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Authenticity matters: Children look beyond appearances in their appreciation of museum objects

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ABSTRACT

Authenticity is often supposed to play an important role in natural history museums. Yet we know very little about how it affects the perception and appreciation of museum objects. In the present study, we examined children's perceptions of real fossils and replicas. We explored four potential explanations underlying the appreciation of authentic objects: physical appearances, ideational motivations (i.e. authentic objects are simply 'better'), associations and contagion (the belief that some quality or aspect of the object's history still inheres in the object). Seventy two children of 8–12 years old visiting a Dutch natural history museum were asked to rate the museum-worthiness of two replicas and two real dinosaur fossils in two states (whole object vs a small fragment). Results suggest that, although appearances and associations do play a role, the appreciation of real fossils is rooted in the contagious belief that previous contact of the object (e.g. with a living dinosaur) continues to act on the object after the physical contact has been severed. Altogether, our findings provide evidence that children look beyond superficial appearances and place great value on non-obvious features such as object history.

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Authenticity; museums; replicas; fossils; contagion; essentialism

Introduction

Museums of science and natural history have traditionally focused on original authentic objects (Evans, Mull, & Poling, 2002). Yet we know very little of the effects of such objects on museum experience. In fact, authenticity has only recently undergone a resurgence of interest, becoming a matter of concern in some leading research agendas (Dillon et al., 2016). Especially in the face of increased digitalization, it is necessary to establish the role of the 'real' and its implications for learning in the broad sense (Watson & Werb, 2013).

Despite its importance, it is unclear how authenticity should be defined. Some authors have noted that it is not inherent in the object, but is instead negotiated or constructed (Jones, 2010; Rossi, 2010). Others have stressed that it pertains to originals (Evans et al., 2002) and some have even argued that no all-encompassing definition exists and that the concept should therefore be abandoned (Reisinger & Steiner, 2006). If authenticity is indeed superfluous, we should expect a well-made replica to afford similar experiences as the original (Latour & Lowe, 2011). On this point, however, the literature appears to be divided. On the one hand, there is evidence that authenticity may play but a minor role in museums (Hampp & Schwan, 2014) and that parents only sparingly refer to an object's

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authenticity during parent–child conversations (Crowley & Jacobs, 2002). On the other hand, people clearly value authentic objects (Frazier, Gelman, Wilson, & Hood, 2009) and an appreciation of such objects has even been shown to trigger more visitor questions in museums (Bunce, 2016a). As it stands, therefore, the role of authenticity in museums is by no means clear-cut.

The purpose of the current study is to fill this gap and examine the role authenticity might play in a museum setting. Specifically, we addressed two research questions. Firstly, do children value authentic objects over inauthentic replicas and secondly, what reasons do they have for valuing authentic objects?. Such knowledge is especially important given the increased usage of virtual objects and the widespread interest in the effects of digital technology on the appreciation of real objects (Eberbach & Crowley, 2005; Katz & Halpern, 2015).

This study identified four competing mechanisms in the existing literature that are believed to underlie our appreciation of authentic objects: *ideational* motivations, *contagion*, *association* and *physical appearance*. These mechanisms are described in more detail in our theoretical framework.

Theoretical framework

There is an important sense in which an object's authenticity is vested in its particular history. People tend to spend enormous sums on celebrity items, visit galleries to view original works of art and go to museums to look at age-old objects, irrespective of their cultural background (Gjersoe, Newman, Chituc, & Hood, 2014). What these objects have in common is that they are often irreplaceable; a facsimile of the Mona Lisa would not be half as valuable as the original painting. Moreover, the qualities causing authentic objects to be treasured over their facsimiles cannot be discerned from their outward appearance alone. Two objects that look alike, may deep down be different. To appreciate this difference, visitors must attend to the history of an authentic object and treat it as an individual (Gelman, 2013).

Interestingly, from an early age children seem to be capable of placing special value on unique individuals. At three years old, preschoolers view their attachment objects such as a sleeping blanket or stuffed animal as uniquely desirable, whilst being fully aware that their preferences may not be shared by others (Gelman & Davidson, 2016). Such judgments also extend to authentic objects. By the age of five, children judge both celebrity items and original creations (e.g. the very first teddy bear) to belong in a museum (Frazier & Gelman, 2009) and these beliefs hold for adults as well (Frazier et al., 2009).

We have identified four existing mechanisms that may play a role in the valuation of authentic objects: *ideational* motivations, the object's *physical appearance*, its *associative* potential and the principle of *contagion*. Jointly, these four mechanisms make up the theoretical framework we employ in analyzing our data. The first of these aspects, *ideational* motivations, has to do with bias towards authentic objects. If people value authentic objects ideationally, they do so because they believe authentic objects are inherently better (Rozin, 2005). Ideational preferences usually do not conform to the actual material quality of the object, but rather reflect a belief that the preferred object is better or simply 'right' (Rozin, 2005). For example, a Louis Vuitton bag that has been made entirely in France is considered disproportionately more authentic than a bag of which 95% has been manufactured in France (Newman, 2016). The actual material difference between the two bags, therefore, is insufficient in itself to explain the sudden drop in authenticity. Admittedly, ideational motivations do not fully explain the valuation of authentic objects, but rather push back the question at hand, because they leave unexplained why authentic objects are believed to be better in the first place. Nevertheless, if a bias towards authentic objects exists, it could lead us one step further towards understanding authenticity.

