees: self-recognition. *Science*, *167*, 86-87.

Gallup, G. G. Jr. (1982). Self-awareness and the emergence of mind in primates. *Am. J. Primatol*, *2*, 237-248. https://doi.org/10.1002/ajp.1350020302

Heschl, A., Burkart, J. M. (2006). A new mark test for mirror self-recognition in non-human primates. *Primates*, *47*, 187-198. https://www.doi.org/10.1007/s10329-005-0170-8

Howell, T. J., Bennett, P. C. (2011). Can dogs (*Canis familiaris*) use a mirror to solve a problem? *J Vet Behav*, *6*. 306-312. https://doi.org/10.1016/j.jveb.2011.03.002

Howell, T. J., Toukhsati, S., Conduit, R., Bennett, P. (2013). Do dogs use a mirror to find hidden food? *J Vet Behav*, *8* 425-430. https://doi.org/10.1016/j.jveb.2013.07.002

Kohda, M., Sogawa, S., Jordan, A. L., Kubo, N., Awata, S., et al. (2022). Further evidence for the capacity of mirror self-recognition in cleaner fish and the significance of ecologically relevant marks. *PLOS Biology*, *20*(2), e3001529. https://doi.org/10.1371/journal.pbio.3001529

Kopp, K. S., Ebel, S. J., Wittig, R. M., Haun, D. B. M., Crockford, C. (2021). Small mirrors do the trick: A simple, but effective method to study mirror self-recognition in chimpanzees. Animal Behavior and *Cognition*, *8*, 391-404. https://doi.org/10.26451/abc.08.03.05.2021

Kraus, G. (1949). Over De Psychopathologie en De Psychologie Van De Waarneming Van Het Eigen Spiegelbeeld. Ned Tijdschr *Psychol*, *4*, 1-37. PMID: 18131275

Litchfield, C. A., Quinton, G., Tindle, H., Chiera, B., Kikillus, K. H., Roetman, P. (2017). The 'Feline Five': An exploration of personality in pet cats (*Felis catus*). *PLoS ONE*, *12*(8), e0183455. https://doi.org/10.1371/journal.pone.0183455

Loong, S., Yong, C. K. S., Johns, P., Plowden, T., Yong, D. L., Lee, J., Jain, A. (2021). Nest predation by oriental pied hornbills *Anthracoceros albirostris* in urban Singapore. *BirdingASIA*, *35*, 86-91.

ManyDogs Project, Alberghina, D., Bray, E. E., Buchsbaum, D., Byosiere, S. E., Espinosa, J., Gnanadesikan, G. E., & Stevens, J. R. (2023). ManyDogs Project: A Big Team Science Approach to Investigating Canine Behavior and Cognition. *Comparative Cognition and Behavior Reviews*, *18*, 059-077 https://doi.org/10.3819/CCBR.2023.180004

Metsalu, T., Vilo, J. (2015). Clustvis: a web tool for visualizing clustering of multivariate data using Principal Component Analysis and heatmap. *Nucleic Acids Research*, *43*(W1), W566–W570. https://doi.org/10.1093/nar/gkv468

Mimothekitten. (2018, September 14). *Curious cat discovers ears* [Video]. *Instagram* https://www.instagram.com/p/BnrkkOUHXzd/?utm_source=ig_web_copy_link

Nelson, X. J., Fijn, N. (2013). The use of visual media as a tool for investigating animal behaviour. *Anim Behav*, *85*, 525-536. https://doi.org/10.1016/j.anbehav.2012.12.009

Nosowitz, D. (2013). This cat did not figure out how mirrors work. *Popular Science*. https://www.popsci.com/science/article/2013-04/cat-did-not-figure-out-how-mirrors-work/ Accessed 24 Jan 2022.

Povinelli, D. J., Gallup, G. G. Jr., Eddy, T. J., Bierschwale, D. T., Engstrom, M. C., Perilloux, H. K., Toxopeus, I. B. (1997). Chimpanzees recognize themselves in mirrors. *Anim Behav*, *53*, 1083-1088. https://doi.org/10.1006/anbe.1996.0303

Plotnik, J. M., de Waal, F. B. M., Reiss, D. (2006). Self-recognition in an Asian elephant. *PNAS*, *103*, 17053-17057. https://doi.org/10.1073/pnas.0608062103

R Core Team. (2021). R: A language and environment for statistical computing. *R Foundation for Statistical Computing*, Vienna, Austria. https://www.R-project.org/

Reiss, D., Marino, L. (2001). Mirror self-recognition in the bottlenose dolphin: A case of cognitive convergence. *PNAS*, *98*, 5937–5942. pmid:11331768 https://doi.org/10.1073/pnas.101086398

Schmidjell, T., Range, F., Huber, L. & Virányi, Z. (2012). Do owners have a Clever Hans effect on dogs? Results of a pointing study. *Frontiers in Psychology*, *3*, 558. https://www.doi.org/10.3389/fpsyg.2012.00558

Sebeok, T. A., Rosenthal, R. (eds) (1981). The Clever Hans phenomenon: communication with horses, whales, apes, and people. *Annals of the New York Academy of Sciences*, *364*, 309.

