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Research Article

Disguising Elephant Ivory as Other Materials in the Online Trade

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Abstract

Despite efforts of law enforcement, tech companies and other stakeholders, the illegal online trade in wildlife products continues to increase. A particular problem in tackling this online illicit trade is the misdescription of item materials, making the search for internationally CITES regulated materials, such as elephant ivory, challenging. We investigated the issue of misrepresentation of materials in item descriptions by studying the trade in *netsuke*, carved objects, attached to the cord of the kimono, originally from 17th century Japan, that are often made of elephant ivory. The study, conducted on the online marketplace, eBay, in the United Kingdom, shows that elephant ivory is still sold in spite of eBay's policy on ivory. While the netsuke trade is small, elephant ivory was most frequently described as cow bone. Our results also indicated that, among the items identified as elephant ivory, only a small fraction were actually detected and removed by eBay. To discourage the sale of ivory items, eBay should increase its efforts to implement its policy banning the trade in ivory. Further, eBay could consider additional restrictions on the range of words that can be used by the vendors in all of the item listing fields.

Keywords

CITES, cyber-crime, e-commerce, enforcement, wildlife trade, policy

Since the beginning of the 21st century, there has been a resurgence in the demand for illegal wildlife and its products (Grieser-Johns & Thomson, 2005; Nellemann et al., 2016). This has resulted in a multi-billion-dollar transnational industry, potentially ranked fourth among the most lucrative illicit trades (Nellemann et al., 2016; Warchol, 2004). Initiatives have been developed to curtail this illicit trade since the early 2010s, with a renewed focus arising from the COVID-19 pandemic, due to the potential for emerging infectious diseases arising from the trade. The trade in illegal wildlife not only impacts the target species but also local economies, societies and the environment (Haken, 2011; Karesh et al., 2005). Among the many species threatened by the illegal wildlife trade, concerns have been raised over the rapid decline in African elephant populations (*Loxodonta africana*) due to the dramatic rise in the demand for ivory products (Bennett, 2015; Maisels et al., 2013).

For centuries elephant ivory has been regarded as a luxury commodity, often associated with status and wealth, especially among Asian cultures (Somerville, 2017; Stiles, 2004, UNEP et al., 2013). Despite the Convention on International Trade in Endangered Species of Wild Fauna and Flora's (CITES) ban on the international commercial sales of elephant ivory since 1990, the exploitation of African and Asian elephants for their ivory is still an on-going threat (Milliken et al., 2016). Killings of elephants for their ivory reached a peak between 2011 and 2013, as well as the continued illegal trade in other wildlife, leading to the first London Conference on Illegal Wildlife Trade that aimed to develop a coordinated commitment to tackling the illegal wildlife trade (Wittemyer et al., 2014).

The increased focus on the illegal wildlife trade, the expansion of internet access and subsequent growth of

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online markets have led to a rapid increase in online trade by facilitating peer to peer exchange across e-commerce and social media platforms (Kramer et al., 2017; Yu & Jia, 2015). Open 24/7, e-commerce and social media platforms provide new and easier routes to advertise illegal wildlife and its products with an increased level of anonymity (Kramer et al., 2017; McCrea-Steele, 2017). Among the many e-commerce platforms, eBay has been identified as a significant channel for sales of potentially illegal wildlife (e.g. Alfino & Roberts, 2020; Hernandez-Castro & Roberts, 2015; IFAW, 2007). During an investigation, the International Fund for Animal Welfare (IFAW, 2007) identified 400 elephant ivory items for sale on this platform in the UK. Consequently, in 2008 eBay was the first online marketplace that pledged to ban the sale of ivory on its site (Coghlan, 2008). However, ivory continues to be sold on eBay despite the company policy that bans the sale of any products from threatened or CITES Appendix I animals and specifically mentions ivory products (Alfino & Roberts, 2020; Hernandez-Castro & Roberts, 2015).