One other possibility is that participants attend closely to the *physical appearance* of authentic objects. For instance, the object might be aesthetically pleasing, (Hampp & Schwan, 2015) or provide affordances for study (Bunce, 2016b). Moreover, things that look old or have clear signs of wear tend

to be viewed as an original, rather than a replica (Hampp & Schwan, 2014). Appearances may therefore play a role in people's appreciation of authentic objects.

Another aspect of authentic objects has to do with their *associative* potential. In other words, the object could serve as a reminder of the source it was once in contact with in the way celebrity items remind you of the owner (Newman, Diesendruck, & Bloom, 2011). In this sense, objects allow visitors to relive previous associations. Nevertheless, structurally altering the object beyond recognition would destroy the connection and negate its associative potential (Nemeroff & Rozin, 1994).

Authentic objects can also be appreciated, because their history is thought to have 'rubbed off' onto the object. This is known as the law of *contagion*, a form of magical thinking where people hold that things that have once been in contact remain in contact indefinitely (Rozin & Nemeroff, 1990). Magical does not imply irrational. Magical thinking rather functions as a cognitive intuition. Something akin to a rapid, but flawed reasoning heuristic (Nemeroff & Rozin, 2000). On this account, celebrity items are valued, because people believe some immaterial quality or essence was transferred from the celebrity or 'source' to the object (Newman et al., 2011). Contagion can be both positive and negative. An instance of the latter is illustrated by the reluctance participants of a study by Nemeroff and Rozin (1994) felt when asked to consider wearing a sweater that has previously been worn by someone evil such as Hitler. These authors found that physical action did little to lessen the aversion, nor did reknitting, or cutting up the sweater. Instead, participants acted as if some immaterial essence was transferred to the sweater.

Discussions of essences also speak to an essentialist account of authenticity (Newman, 2016). Essentialism reflects the belief that members of certain categories have an underlying immutable reality that defines their true nature (Gelman, 2013). Congruent with essentialism, authentic objects such as moon rocks are also believed to share unobservable properties, regardless of their perceptual dissimilarity (Newman, 2016). Although essentialism involves a belief in some deeper reality, it is not a metaphysical conviction. In other words, people do not actually commit to the idea that the essences are really 'out there' in the world independent of our experience (Gelman, 2009). Essentialism as such is therefore chiefly a psychological claim (Gelman, 2004). For example, people might believe that all birds share some inner feature or essence that causes them to be alike, despite within-category differences in appearance; e.g. penguins are birds whereas bats are not, even though bats look more typically like birds than penguins do. Likewise, children may hold there is an innate indivisible difference between men and women, without knowing what this difference entails (Gelman, 2004). Only later on they may come to realize that a person's sex has to do with his or her DNA. Essentialism, thus conceived, is a placeholder notion, reflecting the idea that there *is* an essence, rather than some specific belief in what it is that constitutes the essence. One can therefore hold that there is some common cause central to a category, while remaining agnostic as to its nature. Because the principle of contagion is also grounded in a belief in nonvisible immutable essences, the 'essences' of contagion may very well be the ones postulated by psychological essentialism (Gelman & Hirschfeld, 1999).

Although each of the factors mentioned above has been studied in relative isolation, they have never been examined collectively in a museum setting. As a result, we do not at present know whether or why authentic objects are valued in museums.

Research questions and predictions

This study aims to deepen our understanding of authenticity by addressing two questions. Firstly, do children value authentic objects over inauthentic replicas and secondly, what reasons do they have for valuing authentic objects? In order to address the first question we asked children to judge the museum-worthiness of our objects. This measure is known to be a reliable proxy for the appreciation of authenticity (Frazier & Gelman, 2009) and allowed us to determine the extent to which authenticity adds meaning beyond mere subjective preference. Moreover, by using children as participants we provide a more stringent test, as their appreciation for authentic objects is more subtle (Gelman,

Frazier, Noles, Manczak, & Stilwell, 2015) and they are not yet tainted by education and background knowledge in the way adults are.

To examine the reasons children have for valuing authentic objects, our second question, we asked them to justify their ratings. We predicted that the four mechanisms of our theoretical framework might be involved in the valuation of authentic objects. To reveal the importance of each of these mechanisms, we examined four objects. A real *Tyrannosaurus rex* fossil, a dinosaur footprint and two replicas of the fossil. Participants were told that one of the replicas belonged to a national celebrity. Judgments of museum-worthiness had to be given twice. Once for all items in their original state and once for the (hypothetical) situation in which they had to imagine to only have a fragment of the object. By combining state (fragment or complete object) and object type (celebrity item, real fossil, real footprint, replica) we were able to disentangle previous explanations, resulting in four hypotheses:

(1) Authentic objects are inherently better (ideational). If ideational factors are deemed important, all objects save the replicated fossil should be judged to belong in a museum, as these three objects are authentic by virtue of their history.
(2) Appearance takes precedence. If appearance takes precedence, the replicated fossil should be valued at a similar level as the celebrity object, since they are both visually identical.
(3) Objects serve as a reminder of the source (association). If all objects are valued when complete, but not as a fragment, this would speak to the associative account, because breaking up an object decreases its associative potency. Indeed, all that would be left is an ordinary piece of rock, especially in the case of the footprint.
(4) Some of the history is believed to have 'rubbed off' on the object (contagion). If fragments of the real fossil, footprint and celebrity item are valued over an intact replica, this would be in accordance with the law of contagion, because even small pieces of such objects are held to be suffused with the 'essence' of the source.

