Research Article

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Connecting to nature through tech? The case of the iNaturalist app

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Abstract

Self-defined as 'an online social network of people sharing biodiversity information to help each other learn about nature', *iNaturalist* is a mobile application whose primary goal is 'to connect people to nature', closely followed by the secondary goal of 'generating scientifically valuable biodiversity data from these personal encounters', which the founders believe can be achieved simultaneously with the primary goal in a self-reinforcing logic. Following an approach informed by media studies on wildlife photography and film, and science and technology studies as well as insights from interviews with users and participant observation in the Los Angeles area, this article makes the case that mobile applications such as *iNaturalist* sit at a tension because while they can ignite interest in the natural environment, they also prescriptively describe and normalize a 'nature' and an epistemology that are particular to the natural sciences.

Keywords

Animals, Instagram, mobile media, nature, spectacle, taxonomy, wildlife photography

'I hope he's not claustrophobic', said a young boy to his mother and a small group of adults while we all stared at a bombardier beetle being passed around inside a small display case with a magnifying lens on top. The goal was to get a nice, clear picture of it to contribute as an 'observation' in the context of the City Nature Challenge 2018, a citizen science competition around urban biodiversity organized by the Natural History Museum of Los Angeles County (NHMLA) and the California Academy of Sciences, based on the use of the *iNaturalist* app. One among many of its kind that have recently emerged (Brigida, 2011), *iNaturalist* is a mobile application that allows people to photograph any living thing around them, find out its taxonomy through an algorithmic neural network trained to recognize species, and upload it to a substantive

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database shared by a wide community of users. If the 'observation' evidences a wild organism (meaning not a pet or a cultivated plant), has an accurately specified date and location (the app will register the coordinates of the encounter via the phone's GPS capabilities unless otherwise configured), and is identified down to the species level with the verifying support of two or more users, then the photograph acquires 'research grade'. In practice, this upgrade from 'casual grade' means that the 'observation' becomes a data point that is passed along to the Global Biodiversity Information Database.

Self-defined as 'an online social network of people sharing biodiversity information to help each other learn about nature', the app's primary goal is 'to connect people to nature', meaning 'getting people to feel that the non-human world has personal significance, and is worth protecting', something deemed very important because 'recording information about nature in a social context is a tremendous way to understand the awesome depth and breadth of life on Earth' (iNaturalist, 2016). Closely related, however, is the secondary goal of 'generating scientifically valuable biodiversity data from these personal encounters', which the founders believe can be achieved simultaneously with the primary goal in a self-reinforcing logic:

> We believe *iNat* can achieve both of these goals simultaneously – in fact that they reinforce one another – but when we get pulled in conflicting directions, we measure success by our primary goal. If *we connect people to nature* without contributing to any specific scientific outcomes or quantifiable conservation results, then we're still doing our job, but if we just contribute to science without helping people care about the natural world, we'll be on the wrong track. (iNaturalist, 2016, emphasis added)

The main objective of this article is to trouble that conception and question whether it is in fact possible to 'connect people with nature' through this practice, while also interrogating the construction of 'nature' that is being foregrounded. What it argues is that mobile applications such as *iNaturalist* sit at a tension: on the one hand, they have the potential to ignite interest in the natural environment, but, at the same time, they can also have the effect of further distancing individuals from it by reinforcing the constructed human/nature divide that characterizes Western thought. This has the effect of enthroning both an ontology and epistemology of nature that is particular to the natural sciences. Furthermore, while using *iNat* might bring awareness of the presence of nonhuman others in proximal settings, it can also perpetuate the conceptualization of nature as a spectacular commodity, a shimmering image meant to be consumed.

This analysis follows an approach informed by media studies on wildlife photography and film, science and technology studies, and citizen science literature. Additionally, it draws from insights obtained through participant observation and from a set of interviews conducted with users of *iNat* who attended publicly available events featured in the app and agreed to be interviewed for this project, as well as other users referred to me by some of those attendees. The interviews that inform this research also include interactions with people who were using the app in a different context, namely as part of a training to become California-certified naturalists and as part of a class exercise. All of this took place in the Los Angeles region, where 'connecting to nature' may present special challenges as this is a megacity home to sprawling development and heavy industrialization, including hundreds of factories and the busiest seaport in the Western Hemisphere as well as a concrete river. At the same time, it is a place with special material affordances, such as a pleasant subtropical climate characterized by mild winters and mostly sunny days, as well as the country's largest urban national park, only 8 miles from downtown. Indeed, LA is simultaneously the 'end of nature' (McKibben, 2006) and a supreme manifestation of the 'urban wild' as it encompasses trail-crossed mountain ranges, rugged canyons, miles of beaches, and rustic hillsides

where coyotes, curlews, herons, mountain lions, foxes, wolves, hawks, and racoons can be spotted (see Price, 2005).[1] Lastly, the work also relies on a variety of secondary source material, mostly media texts available through the app's online ecosystem that includes social media accounts, online articles, and a blog.

Nature commodification through media

Nature is a contested idea, so much so that Raymond Williams (2014: 164) described it as 'perhaps the most complex word in the language', one whose trajectory reveals 'a history of a large part of human thought'. Indeed, 'nature' exists in a mutually informing relation with 'culture'; that is, the category of nature is not merely a material one but is always also a product of culture or what Latour (1993) calls 'nature-culture' and Haraway (2003) 'natureculture'. However, as Latimer and Miele (2013) have noted, the relation between nature and culture, of the human and nonhuman, is usually enacted and performed as division and dichotomy couched within a Western discourse edified around binaries such as mind/body, civilized/primitive, and, more importantly, human(culture)/nature.

This Western analytical tradition 'turns everything into a resource for appropriation' because that which is so apprehended becomes an object that guarantees the power of the knower – without ever getting status as agent in the productions of knowledge: 'It – the world – must, in short, be objectified as thing, not as agent; it must be matter for the self-formation of the only social being in the productions of knowledge, the human knower' (Haraway, 1991: 197). Within this tradition, 'nature is only the raw material of culture, appropriated, preserved, enslaved, exalted or otherwise made flexible for disposal by culture in the logic of capitalist colonialism' (Haraway, 1991: 198).