The number of online advertisements displaying elephant ivory as well as other animal products has, over the years, increased exponentially (ICPO-INTERPOL & IFAW, 2013; Krishnasamy & Stoner, 2016, Lau et al., 2016). Due to the internet's ability to reach a wide audience, difficulties in prosecutions, presence of legislative loopholes, insufficient enforcement and limited capacity to conduct online monitoring, it has made tackling the online trade challenging (Hernandez-Castro & Roberts, 2015; ICPO-INTERPOL & IFAW, 2014; Lau et al., 2016). This is further exacerbated through the continuous mutation of the online trade, hindering detection and resulting in enforcement agencies having to constantly adapt their monitoring to identify illicit online traders (Yu & Jia, 2015).

Detecting illegal sales of ivory items is particularly difficult as the word "ivory" can be used to describe a colour as well as the material (e.g. elephant, walrus and hippo) and its substitutes (e.g. vegetable ivory) (Hernandez-Castro & Roberts, 2015; Yeo et al., 2017). Due to the increased efforts to curb the trade in elephant ivory, vendors have adopted the use of code words to disguise the sale of often illicit items (Alfino & Roberts, 2020). This makes tackling this illicit trade even more challenging for enforcement agencies (Alfino & Roberts, 2020; Yu & Jia, 2015).

Netsuke are small carved objects, used in Japan to prevent the inrō (a small decorative container hanging from the kimono cord) from slipping off (St Aubyn, 1987). Today, they are traded as a collector's item with the largest international markets in the EU, the UK and USA (Milhaupt, 2009). Traditionally, netsuke were made of either wood or elephant ivory. However, with the implementation of ivory trade regulations after 1989, netsuke carvers started using other materials as substitutes, such as other animal ivories (including walrus and mammoth ivory), porcelain or vegetable ivory (Milhaupt, 2009; St Aubyn, 1987). Modern cheaply manufactured reproductions of netsuke made of synthetic ivory substitutes (e.g. resin and celluloid) can also be found on sale (Milhaupt, 2009). Recent studies into ivory markets have often reported the presence of netsuke made of ivory on display in retail shops (Kramer et al., 2017; Lau et al., 2016).

Given the use of code words, often based on substitute materials, to disguise the online trade in elephant ivory, this study focuses on a particular item that is likely to contain elephant ivory, netsuke. In this study we aimed to: a) determine the extent of the trade of netsuke containing elephant ivory on eBay UK; b) identify the frequency with which netsuke made of elephant ivory are advertised as other materials; c) determine the frequency with which eBay ends listings of items made of elephant ivory in accordance with their policy.

Methods

This study received ethical approval from the Research and Ethics Committee of the School of Anthropology and Conservation, University of Kent.

Data Source and Acquisition

For the purpose of this study, eBay was chosen as the study website, as recent studies have shown that the trade in elephant ivory is still on-going in spite of the company's policy (Alfino & Roberts, 2020; Hernandez-Castro & Roberts, 2015; Kramer et al., 2017). Specifically, searches were conducted on eBay UK (ebay.co.uk) using the term "netsuke". The results were then narrowed to the category "Antiques" with item location set to "Worldwide".

Item details were recorded on the 17th March 2018, a Saturday; a day after what has been found by previous research to be the weekly peak for advertisements uploading (Yeo et al., 2017). Those items identified as being made of elephant ivory were then revisited a month later (17th of April 2018) to determine whether they had either been removed (it was not possible to determine whether the listing was removed by the sellers or eBay), sold, gone unsold or were still advertised.

It should be noted that each posting was considered to represent a single data point even when a group of items was sold within a single advertisement. This measure was taken as the objective of the study was not to report quantities of ivory but to represent the level of incorrect identification of materials, and for each advertisement, only one box was present containing materials under the structure of eBay's website.

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Only advertisements containing the object name "netsuke" in the "product type" and/or "title" field box were selected. Items advertised as netsuke but were not specifically netsuke (e.g. books on netsuke), were excluded. Finally, duplicate items were removed. The dataset comprised a total of 3,214 items.