Method

Setting and participants

The experiment was conducted in one of the halls of Naturalis Biodiversity Center, a Dutch natural history museum having one of the largest natural history collections in the world. This study was part of a larger set of experiments revolving around the perception and appreciation of authentic objects. Although the museum's main building was closed for renovations, the entrance building housed a temporary exhibition: '*T. rex* in town', which was centered around the display of a real *Tyrannosaurus rex* skeleton.

Seventy-two children were recruited on the spot over a period of three months. Four children were excluded, because they were unable to provide any reasons for their scores or did not pass the training phase. Therefore our study included 68 participants (mean age = 9.68, SD = 1.29, 53 boys, 15 girls). Although more boys took part in the experiment, this was not the result of a selection bias. Rather, more boys in this age group were present at the museum.

Materials

The presented objects included two real fossils and two replicas (Figure 1). For the real fossils we used a toe bone of the long extinct carnivorous *Tyrannosaurus rex* and a dinosaur footprint. To ensure that both objects were similarly appraised, we told participants the footprint belonged to the same species of dinosaur. The two replicas were synthetic copies of a real *T. rex* toe bone and were completely identical to each other, but slightly different in color, shape and texture from the fossil. To convert one of these replicas into a celebrity item, we explained to our

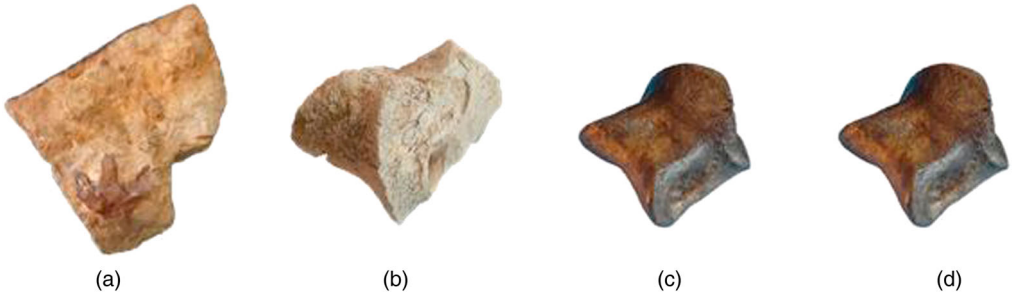

Figure 1. The objects used in the experiment. The footprint (a) and the *T. rex* toe bone (b) are real fossils, whereas (c) and (d) are replicas of the toe bone. Note that (c) and (d) are identical. Participants were told one of the replicas belonged to a celebrity.

participants that it had belonged to Freek Vonk, a Dutch national celebrity who is generally well-liked by children. The other replica was said to have been produced by the museum itself. To test the museum-worthiness of these objects, we employed a novel method. Instead of presenting the children with a forced choice or rank-based assignment, we made use of 'The Dinometer', a life-size abacus where participants could use a slider scale to express their rating (Figure 2). Objects were placed on the left side of the abacus and their positions were randomized across participants.

The choice to use a slider scale in a game-like setting was deliberate. The slider scale allowed us to measure the museum-worthiness of the objects without explicit ranking, since ranking the objects

Figure 2. The life-size abacus. Objects were placed on plateaus at the left hand side. Participants could rate the respective object by moving the black rings across the rods. The distance from the utmost left end of the rod to the position of the ring was taken to be the participant's score.

from one to four would have forced participants to assign a different position to each object, even when a participant is unable to choose between objects, i.e. he or she might think two or more objects equally belong in a museum. Nor did we choose to make use of a likert scale, because children tend to have a limited understanding of likert response formats (Mellor & Moore, 2014). The method we used allowed for this possibility. Furthermore, we believed that by making the apparatus attractive to look at, we would be able to recruit more participants. We did not think the design would interfere with the ratings, because all objects were simultaneously present on the apparatus and the relevant comparisons were between objects.

