Reproducibility, Replicability, and Revisiting the Insta-Dead and the Human Remains Trade

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Photos retrieved from a simple search of Instagram for 'Human Skulls', collected July 10 2017

The trade in human remains on social media happens in an ever-changing field of digital media technologies. We attempt to replicate our earlier study, exploring the differences in what we can observe now in the trade on Instagram versus our first foray in 2016 (published in Huffer and Graham [2017]). While the previous study cannot be reproduced, it can be replicated, and we find that the trade is accelerating.

1. Introduction

Social media evolves quickly. If we think of social media as the 'field' in which we conduct our (digital) archaeological fieldwork, the changes from one year to the next can be drastic enough that revisiting the 'site' would be similar to returning to a (real-world) site after a season and discovering that the topography has changed, and new

archaeological materials of a similar age have replaced what was previously there (on a similar note, see Reinhard 2019 on how a code update to a procedurally generated world obliterated player-made culture within that world, creating and juxtaposing new relationships and assemblages. For the purposes of this analogy, social media is like that game world).

In this report, we revisit the field of our 2017 piece, 'The Insta-Dead: the rhetoric of the human remains trade on Instagram (Huffer and Graham 2017) as an exercise in archaeological replicability; the research for that piece was conducted over several months in 2016. How has the landscape changed in the interim? What patterns remain consistent? Can we reproduce and replicate our earlier research on the human remains trade as it is mediated and documented on the social media platform Instagram? In principle, this should be possible.

Marwick *et al.* (2020) note that there is much confusion around the ideas of 'replicability' and 'reproducibility', depending on the field, with some disciplines regarding them as synonyms, and other disciplines holding their meaning is opposed. We follow the distinction made by Marwick and collaborators: being able to reproduce a piece of research involves being able to arrive at the same results using the same data and the same code (Marwick 2017). That is, there is enough information communicated that someone else might be able to see for themselves if the conclusions are warranted given the methodology. Replication, by contrast, is the ability to get to those same conclusions using new data and new analyses (Marwick *et al.* 2020).

Reproducing our earlier study is already impossible, sadly, because of the frequency of changes Instagram makes to its terms of service and to its application programming interface (API; there is a cottage industry of blogs that track these changes and what they mean along with offering services to make monetizing these changes easier; see for instance Azamanova 2020). That is to say, the way that we were able to access data about individual posts on Instagram - and the degree of data, the kinds of data we were able to access in 2016 when we performed our 'field work' - is no longer possible (noting that *even then* the way we were able to access data changed halfway through our study). Instagram (through its parent Facebook) now approves full access to its API for a limited number of use cases that must be reviewed first; academic research and monitoring do seem to be approved use cases (Facebook n.d.; on the Facebook for Developers community board for instance, a user asked several months ago for explicit guidance on Facebook's review process for academic research; there have been no responses from Facebook, Racsos 2020).

In which case, what we present here is an attempt at replicating that earlier study using new methods, which are limited to the data that are exposed openly by Instagram in json format. Instagram uses an underlying graph database to organise the material being uploaded to it; in a graph database, more 'edges' can be added as more data are appended to an individual post. If for instance one was to open the URL for any given Instagram hashtag in the Firefox web-browser, the ?__a=1 appended to the end of the URL (for now) loads up the data that would ordinarily be displayed using Instagram tiles (rows and columns of images, which can then be clicked on to reveal the comments). With Firefox's rendering of the underlying metadata expressed in json format (i.e. in key: value pairs), one can click through the different edges (key:value pairs where the value is itself another key). It soon becomes apparent that, while not as much metadata is obtainable as was once available, it is still quite a lot. For the purpose of replicating our study, we use Jonas Schröder's (2018) code, 'InstaCrawlR' available on Github. This

code uses the affordances of R and some packages that mimic the actions of a user interacting with a browser to query the exposed json data, and then pulls the result into basic tables that can then be further queried or visualised.

We also wish to replicate our earlier study because that study, having been published as an Open Access paper, found its way into popular venues. We found ourselves being quoted in the same articles as major vendors of human remains - and some of these stories actually reproduced and linked to Instagram posts selling human remains (e.g. Schwartz 2019). Is it possible to identify any change in the discourses of posts - did our study and its popularisation have an impact on the trade that we are studying?