As mentioned previously, netsuke were chosen as the focus of the study to circumvent the problem of identifying code words and phrases used by sellers to describe elephant ivory objects online. As highlighted by previous studies (Alfino & Roberts, 2020; IFAW, 2014; Yu & Jia, 2015), code words may change creating problems around detection. By using the word "netsuke", an object typically made of elephant ivory, as a search term, we aim to overcome the issue of unknown code words.

Visual Identification of Items Material

The attributes of advertisements considered the most relevant to this study were the title, item description, items specific ("primary material") and item images. Given that it was not possible or ethically desirable to obtain the physical objects for analysis, the most reliable indicator for the identification of elephant ivory, Schreger lines, were used (Espinoza et al., 1992). Elephant ivory's Schreger lines are a unique pattern derived from concentric circles that overlap to form a cross-hatched pattern with an angle of $>115°$ in the cross-section. Elephant ivory differs from that of mammoth ivory where the Schreger lines cross to form an angle of $<90°$. Photographs present in advertisements were visually inspected to identify whether the item was made of elephant ivory.

To increase the effectiveness of the detection and narrow the biases, other types of ivories (e.g. walrus, whale and hippopotamus) were identified through their distinctive cross-sections (e.g. walrus ivory has concentric rings in the cementum and marbled secondary dentine), bones and antlers (Espinoza et al., 1992). As the study focused solely on the recognition of elephant ivory, items were grouped into four categories to take into account the degree of uncertainty in identifying the materials from images:

Category 1 (C1): Highly likely to be elephant ivory – Schreger lines clearly visible in multiple sections on the netsuke;

Category 2 (C2): Likely elephant ivory – Schreger lines clearly visible, but only in a single section of the netsuke;

Category 3 (C3): Suspected elephant ivory – Schreger lines not clearly visible, only faintly discernible;

Category 4 (C4): Possible elephant ivory – Schreger lines not visible due to poor image quality, but the item appearance looked like elephant ivory (based on colour and texture).

Additional categories were defined for the other materials encountered: (a) "Other ivories" (a generic category), which included those items that appeared to be similar to animal ivory, but a more precise identification was not possible; (b) "walrus ivory"; (c) "mammoth ivory"; (d) "hippopotamus ivory"; and (e) "whale ivory". For items that were made of natural substitutes, two categories were used: (f) "bones" including antler; and (g) "nut" including tagua nut and walnut. Finally, two categories were identified for manufactured ivory substitutes: (h) "artificial substitutes" including celluloid and resin; and (i) "other materials" such as stones and porcelains. Those items that could not be readily identified were classified as "unknown" (j).

Cohen's kappa analysis was conducted in order to assess the consistency specifically in the identification of elephant ivory (Cohen, 1968). The analysis was carried out by the author and another researcher, who had some experience in elephant ivory identification from images, based on a sample of 100 items from the entire dataset.

Results

Cohen's Kappa Analysis

Cohen's kappa analysis showed a moderate level of agreement ($k = 0.54$, $p < 0.01$, $n = 100$) in the identification of elephant ivory and non-elephant ivory among the two graders. Of the 17 items found to be elephant ivory (out of a 100 items sample), the two graders agreed on 11 of them. The difference in the use of the categories, however, was due to the different familiarity of the two researchers with the recognition and identification of Schreger lines. After discussion, a second analysis was conducted, which resulted in a good level of agreement (14 out of 17 identified elephant ivory items) between the two graders ($k = 0.84$, $p < 0.01$, $n = 100$).