In Europe and North America particularly, this manifests in a romantic image of the natural world, one fostered by a tradition of brave explorers who discovered exotic creatures in far off lands and then brought that back to an enthralled public, one which has developed since the Enlightenment (Jeffries, 2003). In this image, nature is akin to the sublime and, in turn, to the wild. That is, nature is only seen in its vast objects – mountains, oceans, stars, and cosmic space (Nicolson, 1997) – and in a wilderness – understood as a sublime natural landscape, characterized by vastness, infinity, succession and uniformity, and magnificence and light (Stormer, 2004) – uncontaminated by human civilization and its urban-industrial perils. This understanding of nature as a pristine and stable landscape 'out there' is but a cultural construction that works to maintain 'nature' and 'culture' as two separate, incommensurable realms while fetishizing sublime places and open country (see Cronon, 1996) and that continues to sit at the base of our contemporary understanding of the natural environment.

Alongside this natural sublime emerged a technological sublime, which became particularly popular in the United States. As Benson (2010) has noted, Americans' fascination with the wild has always been inherently connected to their equally fervent enthusiasm for technology, which explains why one of the first forms of media apprehension of the natural environment was through *photography*. In one of the key texts for thinking about how humans visually capture animals, Berger (1991) argues that capitalism's reorganization of society has separated us from animals with whom we used to live and, to compensate for this disconnection, offered *images* of animals instead. But, as he notices, the peculiarity of this photography is that it presents an image of the animal as fundamentally separate from the human and offers only a transparent and pure access to nature, erasing even the actual taking of the photograph. Consequently, as animals everywhere 'disappear', they are replaced by imagery and spectacle. While this is a generative argument, it

should be noted that this seminal work has been intelligently criticized for preserving a construct of nature as radically separate from human culture (Armbruster, 1998), given that Berger's conception does represent a more teleological vision of nature that depicts it as an innocent space from which humans must be excluded so as not to allow corruption, as well as constructs a 'history of seeing' that denies the agency of animals and does not question what might be lost for them in that history (Baker, 1993; Burt, 2005).

Others who are critical of the construction of nature as separate from culture have also discussed the role that photography plays in its perpetuation. In his examination of the intersections of animals and cameras in late-nineteenth and early-twentieth century in America, Brower (2011: xvii) provides a clear description of the discursive regime of wildlife photography that continues to shape our current understandings of animals and animal imagery, which is characterized by a separation from animals: 'By positioning real animals as occupying a realm of deep nature, wildlife photography transforms animals into spectacle, severing the human-animal connection; real animals, therefore, only exist when humans are absent'. This rhetoric is coupled with what Brower (2005) calls 'contemporary American woodlore', which suggests that it is acceptable, in fact proper, to 'take only photographs and leave only footprints' when entering 'wilderness' and thus renders photography as a nonintrusive, nonextractive, environmentally friendly activity. Given how central the mode of animals' visualization is to the understanding of human–animal relations (Baker, 2000; Burt, 2002), it is important that we follow Brower in denaturalizing and exposing the constructed nature of wildlife photography as an indexical social practice.

In this context, what are the kinds of viewing and apprehending that *iNaturalist* requires and the kinds it enables? In the context of the City Nature Challenge 2018, a BioBlitz – an event where people try to find as many species as possible – was organized around a popular coastal area, on a beach below steep bluffs that offered great beachcombing and huge tide pools to explore. Unlike a previous similar event hosted by the same scientific research team, this BioBlitz started with an explanation of the significance of the area (its harboring of a uniquely broad diversity of unrelated species, namely species that, although similar in appearance, actually come from very different, distantly related evolutionary families), and with the instruction to be gentle to the animals living there. As a clear expression of 'contemporary American woodlore', the participants of the event were instructed by the scientists to pick up rocks to find 'stuff', take a picture of it, upload it to *iNaturalist*, and put them back in their exact position, as if nothing had happened. In fact, because it wasn't possible for us to get stung, bitten, or injected given the particularly benign nature of the species present, we were encouraged to touch and feel things. Thus, this manipulation of nonhuman beings for the purpose of their visual capturing as a photographic observation through a mobile device was normalized, and the conception of photography as a model of noninterventionist right practice that offers a vision of nature as a special, nonhuman space in which humans do not belong was reified.

Additionally, something that the practices around *iNaturalist* effectively obscure is the labor behind the photographic process. Inhibiting appreciation of the mode of production is characteristic of the rhetoric of wildlife photography, but, as some have noted (McKibben, 1997), this separation only occurs within the logic of the images themselves and not in their actual production as nature's 'paparazzi' sometimes go to worrisome extremes to take pictures of wildlife. During that BioBlitz, one of the researchers found a small octopus that she placed on a white tray with water so that all the participants could see and photograph it. Not only did she have to patiently search for it and kneel on the slippery rocks to get it, but, in order for her to effectively show everybody, she had to keep balancing the tray so that the octopus wouldn't escape, something that