2. Reproduction versus Replication

For the purpose of replicating our earlier study, we scrape the same hashtags, extract indications of the monetary value of human remains being posted for sale, attempt to look at patterns of word use again (using our original code from the original article), and finally try to represent the network of follower-followed relationships for those accounts that post items for sale and name a dollar (pound, euro) value. This data trawl only includes accounts set to 'public', and thus will exclude newly created accounts that have been set to private, or new data from accounts that were public in 2016 but have since been removed or been made private.

Table 1: Seed hashtags

#humanbones
#humanskulls
#oddities
#curiosities
#realbone
#trophyskulls

Scrapes were conducted in mid-September 2020. We used the code at https://github.com/JonasSchroeder/InstaCrawlR to gather the data. We started by searching the tags listed in Table 1. Then, we counted the number of unique hashtags. We then added some more tags (Table 2) to our search that expanded on the original tags.

Table 2: Expanded seed hashtags

#cabinetofcuriosities
#humanbonesforsale
#humanskull
#humanskullforsale
#humanskullsforsale
#odditiesforsale
#realhumankskullforsale
#skullsforsale

From this, we retrieved 77,293 posts. There are another 111,530 unique tags that turn up in those posts. Some posts got captured more than once - there were 5,673 duplicates - making for 71,646 unique posts. Remember that not every post is something-for-sale! The visuality of Instagram posts can be seen to create a kind of 'digital sensorium' that can elicit certain kinds of emotional responses. There is a culture of visual consumption of human remains that does not require ownership of the remains but rather participation in the network of followers of those who do (see Graham *et al.* 2020, and below). Richardson (2018) suggests that we, as archaeologists, have an ethical duty to consider the privacy of individuals whose materials are caught up in such trawls. This is true; our research project was vetted by the ethics research board at our university from a privacy standpoint. Public posts that are meant to achieve a sale the board felt did not have a reasonable right to privacy. Nevertheless, we do not need to rebroadcast individual posts here, given that the legal contexts of this trade are murky (to say the least) and that we are interested in further developing a large-scale, macroscopic, perspective on the trade over time. Thus, we do not share the dataset that this current piece reports on.

3. Results

3.1 Sales figures

Table 3: Annual sales figures in Instagram posts collected in September 2020 *where the vendor was bold enough to state a price*. Note that these figures necessarily *understate* the total volume of sales, and so should be taken to indicate a trajectory, rather than absolute values. Also note that the 2020 values only represent the first three quarters of the year's volume

2020	$164,247
2019	$71,200
2018	$10,983
2017	$48,750
2016	$9,593
2015	$6,927
2014	$8,329

We searched the scraped posts for clear indications of sale, using a regular expression to find strings of numbers with the $ or £ or € symbols. We found 193 unique accounts that stated a price openly, across 833 unique posts. In 2017, there were 22 unique accounts across 1400 unique posts. In the first three quarters of 2020, the value of sales expressed in $USD was over $164,000 (Table 3); note that these figures are necessarily an under-representation of the true value as they come only from posts we found where the vendor was bold enough to state a price up front; many sales take place after private negotiation in direct messages or other private venues. For comparison, the values that we were able to scrape in our earlier research are reproduced in Table 4.

Table 4: Annual sales figures in Instagram posts *where the vendor was bold enough to state a price* from our earlier study (Huffer and Graham 2017)

2016	$57,000
2015	$30,000
2014	$9,900
2013	$5,200

Both sets of data point to an uptick in 2016; the posts our current study found that overlap in time with our earlier study are largely **not** the same posts as we studied then. The difference is that when we did our original scrape, we were much closer in time to when the posts were first put up; as we get further away in time, the greater the

likelihood that posts get taken down, accounts get made private, or posts or accounts get deleted. *These numbers then must not be understood as anything other than a glimpse into the overall trends*: one that is trending higher.

3.2 Hashtags

The twenty most frequent tags and their number of occurrences are listed in Table 5. Only the first three appear in our seed list. This constellation of the most popular tags suggests a harmless sort of hobby, a collection of interesting trinkets, a gentleman-of-leisure and his personal collection (colonialist tropes have a vivid life on Instagram; see also Blouin *et al*. [2020](#)).