Material Identification

Each of the 3,214 items was grouped according to the materials reported by the vendors on the primary material field on eBay. The majority of items on sale were described as "wood" (67.3%, $n = 2{,}162$). The second most frequent category was the general category "bone" (16.0%, $n = 512$), comprising of "cow bone", "ox bone", "water buffalo bone" and "stag antler". For 6.3% ($n = 201$) the material was not provided (Figure 1). Items openly sold as fangs, mammoth tusk, whale baleen or walrus made up only 0.1% ($n = 11$) of the overall items (Figure 1). Finally, only one vendor listed an item as ivory (reported as "IVERY"). None of the vendors listing elephant ivory items ($n = 144$) displayed details of having an Article 10 certificate

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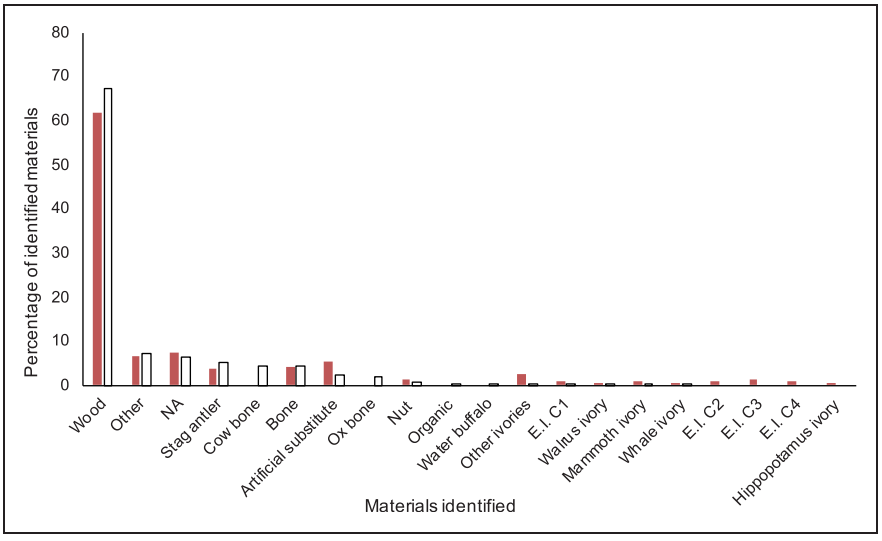


Figure 1. Percentage of Materials Found on Ebay Based on Ebay Sellers (White) and Author (Red) Identification. Categories were created by the author. Elephant ivory (EI) has been divided into four categories that take into account the uncertainty of identifying elephant ivory through images (C1 being highly likely to be elephant ivory, and C4 possible elephant ivory but poor image quality).

(according to Council Regulation No. 338/97 Annex A of the EU Wildlife Trade Regulations as part of the CITES regulations implemented by the EU). While only one vendor displayed a certificate of authenticity, even though the item was not in accordance with CITES regulations.

Of the items classified by the authors (rather than as described by sellers on eBay), 61.9% (n = 1,988) were categorised as "wood", while 8.3% (n = 258) as "bone" (Figure 1). Of the 144 items (4.9%) identified as either likely (C1 and C2) or suspected (C3 and C4) elephant ivory, 50.0% (n = 72) were considered likely to be elephant ivory (C1 and C2) (Figure 1). Finally, 4.8% (n = 153) of the total number of items were identified as made of "other ivories" (generic category), 1.0% (n = 31) as "mammoth ivory" and 0.6% (n = 20) as "whale ivory".

Comparison of the Identified Items

To understand what materials were most often misrepresented, a comparison was made between the materials declared by the vendors and the authors' identification based on the images. Animal ivory materials (including elephant ivory and other animal ivory items) were the most incorrectly reported (Table 1). Among the items where the vendor did not specify a material (NA, n = 200), 9.0% (n = 18) were categorised as C1 or C2 elephant ivory, 12.5% (n = 25) as C3 and C4 elephant ivory and 17.0% (n = 34) as other ivories, although, it was not possible to categorise all of them (Figure 2).