Procedure

Prior to the experiment, we explained the purpose and scope of the study to both children and their parents. They were then asked to read and sign an informed consent form. Participants were seated at the experimenter's table and were introduced to the four objects. The order of explanation was changed randomly per participant. After the introductory phase, the objects were transferred to the abacus. To familiarize children with the apparatus, we asked them to rate how much they would like to eat their favorite food and how much they would like to eat food they thoroughly disliked. The resulting scores had to be at the outer ranges of the abacus. Only one subject failed to pass the training phase and was excluded from the study. Once familiarized with the abacus, we asked the question: 'How much does this object belong in a museum?' for each object. We then told our participants to score the objects again, but this time imagining they only had a fragment of the objects, the size of a marble. Additionally, in both conditions, we asked them to justify their ratings. This was done for the objects with the highest and the lowest score. Responses were elaborated by non-directive probing. Participants who, in their justifications, only referred to the object being real were also presented with a forced choice question where we directly juxtaposed the object's appearance with its source. More specifically, we asked them why they thought it important that the object was real and if this had to do with the appearance of the object or with the fact that it was from a dinosaur. This forced-choice question was done for 27 subjects in total.

The interviews were audio-taped and transcribed for analysis. Quantitative scores were photographed and analyzed using ImageJ processing software (Schneider, Rasband, & Eliceiri, 2012). At the end of the session, participants received a small token as compensation for their efforts.

Analysis

Pictures of scores for museum-worthiness were analyzed by measuring the distance from the left hand side of the abacus to the black rings. The full distance was set at 100 arbitrary units and calibrated for every photo so that all scores would fall between 0 and 100. Distance scores were transformed by the power of 11/6 in order to conform to normality. Mauchly's test revealed a violation of sphericity for which we compensated by applying a Greenhouse-Geisser correction. Model output was passed to the emmeans package for conducting post-hoc contrasts (Lenth, 2018). To control for the family-wise error rate, we adjusted the p-values according to the conservative Bonferroni method. All statistical analyses were performed in R base 3.4.3 (R Core Team, 2017).

The transcribed interviews were coded in QDA miner lite software (Provalis research, v2.01). Only the first justifications were coded, since most participants only provided a single reason per object. Part of the data (20%) was coded separately by another researcher. Intercoder reliability was excellent (90%), Cohen's kappa = 0.87.

Justifications coding

Justifications for participants' scores were grouped in seven main categories, four of which were based on previous studies: authenticity, appearance, history and rarity (Hampp & Schwan, 2014).

Table 1. Categories of justifications. Participants were asked to justify their ratings for the highest and lowest ranking object, both when whole and as a fragment. The total number of coded segments for each category is shown in parentheses. Participant number is included in the examples.

Main category	Sub-category	Description	Example
Authenticity (120)	Reality status (106)	Participant refers to the object being a real fossil or a replica.	'Because this one's real (fossil fragment, 18). Because they have made this one, it's not real' (whole celebrity item, nr. 32)
	Ideational (14)	Real object is better or more interesting than a replica and vice versa.	'Because the real one is more interesting' (whole footprint, nr. 28)
Appearance (41)	Aesthetic (8)	Object is beautiful or unattractive.	'Because it's like art and reallt pretty' (all objects whole, nr. 20)
	Association (9)	Object can be (no longer) recognized or is associated with a T .rex.	'A small piece of this one, then you can't even see what it is' (replica fragment, nr. 67).
	Appearance (3)	Participants refer to the outward appearance of the object.	'Of course, it's nice that you can see what it looked like' (whole replica, nr. 36).
	Study (6)	Object provides information about the natural world.	'Well, if you study it very carefuly, you can probably predict what it looked like' (fossil and footprint fragment, nr. 17)
	Authentic appearance (15)	Object looks real or looks like a replica.	'Well, because it looks real' (whole fossil, nr. 23)
Other (28)	Inexpressible (9)	Participants could not express why they valued the object.	'Just because' (whole fossil, nr. 14)
	Other (19)	Any justifications that could not be classified in existing categories.	'You can still place it in a museum when it's very small, cause then no one will notice' (replica fragment, nr. 58).
Rarity (27)	Rarity (27)	Object is rare, unique or the opposite: participants expressly refer to the commonplace nature of the object or its redundancy.	'Because that one is the rarest' (whole fossil, nr. 52)
Source valuation (23)	Source valuation (23)	Object is from, or has been touched by a dinosaur.	'Because it really belonged to a dino' (whole fossil, nr. 13)
Ownership (14)	Owner (14)	Participant refers to the owner of the object.	'Freek Vonk a little more, because he's important' (whole celebrity item, nr. 23).
History (13)	Life history (7)	Participant refers to the path the object has traveled before arriving at the museum.	'I think it's really special that this foot has been covered in clay for a really long time and that we can just, say, find it' (whole footprint, nr. 41).
	Age (6)	Object is old.	'Because it's really from the past' (footprint fragment, nr. 29)

Ownership and source valuation emerged from the data during coding. Main categories were further divided into relevant sub-categories as shown in Table 1. In total, 266 justifications were coded. All justifications were recorded and analyzed in Dutch. For the purpose of this paper, we have translated relevant quotations into English.