Shoemaker, S. (1994). Self-Knowledge and "inner sense": Lecture I: the object perception model. *Philosophy and Phenomenological Research*, *54*, 249-269. https://www.doi.org/10.2307/2108488

Smith, G. E., Chouinard, P. A., Byosiere, S. E. (2021). If I fits I sits: a citizen science investigation into illusory contour susceptibility in domestic cats (*Felis silvestris catus*). *Applied Animal Behaviour Science*, 240, 105338. https://doi.org/10.1016/j.applanim.2021.105338

Stanton, L. A., Sullivan, M. S., Fazio, J. M. (2015). A standardized ethogram for the Felidae: a tool for behavioral researchers. *Applied Animal Behaviour Science*, *173*, 3-16. https://doi.org/10.1016/j.applanim.2015.04.001

Stewart, L., MacLean, E. L., Ivy, D., Woods, V., Cohen, E., Rodriguez, K., et al. (2015). Citizen science as a new tool in dog cognition research. *PLoS ONE*, *10*, e0135176. https://doi.org/10.1371/journal.pone.0135176

Suarez, S. D., & Gallup, G. G. Jr. (1986). Social responding to mirrors in rhesus macaques (Macaca mulatta): Effects of changing mirror location. *American journal of primatology*, *11*(3), 239–244. https://doi.org/10.1002/ajp.1350110305

Swartz, K. B., & Evans, S. (1991). Not all chimpanzees (Pan troglodytes) show self-recognition. *Primates, 32*(4), 483–496. https://doi.org/10.1007/BF02381939

Thornton, A., Lukas, D. (2012). Individual variation in cognitive performance: developmental and evolutionary perspectives. *Philos Trans R Soc Lond B Biol Sci*, *367*, 2773-83. https://doi.org/10.1098/rstb.2012.0214

Tosa, M. I., Dziedzic, E. H., Appel, C. L., Urbina, J., Massey, A., Ruprecht, J., Eriksson, C. E., Dolliver, J. E., Lesmeister, D. B., Betts, M. G., Peres, C. A., Levi, T. (2021). The rapid rise of next-generation natural history. *Front Ecol Evol*, *9*, 698131. https://doi.org/10.3389/fevo.2021.698131

Vanhooland, L. C., Szabó, A., Bugnyar, T. *et al.* (2023). A comparative study of mirror self-recognition in three corvid species. *Anim Cogn, 26*, 229–248. https://doi.org/10.1007/s10071-022-01696-4

Vitale, K. R., Behnke, A. C., Udell, M. A. R. (2019). Attachment bonds between domestic cats and humans. *Current Biology*, 864-R865. https://doi.org/10.1016/j.cub.2019.08.036

de Waal, F. B. M. (2008). The thief in the mirror. *PLoS Biol*, *6*, e201. https://doi.org/10.1371/journal.pbio.0060201

de Waal, F. B. M. (2019). Fish, mirrors, and a gradualist perspective on self-awareness. *PLoS Biol*, *17*, e3000112. https://doi.org/10.1371/journal.pbio.3000112

Wetsman, N. (2019). The Snapchat cat filter shows how little we know about cat cognition. *The Verge*. https://www.theverge.com/2019/12/14/21020648/snapchat-cat-filter-video-recognition-cognition-mirror-test. Accessed 24 Jan 2022.

Yokose, J., Marks, W. D., & Kitamura, T. (2024). Visuotactile integration facilitates mirror-induced self-directed behavior through activation of hippocampal neuronal ensembles in mice. *Neuron, 112*(2), 306-318.e8. https://doi.org/10.1016/j.neuron.2023.10.022

Zunshine, L. (2018). Groucho, Harpo, and narrative theory. *Style*, *52*, 141-147. https://doi.org/10.5325/style.52.1-2.0141

Appendix A

Video Sources from which Data were Gleaned

Appendix A1

TikTok videos analyzed. We first used the search terms "cat face" and "cat face filter," and were able to locate the original viral video posted (2019-11-11) by user @funny_goe, which received over 8M views and 736.6k likes (as of Jan 2022). After clicking on its audio, titled "original sound (untitled)," we were able to find 67.8k related videos. We went down this list of videos with descending popularity as the order and only chose the videos that included cats and the cat face filter on a human. As we traverse down the list of videos, they became increasingly irrelevant to the cat face trend and we stopped data gleaning after 150 videos, 145 of which were exclusively cat videos. https://doi.org/10.6084/m9.figshare.21080818

Appendix A2

YouTube videos analyzed. We first used the search terms "cat mirror", using "Relevance" as a filter. After exhausting the list of videos that consisted of cats reacting to mirrors (with no human involved), we then changed the filter to "Upload date." We then went down the list, gleaning videos that were novel from the results of our first search. We stopped searching after reaching videos posted in 2012. This search yielded 57 separate instances of cats reacting to mirrors. https://doi.org/10.6084/m9.figshare.21080929

Figure B1

Diagram Of Notable Cat Behaviors In YouTube Videos Whose Descriptions Might Not Do Them Justice (See Table 2)