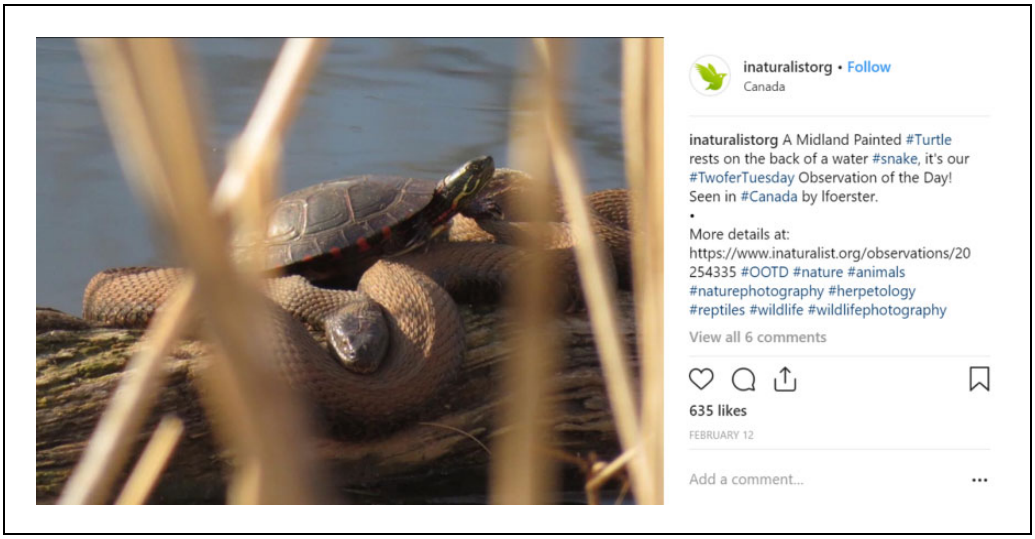

Figure 1. Still of a turtle and a snake balancing together taken by a 'human spy' from behind the bushes. Screenshot of *iNaturalist*'s public account on Instagram.

it was clearly trying to do by aiming for the corners after each jet propulsion. Not only that, but she kept changing the water each time the octopus released ink (a behavior considered to occur as a defense when threatened by predators), which happened three times while she was showing it just to one subgroup of the participants. Although the presence of humans is easier to infer from some of the pictures taken that day because their white background reflects the fact that most of the species photographed were placed in white trays, the majority of the images that circulate in the *iNaturalist* database can be characterized by the lack of reference to human presence. This means that, while it is possible to observe a human hand holding something like a California newt or a mollusk, the clear majority of the photographs are uber-detailed, close-up shots of species in a 'natural' setting (Figure 1).

To better understand the kind of viewing at place here and how it is produced, it is useful to consider another medium for visually capturing the natural environment where the preference for the spectacle over the perceptible world is even clearer: wildlife film documentaries. Just as with wildlife photography, these visual products also structure human–animal relations in a particular way in their representation of animals as expendable resources to be exploited and dominated (Chris, 2006), as markers against which the concept of 'human' can be made meaningful (Mills, 2017) and as providers of entertainment and spectacle (Chris, 2006; Mitman, 2012; Scott, 2003). Because the development of film as a research and educational tool within the scientific domain coincided with the rise of film as a Hollywood technology of mass entertainment, drama and amusement were always part of the formula. As the century progressed, more and more editing and effects were added to the movies and, as a consequence, 'the distillation of the natural world into a series of *dramatic* moments on film created an expectation of nature among lay audiences that was rarely, if ever, realized in the field' (Mitman, 2012: 72, emphasis added). Just as animals were assessed against the image of the wild-animal-in-nature that wildlife photography helped construct, here animals were compared against a spectacular and dramatic film version of themselves (Figure 2).

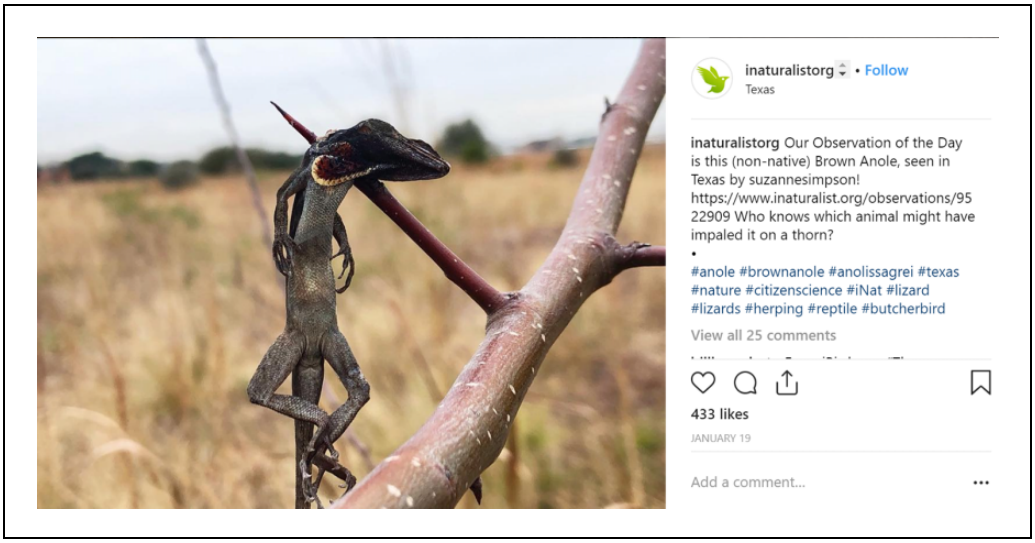

Figure 2. Spectacular capture of a brown anole dramatically impaled on a thorn by a 'butcher-bird'. Screenshot of *iNaturalist*'s public account on Instagram.

This tyranny of the visually spectacular is what Haraway gets at when she argues that 'the critters of the world . . . are assayed by the standard of the visually convincing and, at least as important, the visually new and exciting' (Haraway, 2008: 251). As such, in the exploitation of nature for financial gain through media and its transformation into images that are circulated, nature becomes spectacle, and, in nature as spectacle, following Debord's (1967) logic, reality is partially apprehended as it unfolds in a pseudo-world solely as an object of contemplation, where nature is but a dramatic hyperreal nature. This construction of 'spectacular nature' underpins most of the practices around *iNaturalist* and is institutionally reinforced. As part of its ecosystem, *iNaturalist* has a blog that features something called 'Observation of the Week', which is a curated selection of photographs presented as the highlight observation of that week. These pictures invariably are high-definition, close-up shots of species from all over the world that present a tremendous amount of detail, thus offering not only a dramatic but a hyperreal representation of nature.[2] There is also an Instagram account for *iNaturalist* that features 'Observation of the Day', a collection that follows these same aesthetic criteria and thus showcases pictures because of the drama related to the picture, such as an octopus inside the mouth of a yellow eye rockfish, inside the belly of a lingcod or the impaled lizard above, or because of the exotic or rare nature of the species, such as a Bornean Clouded Leopard or a rare *Serruria rostellaris protea* (Figure 3), one of only three and four available images of the species in the database, respectively.[3]

Equally important, another selection criterion for this curated series of images is the overall spectacular aesthetic of the picture itself (Figure 4).