Results

Ratings of museum-worthiness

Figure 3 shows the mean ratings of museum-worthiness for each object and condition. To examine whether participants accorded higher scores to the real fossils than to the replicas, we conducted a 4 (object type: fossil, footprint, celebrity item, replica) x 2 (state: whole, fragment) repeated measures ANOVA. Ratings of museum-worthiness were highly affected by object type, $F(2.04, 136.94) = 137.15$, $p < 0.001$, indicating that participants readily discriminated between the four objects. The size of this effect was considerable, $\eta^2 = 0.36$. Furthermore, it was found that object state impacted the ratings by significantly lowering them for all objects, $F(1, 67) = 60.14$, $p < 0.001$ at a medium effect size $\eta^2 = 0.13$. We also obtained a significant object x state interaction, $F(2.10, 140.67) =$

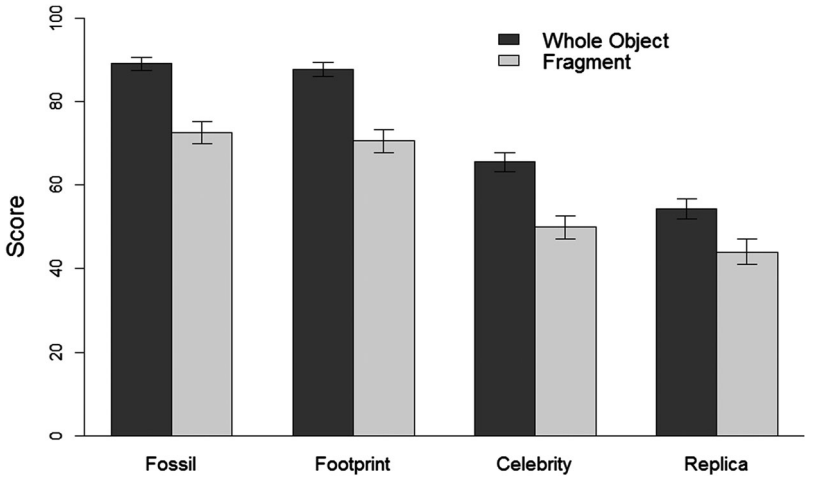

Figure 3. Mean scores of museum-worthiness for the four test objects in two states. Scores are set between 1–100 in arbitrary units. Error bars represent the standard error of the mean.

8.79, $p < 0.001$, implying that the effect of state was different for some objects, but this difference was only small, $\eta^2 = 0.02$.

Post hoc tests revealed that the fossil, footprint and celebrity item were valued more when whole than as a fragment ($p < 0.001$). This pattern also held for the replica, albeit that the effect was less pronounced ($p < 0.05$). Overall, children did not discriminate between the footprint and the fossil (Figure 3), even when asked to only consider a fragment of both objects. Participants did, however, make a distinction between these two objects and the replica, judging the replica to belong in a museum much less than the footprint and the fossil ($p < 0.001$). Although identical in appearance, the celebrity item was assigned a higher score than the replica when intact ($p < 0.001$), but not when fragmented ($p = 1$). And finally, children judged fragments of the fossil and the footprint to be significantly more worthy of being placed in a museum than an intact replica ($p < 0.001$).

Participants' reasons for their ratings

Each participant gave four justifications in total. One for the highest ranking object and one for the lowest. This procedure was repeated for the fragmented state so that we could theoretically obtain $68 \times 4 = 272$ justifications. When objects were given equal scores, only one justification was reported, since in these cases we did not have a highest or lowest ranking object. As a result, the actual number of justifications was 266.

Participants were very sensitive to the object they were presented with. But rather than distinguishing between all four objects, children treated the fossil and footprint very similarly. Likewise, the replica and celebrity item were often given the same justifications. For this reason, we will mainly discuss the difference between the two sets and highlight contrasts within sets where appropriate. Below we will discuss the different themes that emerged: authenticity, appearance, rarity, source valuation, ownership and history.

Authenticity

By far, the majority of the justifications were about the *authenticity* of the objects (120 of 266 justifications by 56 of 68 participants). These justifications were mostly phrased quite succinctly in terms of their *reality status* (106 justifications by 50 participants): 'Because they are, they are real' (fossil & footprint, nr. 32). 'Yeah, it's just that it's the original' (fragment of fossil & footprint, nr. 12). Participants readily discriminated between the objects that were real fossils and those that had been made

artificially. 'Because it's fake and you made it yourselves' (replica, nr. 5). At times, the celebrity item and replica were even treated alike. 'Those are not as special, cause, eh, you just know that it's a piece; this is a piece of plastic or something, some other material, but it's not the original' (fragment of replica & celebrity item, nr. 12).

Although participants cared for real fossils, they did not always voice a bias to see them as more interesting. *Ideational* motivations therefore only accounted for a minority of the authenticity justifications (14 justifications by 12 participants): 'Well, the original is often better than such a fake piece of a fake dinofossil' (fossil & footprint, nr. 62).

Appearance

The second most important category was the object's *Appearance* (41 justifications by 29 participants, Table 1). Again, children treated the fossil and footprint similarly and reported equivalent reasons for the replica and celebrity item. The authenticity of the object was often included in visitor judgments as in the case of the *aesthetic* justifications (8 justifications by 8 participants): 'Yes, but when something's real, it looks really beautiful' (fossil, nr. 24).