Of the 512 items described by the vendors as generic "bone", "cow bone", "ox-bone, "stag antler" and "water buffalo bone", 42.8% (n = 218) were confirmed as being made of a type of bone. The authors classified 8.2% (n = 42) of the items described as bone as belonging to the elephant ivory categories C1 and C2, and 5.9% (n = 30) as C3 and C4 (Figure 3). In addition, 22.1% (n = 113) of the items were identified as other ivories, including mammoth (5.1%, n = 26), whale (3.7%, n = 19) and walrus ivory (2.1%, n = 11) (Figure 3).

Enforcement of eBay's Policy

A month after the first data collection, all netsuke categorised as elephant ivory by the authors were revisited under the assumption that, if eBay was effectively enforcing its policy on ivory, the items would have been removed.

Of the C1 and C2 elephant ivory items identified, 53.0% (n = 38) had been sold, while only one had been removed before the sale ended. Among the items not sold, 48.0% were relisted (n = 16), while the rest were either still on sale or no longer available. It is worth noting that, between data collection and the first analysis of the images, 8 additional items were removed. Of these items, the original material could not be assessed as the pictures were no longer available on eBay, and were, therefore, excluded from the analysis. Assuming that the 8 items removed by eBay before the author's image identification were likely to be from elephant ivory C1 and C2, this could mean that overall 11.3% (n = 9) of the items in the first two categories had been removed.

None of the other animal ivory items (n = 75) prohibited by eBay in their Terms and Conditions were removed. Only one item, openly listed as "walrus

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Table 1. Proportion of Identified Item Materials by the Author as Made of Ivory Including Other Animal Ivories (OAI) and Elephant Ivory (EI) in Each Category of Material Reported by the Vendors in the 'Primary Material' Section.

Vendors ID	Author ID								
	OAI	EI				Hippopotamus	Mammoth	Walrus	Whale
		C1	C2	C3	C4				
Animal ivory	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Artificial substitutes	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Bone	1.6	0.1	0.1	0.1	0.0	0.0	0.0	0.3	0.2
Cow bone	0.1	0.3	0.3	0.4	0.2	0.0	0.0	0.0	0.0
Elephant ivory	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mammoth tusk	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NA	0.5	0.3	0.3	0.3	0.5	0.3	0.2	0.0	0.0
Nut	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0
Organic	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ox bone	0.0	0.0	0.2	0.2	0.1	0.0	0.0	0.0	0.4
Stag antler	0.1	0.1	0.1	0.1	0.0	0.0	0.8	0.0	0.0
Water buffalo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wood	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

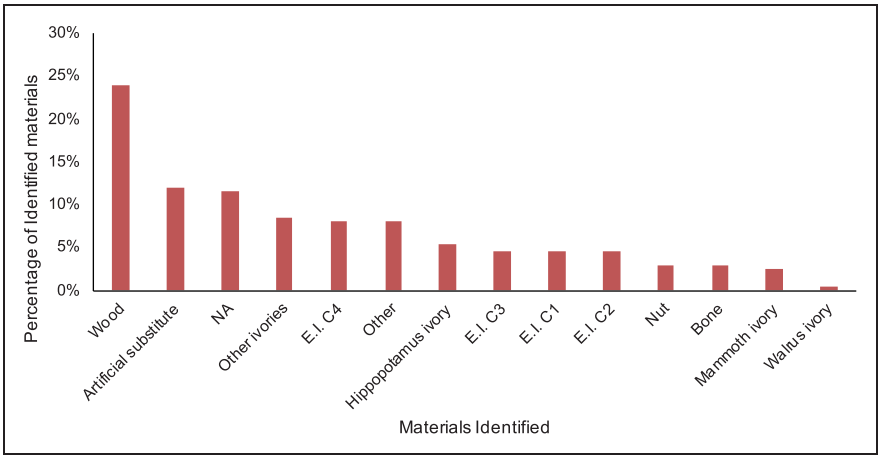


Figure 2. Percentage of Items Identified by the Author per Non-Identified (NA) Materials on Ebay. Categories were assigned by the author. Elephant ivory (E.I.) has been divided into four categories that take into account the uncertainty of identifying elephant ivory through images (C1 being highly likely to be elephant ivory, and C4 possible elephant ivory but poor image quality).

fang", was apparently taken down after the data was collected but before the authors could identify it from the images.