The visually spectacular influence of Instagram seems to loom large on users, as noted by a quote from one of them whose photograph was featured as a special observation in *iNaturalist*'s blog: 'I now have a greater appreciation of nature and am amazed at what I see on a daily basis'. At face value, this could be characterized as an expression of a perceived heightened sense of

Figure 3. Hyperreal photograph of a rare flowering plant, the *Serruria rostellaris* protea, of which there are only a handful of photographs. Screenshot of *iNaturalist*'s account on Instagram.

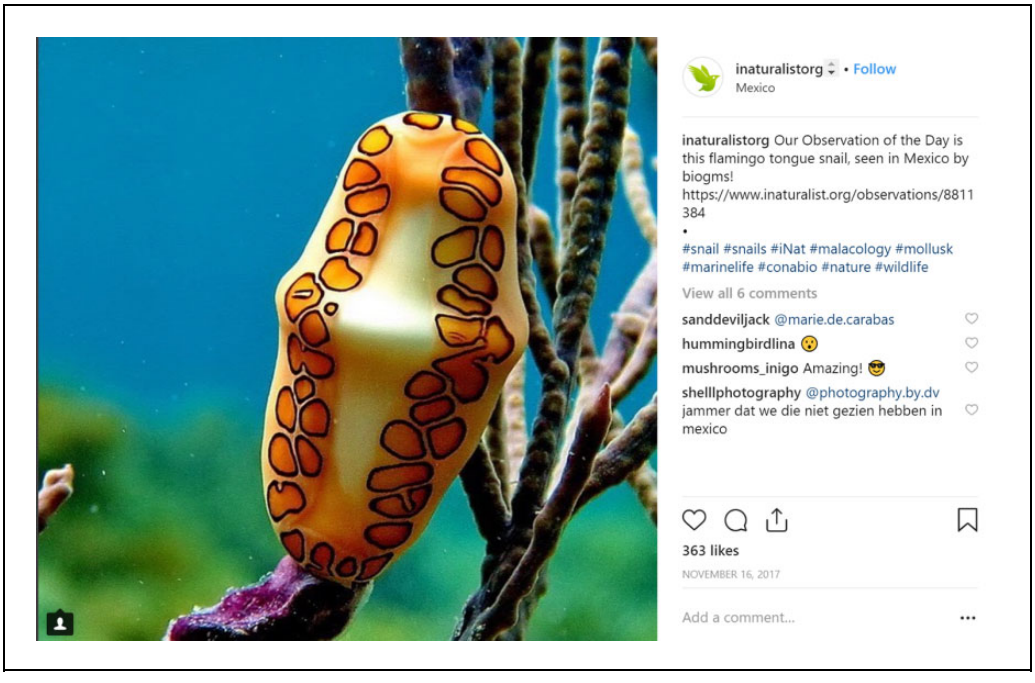

Figure 4. Another spectacular and hyperreal observation of the day, in this case of a flamingo tongue snail. Screenshot of *iNaturalist*'s public account on Instagram.

connection to the natural environment through an increased awareness of the presence of non-human others in proximal spaces of daily life where they might have gone unnoticed before, brought about by the use of the app. However, right after that sentence, the same user writes: 'The luck is finding something interesting to photograph . . . ' (Iwane and iNaturalist, 2017), which reveals that his appreciation is granted only to certain entities that are deemed 'interesting' by that user, which more often than not is inherently related to the spectacular quality of a specimen. In a similar fashion, a college student in a field biology class that incorporates *iNaturalist* explained to me that although when he started using the app he would photograph 'whatever', his current use was determined by the quest to find something 'cool' because 'things like bushes and leaves that are not sticking out, it's harder to identify but when you find something colorful . . . it's kinda cool'. He also mentioned that, after his coursework was done, he planned on using the app only if he saw something 'cool' that the *iNaturalist* database did not already have in the hopes that the picture would become one of those featured daily or weekly observations on Instagram.

This change over time in users' practices was also noted by a professional biologist very familiar with the app (who even informally acted as beta tester), when he told me that 'as a *pioneer* observer, everything is new' but that 'as a veteran' walking some common trails 'you see all those little dots . . . you know it's got to be super rare'. He was referring to a feature of the app that allows a user to '*explore*' the observations other people made in the user's current location, and one of the ways in which that is displayed is as a map with little dots or pings in different colors. Thus, while it is possible to appreciate how the quest for the exotic or the spectacular shapes users' practices, it is also important to underscore the problematic effect those have, which is that they render a skewed photographic sample of nature. In conversation with this biologist, he pointed out that this 'common psychology' around the use of the app creates a situation that 'it's the inverse of reality almost', where the most common plant actually becomes the rarest observation, in the sense that photographs of common species do not occur nearly as frequently as the 'observations' of the rare things despite the formers' more factual frequent occurrence. This not only renders the aforementioned photographic sample skewed but can also distort the perception of what is actually present as users skip over the mundane and ubiquitous. Moreover, the placement of higher value on certain photographs over others is inherently related to the extolling of vision over other senses, as this mobile app only allows users to 'connect with nature' – really, document a reified nature – through pictures. While the desktop version does support the inclusion of sound as an 'observation', at the moment of writing, there are only 153 'observations' with sounds in the Los Angeles area out of the grand total of 307,380 'verified observations'. In this way, the app incentivizes a very particular interaction with the natural environment, namely a visual, still and proximate one.