Participants also believed that an object had to look real. *Authentic appearance* (15 justifications by 14 participants): 'Cause that one, eh, you sort of see that it's a copy' (replica, nr. 65). Interestingly, they did not only believe that an object had to look real, it also had to be real in order to appear authentic. 'Well, yeah, cause, ehm, now you can see what it really looks like and not how it's, you know, copied' (fossil & footprint, nr. 12). And the objects that were, in fact, identical, were sometimes regarded differently. 'It (the replica) looks less real than that one' (celebrity item, nr. 31).

Understandably, the objects were only found to be physically attractive when whole and never as a fragment. But both fragments and intact objects allowed for *study* (6 justifications by 5 participants): 'Because people can learn from it, because we found them' (fragment of fossil & footprint, nr. 57).

Justifications having to do with the object's *association* were almost exclusively mentioned in the fragmented state: 'Yeah, cause it's sort of nice, that when you see a piece as a kid, that you can see it's a bit from that, the toe' (fossil fragment, nr. 36).

Rarity

The *rarity* of the objects was the third type of justification (27 justifications by 21 participants). For justifications of the fossil and the footprint in this category, visitors often emphasized that the object was rare or unique: 'Ehh, because you seldom find one' (footprint, nr. 52), 'Well, because, when you find it, it's often rare. There aren't that many to find' (fossil, nr. 64). But for the replica, they mentioned its artificial nature without exception: 'Yeah, cause when you have the machine for making them, you can do it yourself' (replica, nr. 47), 'Ehhm, because almost anyone can make such a toe bone' (replica, nr. 52).

Interestingly, participants more often referred to rarity in the fragmented state (16 participants) than when the object had to be judged intact (8 participants). Having a fragment of a replica was even considered pointless: 'Because it's a copy, and then, if you put it there, you could do it, but then you've only got a small piece of something you made yourself. It would be better to make a new one' (replica, nr. 60). But a fragment of a real fossil was still valued: 'Because, yeah, you don't get this just like that. The smaller, the more valuable' (fossil and footprint, nr. 47).

Source valuation

Another important category explaining the high scores for the fossil and footprint was their *source valuation* (23 justifications by 21 participants). These justifications were somewhat more elaborate than those of the other categories. Interestingly, visitors mentioned the importance of physical contact between the dinosaur and the object. They did not value the object for what it was materially, but rather for what it used to be or came in contact with. As a result, it mattered little whether the object was fragmented or not: 'Well, because it's still important, cause it's part of a dinosaur and a small piece can also be important. It was once attached and it also moved' (fossil fragment, nr. 43). The

physical contact between the dinosaur and the footprint seemed to impart an ordinary piece of clay with an extraordinary quality: 'Well, I think the footprint is very special, that some dinosaur once stood in the clay like that. You don't see this every day' (footprint, nr. 2). The two artificial objects, on the other hand, seemed to lack this quality: 'Well, yeah, because they were never really used by a dinosaur … Yes, because it has never been alive' (celebrity & replica, nr. 4).

Ownership

The one category that might shed light on why the celebrity item was valued over the replica is *ownership* (14 justifications by 12 participants). Children clearly paid attention to whom the object belonged and conflated the status of the celebrity with that of the object: 'Well, because it's from Freek Vonk, from someone who's very special and Freek is really famous' (celebrity item, nr. 71).

History

Finally, the *history* of the objects was only occasionally alluded to (13 justifications by 13 participants). The *age* of the objects often impressed the children. They could often hardly believe that what they were looking at was in fact millions of years old. 'Well, cause it's from millions of years ago and we're still able to find it millions of years later' (fossil, nr. 19). The object's past or *life history* was also brought up. Especially in relation to the excavation: 'Because it's more special when you really discovered it. Cause it took a lot of effort and that makes it more special' (fossil fragment, nr. 54).

Forced choice question

Many participants spontaneously expressed that they valued real objects, but when pressed to provide an additional explanatory step, they often resorted to circular reasoning or repeated their previous answer:

Child:	because it's real.
Researcher:	And why is it so important that it's real?
Child:	Well, because when something's fake … then I think it doesn't belong in a museum.
Researcher:	Ok, and why not?
Child:	Because it's fake (fossil, nr. 18).

To further explore why they appreciated real objects we took two of our main categories, *appearance* and *source valuation* and pitted them against each other. The overwhelming majority (23 of 27 participants) expressed that their preference for real objects was because they valued its source, the *T. rex*, rather than the object's outward appearance (1 of 27). Interestingly, three children could not make a decision, even when pressured to do so. We therefore assigned them to a position in between the two choices.

Discussion

The primary goal of this study was to examine whether children value authentic museum objects over replicas and why they might do so. Using a novel procedure we asked children to rate the museum-worthiness of two fossils and two replicas, one of which was told to belong to a celebrity. This setup allowed us to test four possible explanations underlying the valuation of authentic objects: (1) Authentic objects are believed to be better. (2) Authentic objects are valued for their appearance. (3) Authentic objects serve as a physical reminder of the source. (4) The history of authentic objects is believed to have 'rubbed off' on the object. We will address each of these predictions below.

Are authentic objects believed to be better than replicas?