Discussion

Netsuke are popular carved items found both on online and antique markets (ICPO-INTERPOL & IFAW, 2014; Kramer et al., 2017), and are made of a variety of natural materials ranging from elephant ivory to vegetable ivory or artificial materials such as resin and porcelain (Kramer et al., 2017; St. Aubyn, 1987). In this study, we found that netsuke made of elephant ivory, identified from images based on the presence of Schreger lines, constituted a small portion of the overall number of items on sale (2.2%). However, the actual amount of elephant ivory advertised is likely to be higher, rising to 4.5%, if the unidentified items and the suspected elephant ivory items are included (i.e. elephant ivory items from categories C3 and C4).

As previous studies have also highlighted (ICPO-INTERPOL & IFAW, 2013, 2014), the generic category 'bone' was found to be the most misused, with the most frequently used terms being 'cow bone' and 'ox bone'. The only category, that did not include elephant ivory, was 'stag antler', most likely due to its characteristic morphology. However, it was found that one seller

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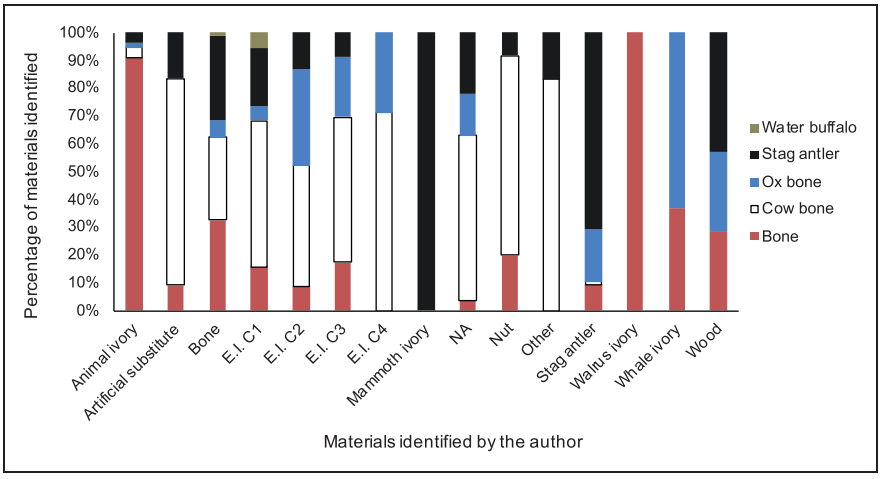


Figure 3. Percentage of Materials Identified by the Author SV for the Materials Identified by Ebay's Vendors as "Bone" (Red), "Cow Bone" (White), "Ox Bone"(Blue), "Stag Antler" (Black) and "Water Buffalo Bone"(Olive), Reported Under the Section "Primary Material." Elephant ivory (EI) has been divided into four categories that take into account the uncertainty of identifying elephant ivory through images (C1 being highly likely to be elephant ivory, and C4 possible elephant ivory but poor image quality).

used this category to identify a number of mammoth ivory items, whose characteristic colouration could be considered to resemble that of deer antler. During the analysis, it was also observed that the category 'bone' was used to describe most of the other animal ivories. Further, many items made of an artificial substitute were sold under 'bone', indicating either a lack of adequate identification skills by the sellers or the intent to make the item appear more valuable.

Turning to eBay's enforcement of their policy on ivory, 7.0% of the items observed were made of animal ivory (excluding elephant ivory from categories C3 and C4, but including all other animals ivory). This clearly indicates that, despite eBay's strict policy on Animal and Wildlife Products (eBay, 2018a), there is still an on-going trade in ivory, mostly concealed as other non-restricted materials. Moreover, in four instances the material of origin (e.g. ivory, tusk, walrus, whale) was stated by the sellers in the 'primary material' section violating eBay's listing conditions and policy (eBay, 2018b) without any noticeable intervention from the website's monitors; all four items were never removed during the one month period.