To fully characterize the commodification of the natural environment that the practices around this app enable, it is necessary to analyze the modes in which these pictures are distributed, as circulation is also a value generating mechanism. For example, another 'Observation of the Week' in *iNaturalist'*s blog was that of a *Aspidimorpha sanctaecrucis* beetle which was featured because the photograph had become one of the most viewed social media posts ever, with almost 12,000 views on Twitter, where it became popular as 'Power Ranger beetle', and 6000 on Facebook, where it was called 'Iron Man beetle' (Iwane and iNaturalist, 2017). Similarly, when a group of *iNaturalist* users and I came across a native California peony – a rare find – during a hike on some foothills north of the city of Los Angeles, one of them relayed the story of how elated she was when she had found a native Orchid in a similar situation only to finish by claiming that that photograph 'was quite the hit on *iNaturalist* . . . I had a lot of attention on that one'. While the most circulated

pictures tend to be the most valuable ones, meaning the most *spectacular* ones, it can be argued that in the context of *iNaturalist*, any picture that is not uploaded and shared is worthless, rendering the experience in the natural environment that led to that picture as obsolete and, what is more, nonexistent. In this sense, these digital photographs of a 'wild nature' become commodities whose value increases as its exchange value increases and can even perform as 'trophies' in the same way that photographs performed as hunting trophies for American camera hunters in the 1890s (see Brower, 2011).

Moreover, there is also a clear accumulation logic in place, evidenced not only by users' practices and profiles but also in the design of *iNaturalist* itself. When describing her use of *iNaturalist* to me, a young woman I encountered on a trail in a hilly, wooded area northeast of the city of Los Angeles admitted that she doesn't spend more than a couple of seconds photographing the plants she comes across because for her 'it's more like here we go, got it, got it, on to the next thing'. This type of behavior constitutes another trait of the 'common psychology' noted by the biologist above, namely that the goal that a significant amount of people have when using the app is to get more observations and more species in their record. In fact, he mentioned the case of a former student of his who would sometimes have over a hundred observations a day, something that lead him to wonder whether his student was having an observational experience or just 'stamp-collecting' but which nonetheless lead the team behind *iNaturalist* to give him an award for 'most observations'. This positive reinforcement is also embedded in the design of the desktop version of the app that, unlike the mobile app, features a 'Community' section through which users can find other users. Here, the people who form the *iNaturalist* community are displayed in 'Leaderboards' ranked from first to fifth, sorted by 'most observations', 'most species', and 'most identifications' for the current month and year, as well as past months and years (iNaturalist, n.d. b). Thus, although the community is said to be comprised of a little less than a million total users, the website only features a handful of them, namely those who have accumulated the most (this is equivalent to monthly 'observations' in the order of the thousands and species in the hundreds). A ranked list of users based on their accumulated total observations is also the way in which *iNaturalist* displays observers when sorted by region in the 'Explore' section. Los Angeles, for example, displays a total of 11,762 users with verifiable observations (this means that they are eligible for research grade), but the website only shows the first 500 ranked by number of 'observations' and species observed (for the user in the first place is 17,675 and 1860, respectively, while for the one in 500th place, it is 75 and 38, also respectively; see iNaturalist, n.d. a). Although this community itself can be construed as spectacle in Debord's (1967) conception of it, given that it is 'a social relationship between people that is mediated by images', so can the whole set of constructed practices around *iNaturalist*, which can be argued to be replacing the perceptible world 'by a set of images that are superior to that world yet at the same time impose themselves as eminently perceptible'.

Finally, it should be noted too that the app capitalizes on our already 'built-in' contemporary and common sociocultural behaviors, namely those of taking and sharing digital photographs through networked devices and online platforms. Indeed, the cameras on our smartphones have become daily companions and, as a result, people take more photos now every 2 min than ever existed in total 150 years ago (Eveleth, 2015). Moreover, those photographs then get shared online through social networks such as Instagram, where over 40 billion photos and videos have been shared since its emergence (in 2010), and 95 million are uploaded daily (Lister, 2019). Therefore, the use of *iNat* is cemented by the daily practices of users-as-individuals that go about their daily

life, enveloping the taking and sharing of photographs through the app in a wider sociotechnical context already punctuated by the mediation of photographs.

In conclusion, the prevalent logic at work seems to indicate that the practices around this app, despite its declarative intentions, are not about connecting with the natural environment as is or with a 'nature-culture' that has personal significance, but about finding something dramatic and visually *spectacular* that is 'worth' capturing in camera and shared. In what follows, the article discusses yet another marker of value for these images, which lies in their eligibility for research grade.

Nature commodification through science

The premise that underpins the practices around *iNaturalist* estimates that verified photographs – not incidentally always referred to as 'observations' – will become data points that will make themselves useful for *some* undefined research project conducted by certain undefined scientists, which in turn casts those practices as contributions toward an undefined greater good. It is precisely this rationale what informs 'citizen science' as a whole, a practice that engages 'members of the public in authentic research experiences at various states in the scientific process using modern communication tools to recruit and retain participants' (Dickinson et al., 2012) and whose emergence as a new category of scientific activity is inherently related with the development and expansion of new information and communication technologies (ICTs) (Wynn, 2017). The concern with some of these ICT enabled practices (as was also the case for the early uses of radio telemetry for animal tracking, like Benson (2010) explains) is that the mere observation of species' presence or ecological patterns is largely descriptive, and whereas it has been argued that citizen scientists can be recruited into question-driven and experimental studies (Cooper, 2016; Wynn, 2017), most large-scale citizen science projects (like the one *iNaturalist* represents) provide long-term monitoring data of numerous species over broad geographic regions with the idea that data will ultimately be useful for a broad spectrum of questions (Dickinson et al., 2010). Furthermore, it has been recognized that one of the reasons why scientists seek nonexpert volunteers, despite their lack of formal knowledge or rigorous training, is simply because they cannot afford to hire other scientists, graduate students, or field technicians (Cohn, 2008) and that the capacity of ICT-enabled citizen science to promote social outreach is extremely attractive to scientists who are competing for governmental funding, as outreach is one of the criteria included for awarding grants (Silvertown, 2009; Wynn, 2017).