Our quantitative data support an ideational account, meaning people value authentic objects as being better than non-authentic objects. The fossil, footprint and the celebrity item were consistently given

higher ratings than the replica. However, when asked to justify these ratings, only few participants spontaneously expressed their justifications in terms of ideational motivations. This suggests that the ideational bias is either implicit or the manifestation of some deeper underlying reason.

Are authentic objects valued for their appearance?

In line with the findings of Hampp and Schwan (2015), our participants often mentioned the appearance of the test objects. Where our findings deviate from the authors' findings, is in the independence of authenticity and outward appearances. While Hampp and Schwan (2015) emphasize the precedence of appearances over the historical significance of a museum object, we reveal that appearances are subordinate when pitted against the backstory of such an object. Although both views are diametrically opposed, we deem it more likely that appearance and authenticity are intertwined, so that the one may affect the other. At least three lines of evidence seem to point in this direction. Firstly, the celebrity item was valued higher than the visually identical replica. Hence, objects that are perceptually similar do not have to be treated alike. Secondly, participants reported that sometimes one and sometimes the other of these replicas looked different, even though this was not the case. Thirdly, the results of our forced choice question show that participants value the object's source more than its appearance. In sum, we have strong evidence in favor of the view that appearances do not *always* have the upper hand over authenticity, but may play a minor role when the source of the authentic object is greatly appreciated.

Alternatively, the differences between our results and those of Hampp and Schwan (2014, 2015) could also be explained by the type of participants and the objects used. Our study involved children, instead of adults and made use of fossils, rather than a tunneling microscope or moon stone. It is plausible then, that our combination of objects and participants has led us to a different outcome than the abovementioned authors.

Do authentic objects serve as a physical reminder?

In accordance with the associative hypothesis, we found that all objects were judged to be significantly more museum-worthy when complete than as a fragment. However, in their justifications of the ratings, participants only sparingly referred to the loss of associative potency. Moreover, if the objects served exclusively as a reminder of the *T. rex*, we had expected that all fragments would be valued at a score below 50. That is, they would not be considered worthy of being placed in a museum. But as demonstrated by the real fossil in the fragmented state, small pieces of a precious object are still considerably valued. Strikingly, participants gave similar ratings to the fragmented footprint as to a piece of the real fossil. This is puzzling; there is no qualitative difference between an ordinary piece of rock and a fragment of a fossilized footprint. Here, the *loss* of value would be explained by a lack of association, but the retained value of the fragment would not. Association thus plays a definite role in the valuation of museum objects, even though it is clearly not the only mechanism at work.

Does the history of the object 'rub off'?

The substantial valuation of the fragments of the real fossil and the footprint could not readily be explained by either an appeal to appearances or association alone. Although both fragments were believed to be better and more interesting, there seemed to be some underlying reason motivating the ideational claim. Note that a fragment of a fossil and footprint have very few features in common. They do not look alike, nor do they share a similar relation with the dinosaur they owe their existence to. One is believed to actually have been a part of a *T. rex*, whilst the other has only been in brief contact with the dinosaur. Yet both share a common history: both fragments have been in contact with a *T. rex* somewhere along their trajectory.

We therefore propose that participants were under the impression some of the history 'rubbed off' onto the object. In other words, they acted in accordance with the principle of contagion, by which things that have once been in contact remain in contact indefinitely (Rozin & Nemeroff, 1990). Justifications also confirmed the two hallmarks of contagion: dose insensitivity and route insensitivity. Dose insensitivity entails that the duration of contact is irrelevant in establishing an effect, whereas route insensitivity implies that any part of the source can transmit something of its essence (Nemeroff & Rozin, 2000). Congruent with these basic properties of contagion, both a fragment of a toe bone (believed to be a part of a dinosaur) and footprint (having had brief contact with a dinosaur) were capable of having a similar, substantial effect.

More importantly, we suspect that the overwhelming majority of justifications on the object's reality status had, at their root, an appreciation of its source. That is to say, children judged the fossil and footprint to be museum-worthy because they were really from a *T. rex*. The responses to the forced choice question also point in this direction. They reveal that an appreciation of the 'real' is actually about an appreciation of the *T. rex*, the object's source. Participants thus appeared to conflate object and source, which incidentally, is one of the tenets of magical thinking (Nemeroff & Rozin, 2000).

Other observations also seem consistent with the principle of contagion. The appreciation of the celebrity item relative to the replica, for instance, could only have been due to its owner. Indeed, justifications confirm that ownership was an important factor for this object. The importance of ownership has been implicated in other studies as well. Newman et al. (2011) have shown that a celebrity's physical contact with an object can contribute to its value. The interpersonal influence of our national celebrity, may therefore have led subjects to subliminally believe some of the qualities of the owner were passed down to the object, as stipulated by the law of contagion.

Yet, there is one finding that diverges from our current explanation: the low score for the celebrity object in the fragmented state. Under the principle of contagion, we had expected a fragment of the celebrity object to be valued significantly higher than a fragment of the identical replica, because even small pieces of objects are held to be suffused with the source. The low score implies that, for the celebrity item, contagion plays a marginal role at best. This could be explained by the fact that the celebrity in question is still alive. A fragment of the celebrity object could therefore potentially be replaced by another. Since participants also referred to the replicability of the fragmented celebrity object, it may be unsurprising that they did not make a clear distinction between it and a fragment of the replica in their value judgment.