Table 5: The twenty most frequent hashtags in scraped posts, 2020

#oddities	33362
#cabinetofcuriosities	20959
#curiosities	20260
#skull	20150
#humanskull	16540
#odditiesandcuriosities	16539
#taxidermy	16407
#odditiesforsale	14498
#skulls	12355
#vultureculture	11241
#oddity	10838
#art	10569
#curiosity	10101
#macabre	10036
#wunderkammer	8413
#gothic	8085
#bones	8021
#darkart	7032
#vintage	6067

3.3 Social Network

Let us consider how the unique accounts who are selling materials are interconnected. We attempted to scrape all the followers for each of the 193 accounts, using a custom Python script. We were able to retrieve the followers for 70 accounts, which covered all the 2020 posts that we discussed above. That is to say, the network we are able to stitch together would seem to be representative of the state of play for 2020. The result is a network of 235,593 accounts connected by 257,676 edges.

(The fact that we only have a network from the 70 accounts that posted in 2020 naming a price is due to the fact that Instagram's automated blocking algorithms kicked in and prohibited any more connections from our IP addresses. There are paid services one could use that could circumvent these algorithms, but the legality of this is a grey area. The following/follower data is not exposed in the underlying .json that we used to recover the language of the posts).

To see what kind of structure exists within this network, we filtered the network so that we can only see the interconnections among those 70 accounts (Figure 1). If there is an edge between them, it is because they follow one another. The plot shows there is a clutch of accounts that follow each other, and then a series of accounts that do not follow any other of these seed accounts. Finally, there are pairs of accounts where a relationship (one follows the other) exists.
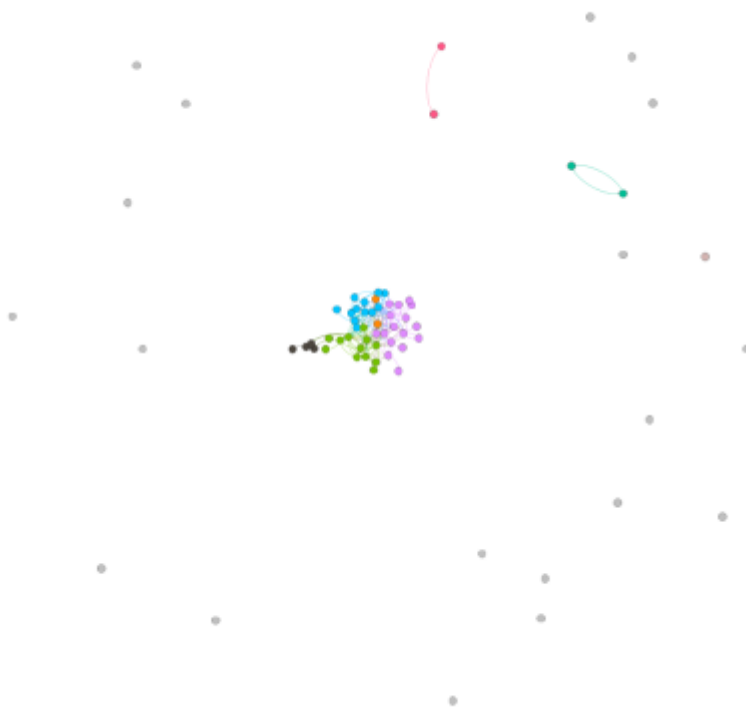

Figure 1: Social network visualisation of the filtered network of 70 accounts that named a price in posts made in 2020; the unfiltered network consists of 235,593 accounts

connected by 257,676 'follower' relationships at one step. Colour is assigned through community detection (nodes that have similar patterns of relationships are assigned to the same cluster and coloured accordingly). There is a central 'core' group of vendors who are connected together, while there is a large penumbra of 'one off' accounts that from this perspective have nothing to do with each other.

In that central cluster, we can examine the groups to see what kinds of materials they tend to post. The purple nodes are all sellers who deal almost exclusively in human bone. The green are accounts that also deal mostly in human bones, but also tend to show off more of their collection (there appears to be fewer overt sales, for instance). The blue (and the two orange nodes) are general antique dealers who sometimes seem to come into ownership of human remains, while the dark nodes appear to be artists who don't necessarily trade in bones *per se*, but in artworks that feature, incorporate, or are inspired by human remains (when real human remains or cremains are incorporated into the artwork, where did the remains come from and when?).

This pattern seems broadly in keeping with what we observed in our earlier work. If we calculate 'betweenness-centrality' for these nodes in the central cluster, we find that nodes in the green and purple are the mostly likely to be traversed - that is to say, if a person happened onto one of these accounts, and then clicked on the links of followers/following, their path would take them through these most 'central' nodes.