The equation of the use of *iNaturalist* with a contribution toward valuable scientific research is constantly being reinforced, to the extent that, at times, it entirely defines the app's identity and thus challenges the viability of the self-defined goals of the app, which are primarily to 'connect people with nature' and only secondarily (but which is believed to be simultaneously possible) to generate scientifically valuable biodiversity data. One of the main promoters of the app in the Los Angeles area is the NHMLA, whose citizen science coordinator can be seen in a video on the *iNaturalist* blog stating that when he first explains the app to people and defines it as social network for naturalists, he also

> (. . .) really try to communicate that peoples' photos, when they post them to *iNaturalist*, become data points in a research project and I find that when I use the word *data point* that people really respond to that . . . they seem excited that something that they see can be a data point in an actual scientific project and I think that motivates them to want to participate and to want to contribute, and I think that makes

> them see the *iNaturalist* platform as something scientific and valuable that they can be a part of and have access to . . . (Iwane and iNaturalist, 2018)

In a training organized by the same institution, a staff member narrated the story of a user who, after uploading some 'observations' of a snail in her backyard to *iNaturalist*, became a co-author in a scientific publication because it happened that those were the first observations of that particular snail species in the city. The people present at the meeting certainly responded to that story as the woman next to me uttered a loud 'how cool' and everybody nodded. Similarly, most of the users I have interviewed resonate with this aspect of the app because they want to contribute to something 'scientific' or, as the young woman I encountered hiking in northeast Los Angeles said, 'it feels good to know that I'm contributing to something larger or maybe helping somebody identify something'.

What enables this operationalization of a photograph as a scientific data point are the unchallenged assumptions of accuracy and objectivity that mobile or 'traditional' cameras embody as means for knowing nature. Daston and Galison (1992) have discussed at length the process of scientific image making and how its presumed objectivity was moralized, demonstrating how the conception of subjectivity as a true sin during the nineteenth century paved the way for the embrace of highly regarded automatic recording devices, such as photographic cameras and their photographs, given their ability to surpass human observers. Surrounded by this aura of authority and objectivity, visualizing technologies have expanded without apparent limit, so much so that to Haraway (1991: 189), our eyes can be endlessly enhanced by means such as artificial intelligence-linked graphic manipulation systems and cameras for every purpose. Thus, although wildlife photography is one of the most heavily edited genres (not to mention wildlife documentaries), this belief in the camera as a legitimate instrument of scientific inscription has not dwindled and informs the practices around *iNaturalist*. Moreover, at times, the technology seems to not only lend objectivity but to grant or disclose existence: as one of last year's users with the most observations explains in her profile, it wasn't until she got a 'decent digital camera' that she started identifying insects, despite having identified plants for 30 years. In other words, the mediation of the camera for this user worked to craft the *being* of insects as noticeable entities.

Likewise, it is technology in the form of an algorithmic neural network what grants identity to the organisms photographed: after taking a picture or selecting one to upload, the algorithm scans it three times and triangulates with the information it has about species observed in the area and then provides an identification regarding the species genus, as well as a top-10 species suggestion. This wasn't always the case, though, as older versions of the app did not have any element of artificial intelligence and required that users enter the identification themselves. Making a good identification is crucial because, as briefly mentioned earlier, when two or more users agree on the species identification, the image loses its 'casual grade' and becomes a data point that is added to the Global Biodiversity Information Database, an international network and research infrastructure funded by the world's governments that provides open access to data about all types of life on Earth (see 'What Is GBIF?', n.d.).

Most of the users interviewed for this project concluded that the accuracy of the algorithm was not particularly good, although they recognized that it did fare better with plants compared to insects or mushrooms. While it is not clear if this is the case because there's less people interested in those forms of life or if they are harder to identify in themselves, this certainly creates a situation akin to what Bowker (2005: 141) calls a reverse bootstrapping process, whereby 'things that cannot

be described easily and well get ignored, and so receive an ever-decreasing amount of attention'. They also noticed that, because of its crowdsourced nature, it is easy for the algorithm to perpetuate a wrong result: if a user posts an observation of a plant and provides an incorrect identification, it is possible that the next person who takes a picture of that same plant will receive that wrong identification as a suggestion and accept it, further establishing the incorrect association. Another effect a long-term user of the app noted was that this technology was affecting the amount of attention she paid, meaning that whereas before she would pay 'really close attention' to the specimen, she now relied more on the algorithm to tell her what something was, which lead her to wonder if she was learning as much despite not observing as closely.

Something that surfaced through participant observation and from conversations with users is that most of them take pictures of the living things around them as they encounter them and upload the pictures to *iNaturalist* afterward, given that cell service is usually poor in the areas where users hike, which is when most tend to use the app – not to mention that the app can be slow and glitchy. This means that at the moment in which people actually go through the process of species identification, they don't have the real thing to observe anymore, but rather the photograph that stands in its place. At this stage, they have to go through their pictures and check them against what has already been catalogued in *iNat*'s (or other) database. The issue at stake is that because our knowledge of biodiversity in terms of named organisms is highly skewed in favor of certain groups, like birds, mammals, or flowering plants, the use of taxonomic knowledge also contributes to the production of a distorted reality initiated by photography. In Bowker's words, 'the world that is explored scientifically becomes more and more closely tied to the world that can be represented by one's theories and in one's databases: and this world is ever more readily recognized as the real world' (2005: 152).