Due to the nature of netsuke, all elephant ivory found were carved, which according to CITES regulations can be traded for commercial purpose only when acquired pre-Convention ("antique" ivory; CITES Conf. 10.10 Rev. CoP18). However, none of the international sellers mentioned the need for CITES permit in the item description nor any of the UK sellers complied to Article 12 regulation (EU Regulation No 1007/2011) of the European Union or made any reference to the newly passed UK Ivory Act (2018), a landmark piece of legislation aimed at closing UK's domestic ivory markets. Given the small volume of ivory items, the absence of adequate certifications may be due to a lack of awareness of regulations and a limited understanding of the requirements for selling elephant ivory items (Yeo et al., 2017). However, given the significant coverage around the implementation of the UK's Ivory Act, this is likely to have significantly increased awareness.

Implications for Conservation

Ivory is but one of a number of wildlife products sold on eBay (with varying degrees of legality), ranging from timber products and traditional medicines to live fish and orchids. To ensure that any trade is legal, platforms need to provide sufficient information on regulations and export requirements in their Term & Conditions for sellers and buyers, and support law enforcement by taking active actions in removing non-compliant listings. Further, e-companies should require sellers to provide evidence of the correct permits within advertisements (e.g. Article 10 certificates), and/or make buyers aware of the need for permits if required for trade (e.g. CITES export/import permits, phytosanitary certificates). In the UK, once the Ivory Act (2018) comes into force, it will prohibit the sale of elephant ivory, but for a few exemptions, such as items of the very highest quality that will require the application for appropriate certificates. Even at a basic level platforms could make it a requirement that sellers provide information as to whether the species is on the CITES Appendices; the platform preloved.co.uk has been doing this for a number of years.

After one month, it appears eBay had only removed between 1.3% and 6.9% of the elephant ivory items. Given eBay's own commitment to regulating the sale of ivory across its platforms (Coghlan, 2008; eBay,

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2018a), and as a member of the Coalition to End Wildlife Trafficking Online (2016), we suggest eBay and other platforms focus more effort on this issue. Based on this study, such efforts could include the targeting of the "primary materials" and "description" sections. Further, reporting systems need to be significantly improved as, based on observations (Anon pers. comm., Roberts pers. obs.), when ivory and other potentially illegal wildlife products are reported through eBay's reporting system, very few are ever removed. However, given the number of people using online platforms, the challenge of detecting illegal activity is significant. Big e-tech companies, like eBay, have the resources, as well as importantly the data, that could be mobilised to tackle this challenge of illegal wildlife trade. Identification of key words and phases using data analytic tools is likely to support the identification of illegal wildlife products being traded online, or at the very least reduce the numbers of items needed to be manually searched. However, key words and phrases are not the only attributes of an item for sale that can be targeted to increase identification. Hernandez-Castro and Roberts (2015) used often overlooked data associated within items, such as postage cost and feedback scores, to identify potentially illegal elephant ivory with a 93% success rate. While others (e.g. IFAW, 2020; Loos & Ernst, 2013) have focused on image-recognition with varying levels of success. It is likely that a combination of these approaches will be required to significantly impact the illegal online wildlife trade.

Finally, to have confidence in the global response to the illegal wildlife trade, including online trade, greater transparency and monitoring of interventions is required. To our knowledge, this is the first study that has looked at the success of a policing policy related to cyber-enabled illegal wildlife trade, as such more work is required.

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Ethical Standards

This study received ethical approval from the Research and Ethics Committee of the School of Anthropology and Conservation, University of Kent, and followed the ethical standards of the Economic and Social Research Council, and the Ethics Guidelines for Internet-mediated Research of The British Psychological Society.

Declaration of Conflicting Interests

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