We can change focus slightly, and ask, what does this network look like if we try to see things from the point of view of *the followers*? That is, rather than the direct follower/following relationships among these vendors, what if we looked at how the vendors are connected to each other by virtue of having *followers in common*? This is what we did in our original work. When we re-project the network data so that we end up with a visualisation of vendors connected to other vendors by virtue of having a follower in common (Figure 2), 13 of the vendors do not have followers in common, and so drop out of the network. Of those that remain, we can then see that there are three broad communities (two large, one very small), but this time the nature of the communities is slightly different. In the visualisation, groups are organised as radial spars; the size of the node reflects the relative 'importance' in the network in terms of centrality. In the diagram, the accounts that deal almost exclusively in bones form the largest spar (pink). The green are accounts that tend to deal in a wider assortment of antiques. The final group, interestingly, contains the accounts of tattoo parlours.

We might wonder at how pairs of nodes end up with high numbers of followers in common. Instagram's own algorithm for suggesting other accounts to follow might be one culprit. Another factor might be geography - some of the pairs seem to be within the same general region, for instance. Indeed, there looks as if there might be a broad trans-Atlantic divide between the two major groups, but it seems weak.
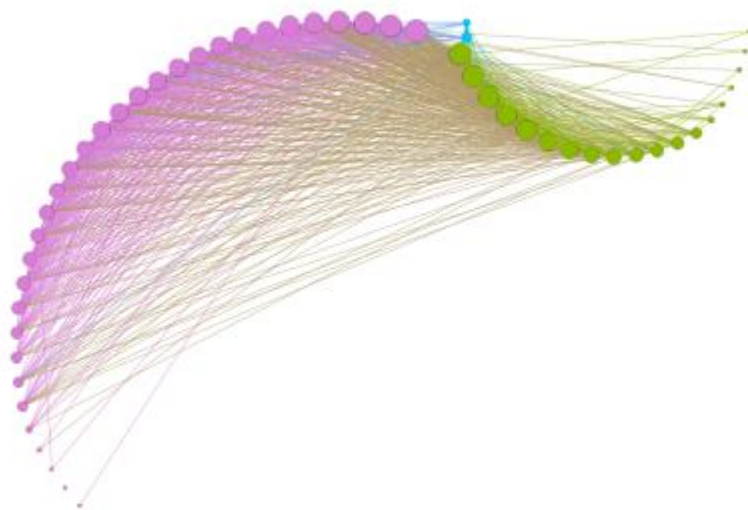
Figure 2: Social network visualisation of the same data (235,593 accounts connected by 257,676 edges) recast so that the 70 vendors are connected to each other by virtue of having followers in common (a person that follows vendor A and also follows vendor B is turned into an edge or tie between A and B; each edge thus has a 'weight' that represents the number of followers in common). A vendor might not follow another vendor (as in that 'penumbra' depicted in Figure 1) but be connected by having followers in common: thus *for those followers* the two vendors' posts help create a culture of consumption around images of human remains (which may or may not lead to purchases). Community detection is run again, taking edge weight into account. The result is three distinct groups

3.4 Word use in posts

In our earlier investigation, we looked at the 'word space' of the posts. Using a word vector model, we were able to express the relationships between all words in the corpus as a spatial relationship; in this way, we can ask which words are 'closer' in the way they are used. In our first article, we looked for words that appeared in a similar space like 'notforsale'. The words that turned up - like 'antiquesforsale' or 'internationalshipping' seemed to us to suggest that the phrase 'notforsale' as a hashtag was a winking 'ok it really is if you ask'. Using the same word vectors code from the 2017 article, we built a model for the post-2016 posts in our crawled data – thus, 70,167 unique posts - and then here compare 2017 and 2020:

2017 'notforsale': 'antiquetaxidermy', 'naturalbone', 'deadperson', 'realhuman', 'iliveinamuseum', 'internationalshipping', 'funforever', 'pepper', 'antiquesforsale', 'medicalspecimen'

2020 'notforsale': 'oddities', 'skull', 'cabinetofcuriosities', 'curiosities', 'skulls', 'taxidermy', 'odditiesandcuriosities', 'humanskull', 'odditiesforsale', 'art'

The winking nod remains.