Despite this, users repeatedly highlighted the educative potential of the app since it was perceived as a tool that allowed them to gain knowledge, by which they specifically meant taxonomy. As mentioned above, if a species in a picture is not classified, then the photograph becomes less valuable because, on top of being 'an online social network', *iNaturalist* defines itself as a 'crowdsourced species identification system'. And it is here where the challenge to the viability of the theoretically self-reinforcing goals of the app becomes palpable again: the discourse around these practices, as evidenced in the blog's posts, the conversations on *iNaturalist*, the descriptions of the images on Instagram, and the descriptions given by users in conversation, revolves solely around identifying or being able to name the species photographed, and this does not necessarily imply or correlate with 'connecting with nature'. In this sense, *iNat* behaves as just another field guide or list as Law and Lynch (1998: 276) have described them, namely as a durable artifact through which sightings from a local context get inserted into a network that monitors, selects, and compiles lists on a collaborative basis once those initial sightings have been translated into a 'canonical and normalized form in which one set of textually expressed similarities and differences is emphasized at the expense of others'.

According to Fowles (1979: 50), this 'taxonomic game' can be especially detrimental to this connection with nature:

> Even the simplest knowledge of the names and habits of flowers or trees starts this distinguishing or individuating process, and removes us a step from total reality toward anthropocentrism; that is, it acts mentally as an equivalent of the camera's viewfinder (. . .) destroys or curtails certain possibilities of seeing, apprehending, and experiencing.

As a self-proclaimed naturalist and pseudoscientist, Fowles explains that his participating in the 'taxonomic game', whereby he would try to name names and explain behaviors, made him realize just what an inadequate way of interacting with nature that was as it distracted from and limited what he considered to be the total experience and the total meaning of nature. He claims that naming things, which is a (if not *the*) significant part of *iNaturalist*,'is always implicitly categorizing and therefore collecting them, attempting to own them', which is made worse by the highly-acquisitive nature of man for whom 'mere names and the objects they are tied to soon become stale' thus creating a 'constant need, or compulsion, to seek new objects and names – in the context of nature, new species and experiences' (Fowles, 1979: 51). This was evident in the self-described behavior of some participants, such as in the case of a young woman with a strong interest in native plants who interpreted the app as her self-made, tailored field guide and only took pictures of the native species she did not already know to be able to discover and learn their names. This 'collecting of nature' was explored above in relation to the accumulation of photographs as a source of value but it's worth revisiting the concern that this behavior, as expressed by the biologist informant, could be equated more to stamp collecting than to connecting with nature in this context. On a separate occasion while we were out hiking, he brought this up again and added that he noticed that a lot of people using *iNaturalist* just stopped at the identification, 'they get the name and move on', instead of interpreting the name as a door or portal to other ideas, which was his interpretation of a correct use of the app. Indeed, this idea of the taxonomic name or classification as a password that 'gives you access to entire realms of knowledge about the natural world that would otherwise be inaccessible' has been mentioned by others, who have gone as far as to say that 'learning the names of our many wild neighbors is an exercise in perspective and empathy' (Jabr, 2017: 32). The intent of this article is not necessarily to argue that that is not the case for certain people in some form because as Baker (1993: 15) has noticed, 'the practice of looking is at the heart of both our sympathy for and our oppression of the animal'. However, it does want to be critical of the totalizing weight of these assertions around *iNaturalist* in that they assume that the only way of connecting and respecting nature is by knowing its taxonomic name as defined by modern science.

Contesting these assumptions is Yoon (2009), who argues that the scientific project by which nature is classified via species and other taxonomic structures functions as a way of distancing humans from the environments in which they live. Similarly to Fowles, she states that

> [w]e depend upon field guides not simply because we are hoping to understand living nature, but because we do not feel that we have really understood it – despite having seen, heard, and enjoyed it with our own very eyes and ears – until we have verified for us by science what we really saw. (2009: 20)

She is not, however, arguing against the ordering of the life around us, something that she claims people in different places and times have consistently done, but rather against science's exclusive status as the only valid way of knowing nature (or 'a nature'). In this sense, Yoon thinks that the normalization of our deference to science, of having someone else be in charge of the living world, carries with it a cost, namely that despite having it unfold every minute before our eyes, we are missing it all. At the core of Yoon's argument is her belief that a deeper scientific knowledge of life is supposed to enhance our understanding of the living world instead of undermining it. At the core of Fowles's is the belief that scientific tools, which in essence are disturbers and rearrangers of primordial nature, relegate the inherent presentness of nature to an automatic

pastness, 'a status of merely classifiable *thing*, imagen taken *then*' (Fowles, 1979, emphasis in original).

This tension was noted by one user, an herbalist I met on a trail, who confessed that for a lot of years, she resisted identifying plants – despite going on frequent hikes and taking lots of photographs – because she believed that knowing the scientific name was going to 'take her away' from the direct, personal connection she felt with nature. Although this changed for her when she grew interested in herbalism and plant names became more necessary to know, she told me that in the educative plant walks she organizes, she consciously works toward giving people a different 'entry point' to plants, an alternative to naming or learning about their utility: 'The first thing people want to know is always: 'What is this plant? And 'What do you use it for?' So now I tell people that we are going to spend time, smell the plant, maybe taste it too, look at the colors, and then later I'll tell you what it is'. In doing this, she seems to be resisting the inversion of the relationship to nature that knowledge might promote according to O'Neill (1993), in which knowledge does not issue a disinterested openness to the object, but rather seeks an object to satisfy the desire to know. According to him, scientific education involves not just the apprehension of a set of facts but also the development of the capacity to perceive and feel wonder at the natural world, a capacity for contemplation of objects free from the compulsion of need – a disinterested openness to objects of the nonhuman world that responds to their own qualities and properties. Yet this positive stance can easily be upended when organisms become merely means to satisfy the itch of curiosity, and the pleasures of that curiosity become the end goal. This is certainly evident in some *iNaturalist* users' behaviors, such as the young woman who had the explicit goal of being able to recognize all native plants and thus used the app just to extend that knowledge. Similarly, the other young woman I met mentioned that she gets frustrated when she doesn't know what something is and she can't find it in the app, but that this is an 'exciting frustrating' because then she goes home and looks through her books to try and figure out what that was before uploading. It is in his analysis of this 'vice' of science that O'Neill's argument circles back to Fowles, for whom it is science's modus operandi which has addicted us to purpose – the addiction to finding a reason, a function, a quantifiable yield against which nature suffers as its seemingly only purpose appears to be existing and surviving, just being.