Essentialism

The results of the current study also fit within an essentialist framework in which attention to object history is given special significance. Like contagion, essentialism prioritizes invisible essences over superficial appearances. In our study, this was most clearly demonstrated by the celebrity item, which was judged to be more museum-worthy than the replica, despite being visually identical in every respect. For the fossil fragments as well, participants privileged the object's past interactions over its current appearance. Participants thus acted as if some underlying immutable reality (essence) determined the identity of the objects. Our findings therefore suggest that the essences of contagion and essentialism are highly analogous. However, whether contagion can be subsumed under essentialism, or if it functions separately instead is impossible to resolve at present and requires further study.

Implications for practice

One of the most straightforward implications is that visitors care deeply whether a fossil is the real thing or a replica, therefore its label should reflect the object's authenticity. Moreover, contrary to what we had expected, children showed quite some level of sophistication in their reasoning

about the authenticity of museum objects. They were able to vividly imagine the *T. rex* when viewing the real fossils and reason about their origin when considering the fragments. Something which they accomplished without support from either their parents or the researcher. This sophistication could be taken advantage of in museums. Instead of displaying objects with limited background information, an object's appreciation could be markedly increased by conjoining it to some aspect of its history the visitor deeply cares for. In doing so, visitors might be primed to increase their sensitivity to contagion (Newman et al. (2011). Taking fossils as an example, this might be realized by showing the meticulous process of excavation, or by accentuating that the fossil used to be part of a living creature, and even by allowing a popular scientist to tell about his or her discovery of the fossil or by involving celebrities with the museum's collection.

Another subsidiary, yet surprising result was the enthusiasm with which children participated in the experiment. This shows that research does not always have to be a tedious burden for the visitor, but can also add significantly to the enjoyment of a museum visit.

Limitations and future research

Several limitations to this study are worth mentioning. Firstly, care should be taken to avoid immediate extrapolation of our present results to instances other than fossils. It could be the case that extant organisms are uniquely affected by contagion, since a fossil is the closest a visitor can ever come to a real dinosaur. Two questions that need to be addressed in the future, therefore, are whether the effects we report here also hold for organisms that are not extinct, like for instance rabbits, and whether they are equally important in judgements about living objects, like plants.

Another factor we have left out altogether is the functionality of the object. Functionality has been reported to be important for scientific instruments such as a scanning tunneling microscope (Hampp & Schwan, 2014). Following the suggestion of Newman and Bloom (2012), it might be worth examining whether functional value decreases the saliency of historical factors such as contagion. This would be especially relevant in science museums with a collection of scientific instruments as opposed to natural history museums, since functionality often takes a back seat in the latter. Nevertheless, there is a way in which functionality features in natural history museums. A minority of our participants mentioned the relevance of study for fossils. By focusing on the fossils' use, instead of their history, the effects of contagion on object appreciation might be attenuated by means of framing (Rozin & Nemeroff, 1990). Future research could address how the four mechanisms we reported on here play out for scientfic instruments.

A third limitation of this study is that the fragmented state required a substantial feat of imagination on the part of the participant. We are duly aware that the comparison between whole-size objects and imagined fragments is by no means ideal. Nevertheless, we also rest assured in the conviction that the ratings were in no way indiscriminate. Participants' justifications were always reasonable and seldom far-fetched. Besides, being able to view and hold the actual objects should in itself be a considerable improvement upon the questionnaires that have been conducted thus far (Frazier et al., 2009; Frazier & Gelman, 2009; Gelman et al., 2015). In these studies, participants were asked to make comparisons between authentic and inauthentic picture pairs (Frazier & Gelman, 2009) or read about the objects without ever seeing the items they were supposed to rate (Frazier et al., 2009).

Another drawback in the present setup is that we were unable to distinguish between the effect of rarity and contagion. Rarity is known to affect the appreciation of celebrity items as well as museum objects (Hampp & Schwan, 2015; Newman et al., 2011). We do not, however, consider rarity to be an alternative explanation, but rather one complementary to contagion. This is because a fragment of a *T. rex* fossil would not at all be rare if it had not been in contact with a dinosaur – it would be an ordinary rock instead. It is the principle of contagion that elevates the object from the commonplace to the museum-worthy. Therefore, rarity does not undermine an explanation based on contagion.

Conclusion

This current study adds to a growing body of evidence demonstrating the importance of authenticity in the valuation of museum objects. Specifically, we found broad endorsement of the principle of contagion for authentic objects. Participants strongly believed some quality of the object's source was passed onto the object. Children's convictions that authentic objects were simply better or more beautiful were shown to be insufficient in explaining the retention of value for real fossils. Furthermore, we confirmed the role of association as an important factor contributing to the appreciation of the objects, meaning they also served as a physical reminder of the source they were once in contact with. Overall, our results suggest that visitors of a natural history museum seek a deeper connection with objects that goes beyond mere surface appearances.

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