When we look for words closest in the model to 'forsale', we find these are actually several usernames connected with making art *depicting* human remains. This is dissimilar to what we found in 2017, where there were more words connected to particular kinds of bones and their desirability. If we look at 'sell' we find the closest words are:

skullsell, heavyskulls, cannibal, cannableskull, legal, prohibited, [username redacted], [username redacted], possess, zeldaskull

'Cannibal' and 'cannableskull' suggest the association with the exotic, while 'legal', 'prohibited', and 'possess' point to a concern for 'covering the bases' as it were, a warding off the inevitable question 'is this legal'. The final 'zeldaskull' points back to making art. Thus, between 2017 and 2020 there is an indication of more of a concern towards the legality of the trade: while at the same time being more explicit that, yes, this item may be purchased.

We can explore the idea of 'legal' discourses in more depth by looking at the vector of words around 'legal' and 'prohibited'; instead of merely listing the closest words, we took the distances in the vector and expressed them as a dendrogram (Figure 3). The result almost reads like a post itself. It is interesting that expressions of price also fall along this vector, and that the majority of these are denominated in Canadian dollars. We might speculate that news coverage during the last Canadian federal election where a candidate was 'outed' in news media (not by us) for buying a human skull and giving it to her partner (Troain 2019a; 2019b) might lead to this language in posts from Canadian accounts around the legality of buying/selling. In those news stories, our work was cited, and we were invited for comment, since the 2017 article was readily found by the journalists. Thus, in a roundabout way, we can see in the current discourse perhaps a hint of the impact of our earlier work.
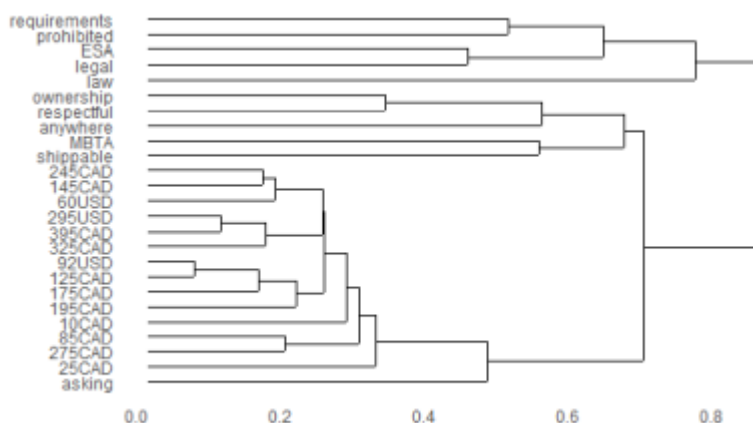

Figure 3: Dendrogram of word vector distances illustrating the vector space around the word 'legal' in Instagram posts

3.4.1 Topic models

Using the same code that we used in the 2017 article, we created a topic model of 25 headings to see how the compositions of post texts may have changed over the interval. We can think of each topic as the 'bin' from which different ideas are drawn. Individual words within a topic will help compose the topic in different proportions; in the list below, the most important words in this sense are listed left to right.