So, connecting to 'nature'?

One of the two *iNaturalist*'s aims is 'to connect people to nature', and while there are multiple definitions of what 'connecting' with nature might mean (and multiple scales to measure it, see for example Schultz, 2002; Zelenski and Nisbet, 2014), there also are many 'natures' to connect to. For the creators of the app, this seem to be equivalent to 'getting people to feel that the non-human world has personal significance'. However, as described above, the logics that operate and the practices that are promoted by the app appear not to be conducive toward that goal. In other words, by reproducing and reinforcing the assumptions and values that underpin the natural sciences as well as mainstream wildlife entertainment, they seem to be promoting a construction of nature that denies its co-constituted character with culture, and that is meant to be accessed through particular technologies and articulated by specific words.

From an informational or cognitive perspective, *iNaturalist* might have a positive correlation with a perceived stronger connection with the natural environment, and in turn even with sustainable behavior for certain users. Indeed, some have noted this connection in themselves, like a young woman who explained that she felt that the app had enhanced her 'connection with nature'

because it allowed her to understand it more, which then lead her to 'appreciate it more, want to be in it more, protect it more, advocate for it more'. For this user, it was the specific knowledge that the app provided what created a stronger connection with the plants and animals that surround us. Interestingly, this was also the user who had a deep-seated desire to learn all the names and be able to identify all the native plants of California, which goes to show that apps such as *iNaturalist*, by being capable of eliciting complex phenomena, can ignite interest in the natural environment but, by promoting a connection towards a very specific construction of nature, can reinforce the human/nature divide that characterizes Western thought at the same time. If, instead, we focus on other ways of knowing or sensing the environment, it is easy to appreciate that while *iNaturalist* might promote contact, it does not seem to elicit an emotive or compassionate connection with nature. In fact, the only emotion mentioned by users was 'excitement' upon finding a rare species or being able to make an observation of a specimen that would be useful for a particular research project the user was aware of. It was only the little boy from the beginning the one who, without losing a sense of curiosity, was able to transcend the human-as-subject to nature-as-object relationship by developing an empathic connection with the bombardier beetle that entailed feelings of care for its present well-being, hoping that the insect wasn't having a bad time inside the case, as well as its future well-being, making sure that the adults deposited it back exactly where it was because 'it was on a mission'.[4]

It is no coincidence that the majority of users on the network constitute a self-selected crowd who already engage with the natural environment in ways similar to those the app promotes. Invariably, all the users I talked to had a previous interest in 'nature' in some form, because they were biology majors or professionals, worked at environmental nongovernmental organizations, were seeking a minor in environmental studies, already were or were aspiring to become certified as 'California naturalists', were 'birders', had thought about becoming marine biologists at one point, were employed in zoology and entomology laboratories, wanted to be veterinarians in the future, or had a manifest interest in citizen science. Therefore, as many of them expressed, these are users that already see themselves 'connected to nature' in some capacity and have a vested interest in knowing more about it. For them, *iNaturalist* has not changed the way they conceive of or interact with the natural environment but has enhanced the practices that were already in place. It is certainly the case that this article is limited in that it does not include the perspective of *iNaturalist* users without those preexisting motivations, but it just might be the case that those are extremely rare if present at all. One college student I talked to went as far as to say that this is an app 'designed around a professional community' which, coupled with the fact that it 'is not made to be addictive like social media', makes it 'non-approachable for a general audience', a group that he didn't think would ever want to use *iNaturalist*. But, assuming this was not the case and that there are people out there who have randomly decided to download the app and started 'connecting' with 'nature' in this way, what needs to be foregrounded is that this 'entry point' promotes a very particular interaction with a particularly conceived nature that might inhibit others.

In conclusion, what these new technologies seem to be promoting is not only a totalizing and spectacular 'nature' but a scientific apprehension of a nature as characteristically defined by the natural sciences in the West. It is in this context that the assumptions and operations at work in modern, environmental ICTs such as *iNaturalist*, as well as the practices they enable, need to be critically examined as they can render the natural environment as something there not for itself but to provide material for labeling, classifying, and analyzing. This is not to say that the presence of technology automatically forbids 'a connection' with 'nature' from happening because if nature is a human idea entangled with the words and images we use to describe it (see Cronon, 1995), then

technology (especially in such a ubiquitous form such as a mobile app) is yet another value-laden lens through which we encounter that deeply material yet equally intrinsically cultural realm. Instead, we must interrogate these technologies that claim to get users to 'connect' with an authoritatively defined 'nature' when it seems that they instead promote a colonizing way of knowing that reinforces the distance of human as subject and nature as object, rather than a more intimate way of knowing, sensing, or interacting that acknowledges the nonhuman others as the subjects with whom we share and coconstitute our habited spaces.

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Notes

1. It should be noted, though, that said park and other abundant green spaces in the city are not equally accessible to all as low-income neighborhoods and those where people of color, African Americans, and Latinos are predominantly present have significantly lower levels of access to park resources compared to White suburban areas (Byrne and Wolch, 2009).
2. The vast geographic span is also characteristic of the wildlife documentary genre, which intersperses depictions of species from different corners of the world.
3. Interestingly, despite the fact that the picture of the octopus, rockfish, and lingcod showed all the dead species on the floor of a boat, another user was quick to reply that the caption that read 'An octopus in the mouth of a yellow eye rockfish, inside the belly of a lingcod' had forgotten to include 'inside the boat of a human'.
4. It was his mother who owned the phone from which iNaturalist was being used.

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