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[1] " oddities taxidermy skull vultureculture skulls
odditiesandcuriosities curiosities oddity bones odditiesforsale"
[2] " ãƒâ cabinetofcuriosities cabinetdecuriositãƒâ curiositãƒâ
les pour sur des wunderkammer une"
[3] " oddities odditiesandcuriosities odditiesforsale taxidermy
vultureculture bones bonejewelry curiosities taxidermyart
boneart"
[4] " oddities etsy halloween shop spooky link etsyshop bio
gothicdecor curiosities"
[5] " oddities odditiesandcuriosities odditiesforsale macabre
gothic curiosities vintage cabinetofcuriosities goth creepy"
[6] " skull oddities humanskull horror darkart macabre
curiosities death gothic halloween"
[7] " skull sold piece shipping glass black hand sale real set"
[8] " skull skulls humanskull skullartwork skullsofinstagram
skulladdict skullart skullobsession skulltattoos skulldesign"
[9] " ã,â curiosities skull crystals crystal skulls
cabinetofcuriosities skullsforsale quartz oddities"
[10] " skull humanskull human skulls osteology oddities
skullcollector bones wunderkammer taxidermy"
[11] " oddities witch witchcraft witchesofinstagram gothic pagan
goth curiosities vintage wicca"
[12] "life time people body itã human history day love death
museum"
[13] " skull humanskull art drawing skullart darkart skulls
illustration artist sketch"
[14] " entomology butterfly oddities curiosities
cabinetofcuriosities insects taxidermy butterflies insect
odditiesandcuriosities"
[15] " cabinetofcuriosities fãƒâ und eng museum der nden
wunderkammer art ãƒâ"
[16] " vintage curiosities oddities cabinetofcuriosities antique
art antiques visit etsy link"
[17] " shop time link love bio day check itã pieces week"
[18] " instagram curiosities memes follow stories game meme tags
followforfollowback videos"
[19] " cabinetofcuriosities curiosities oddities wunderkammer
taxidermy art antiques interiordesign vintage naturalhistory"
[20] " skull humanskull cabinetofcuriosities death skulls
tribalart bones wunderkammer tribalskull mementomori"
[21] " art cabinetofcuriosities artist photography wunderkammer
curiosities sculpture cabinet unique photo"
[22] " oddities giveaway follow feff tag post curiosities enter
winner [url-redacted]"
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[23] " oddities odditiesandcuriosities odditiesforsale
curiosities odditiescollection odditiesmarket odditiesshop
odditiesandcuriositiesexpo curiositiesforsale odditiesfleamarket"
[24] " tattoo humanskull skull oddities cabinetofcuriosities
skulltattoo odditiesandcuriosities weirdandwonderful
throughthelookingglass witchyvibes"
[25] " curiosities del una los por para ãfâ che curiosidades las"
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What is striking in 2020 is the relative *absence* of words connected with, for instance, the Asmat or Dayak peoples, Tibetan kappalas or the practice of headhunting among the diversity of cultures who practised it (except for the minor mention of 'tribalskull' in topic 20), while the continued association with Hallowe'en, Etsy, tattoo culture, and witchcraft remain strong. It is important to note that these kinds of materials are still being traded and are indeed mentioned in posts; what this *model* indicates is the relative role - or not - of words like 'Dayak' or 'Tibetan' in forming a coherent topic visible at a macroscopic level. We might perhaps interpret this to mean that there are fewer overt mentions of this particular material compared to other words, relatively speaking. While in 2017 there was a topic related to tourism (catacombs and so on), that topic does not seem apparent now. The practice of giving away human remains as a kind of loss-leader that was apparent in 2017 continues in 2020 (topic 22, which also has the url to the store of one major trader as a prominent word in the topic).
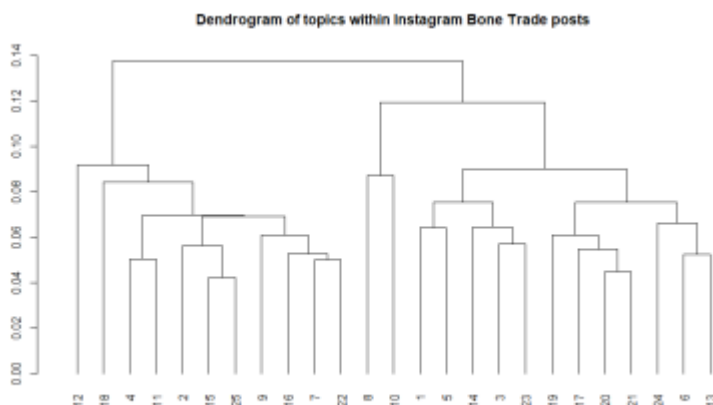

Figure 4: Dendrogram of topic similarities in a 25 topic topic-model of the posts

In our earlier work, we found that there was a close clustering of topics related to 'ethnographic' materials and topics concerned with the mechanics of buying and selling. That clustering is not present in the more recent materials. Indeed, while there seemed to be a much clearer break in the first study between topics related to possessing the dead, and topics related to art, in these materials that line is much more muddied.

4. The Act of Observation

That we can spot some changes from 2017 in the discourses surrounding human remains that seem connected to our own work, in that there is a change towards a bit more caginess (in at least a Canadian context), is in some ways heartening. But in other ways, it is troubling. When we do non-digital archaeology, the materials do not push back at us, they do not change because we are looking at them, in the way that digital

materials do. Traders that we have observed for some time now take pains to not mention explicit prices (they instead direct communications into private 'direct messaging' applications); when we do work on the image data itself, we notice individuals overlaying text into the images to evade metadata crawls (Huffer and Graham 2018; Huffer *et al.* 2019). The nature of the data seems to be changing because of our observations and reporting (we are also engaged in activism, helping to co-found the Alliance for Countering Crime Online).

Not only does the act of observation change that which we observe, it also triggers a kind of red-queen effect, where we have to keep modifying what we do to stay ahead of that which we study, and why replication/reproducibility is a necessary part of our work. This opens up another dimension to the ethical considerations of digital archaeology around replicability – or at least, the *reporting* of replicable research. The episode that led to our brief moment of media attention triggered much sensational reporting. The major inflection point was when our research was paired with interviews with bone traders in *Wired* magazine (Schwartz 2019). After that moment, the story was repackaged and reprinted in other outlets like the UK's *The Sun*; as we tracked these iterations, our academic view was filtered, diluted, and reduced but the bone traders' perspectives continued to be showcased. How much *new* traffic was pushed towards bone traders as a result? We do not believe that it is possible to quantify, since if one is interested in human remains, it is easy to find these on Instagram, Facebook, or elsewhere. It takes but a moment to find public and private groups on Facebook dedicated to trading human remains. Joining private (let alone secret groups) almost always requires appearing to have the 'correct' sort of profile and/or satisfactorily answering the gatekeeping questions of the groups' administrators – something a passingly curious individual reading our research but not actively collecting would likely be able to do. Whether or not someone's curiosity is sparked enough to search for human remains due to reading newspaper articles that quote us or our published work, examples of human remains trafficking on these platforms are not made difficult to find. Indeed, having shown the machine such an interest, the platform's recommendation algorithms will facilitate further connections.

After an article appeared on Live Science.com (Jarus 2020) that quoted us and several law enforcement officials, in which the reporter described what he saw during several months of clandestine observing of several private human remains trading groups on Facebook (and then approached Facebook officials), two of the largest groups dedicated solely to human remains were removed. Almost immediately, however, the admins of these groups formed new ones, as did prominent collectors who used the now-removed groups. In the 'about' information publicly stated for these new groups, a key requirement for membership is that prices not be stated at all. Note that many other groups also exist that are older and have not markedly changed policy, save for using emoji numbers or symbols to state prices or willingness to ship, misspelling 'human', etc. It is arguable that these slight changes of discourse in the language of the posts on both platforms reflect a greater concern for the apparent legality of the trade than there once perhaps was.

5. Conclusion

This brief report revisited the work we conducted four years ago to see if the broad patterns in terms of amounts being sold, and structure of the network, held up or if they had changed. It is possible to *replicate* the general thrust of what we tried to do in our

2017 article, but we cannot exactly *reproduce* what we did (understanding the difference between reproduction and replication as proposed by Marwick 2017, Marwick *et al.* 2020).

We find that the amount of money and the amount of materials being bought and sold seems to be accelerating, and the numbers of people participating in this trade seem to be increasing. The language of posts has changed in subtle ways that we might see as a response to the increased media attention the trade has received in recent years. The overall structure of *kinds* of accounts and their interconnections seems to be holding. Of course, Instagram does not make it easy to scrutinise what is going on, and its parent company Facebook continues to tinker with monetizing various parts of its various platforms. When eBay banned human remains on its site in 2016 the dollar value of sales crashed on that platform (even though some sales continued, evading the ban, Graham 2020); the figures presented here show a large jump in stated values given on Instagram posts around that same period which perhaps can be interpreted as a shift by vendors to the newer platform. Facebook (Instagram's parent) seems to want to encourage transactions in private groups using Facebook's own financial exchange mechanisms, though this process has not been completely realised yet, and might never be. When/if it does, we might expect to see a drop in posts naming a price for human remains as Facebook's newer systems come online and vendors shift platforms again.

Studies that take social media or other online sources as archaeological (or criminological, sociological or ethnographic) data likely will never be reproducible, but they may be replicable. The underlying platforms change too fast; the legal and cultural contexts change, and users and the platforms themselves actively (algorithmically) resist the act of observation by researchers. But should we be reporting these studies in open access venues or publications? A paper Graham gave as part of the 4th Public Archaeology Twitter Conference (https://publicarchaeologyconference.wordpress.com/patcs-past/patc4/; see Graham 2019 for a copy of Graham's tweets) asked this question in the light of our brief media moment earlier that summer; reaction from participants came down on either side of the question, with no clear resolution. As more archaeological research engages with the intersection of social media and material culture, we need to be engaging with the literature in the social sciences and new media spheres to learn how best to deal with these issues. The work of scholars like Richardson (2018) and Dennis (2020) could not be more timely. This interplay between algorithmic agency and the practice of research into grey-market areas like the humans remain trade we intend to explore in future work. In the meantime, we are left uneasy at the intersection of archaeological ethics and the ethics of open access research.

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