An Appetite for Meat?

Disentangling the Influence of Animal Resemblance and Familiarity

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Abstract

Consumers in modern society are often less exposed to meat that resembles the animal, and thus are less familiar with it, making it difficult to disentangle the influence of these two inputs (familiarity vs. animal resemblance) on meat appetite. Across three studies, we sought to systematically disentangle the impact of familiarity and animal resemblance on meat appetite using inductive (Study 1) and experimental (Studies 2a-2b) approaches. In Study 1 ($N = 229$) we separated familiarity and animal resemblance into orthogonal dimensions using 28 meat products. Participants provided free associations and rated the products on familiarity, animal resemblance, and appetitive appeal. In Studies 2a and 2b ($N = 514$) we experimentally examined the independent contributions of familiarity and animal resemblance, using stimuli normed in Study 1. We hypothesized that animal resemblance has its most pronounced influence on appetite when meat products are unfamiliar. Participants' free associations and ratings of the products were in line with this conditional hypothesis (Study1), as were the experimental manipulations of familiarity and animal resemblance (Studies 2a-2b), confirmed by a mini meta-analysis. In all three studies, familiarity had a pervasive influence on appetite. These findings suggest that product familiarity can attenuate the psychological impact that animal reminders have on appetite. Thus, interventions aimed at eliciting animal associations with meat should consider the familiarity of the products employed.

Keywords: Meat consumption, animal resemblance, familiarity, association, appetite

1. Introduction

Meat that highly resembles the animal source can be off-putting for some consumers, possibly because it reminds people of its animal origins or triggers thoughts of animal slaughter (Benningstad & Kunst, 2020; Rothgerber, 2013; Tian et al., 2016), The modernization of meat production has aided consumers in avoiding animal reminders by providing consumers physical and psychological distance from the potentially upsetting sights and smells of animal slaughter (Bastian & Loughnan, 2017; Rozin et al., 1997; Segers, 2012). Many meat products purchased at market, particularly in Western cultures, lack a strong resemblance to the animal source (Hoogland et al., 2005). Presumably, this distance serves to preserve appetite for meat by preventing consumers from recurrently associating meat with its animal origins or, perhaps, the violence of animal slaughter (Benningstad & Kunst, 2020; Kunst & Hohle, 2016).

Indeed, several studies have shown that getting consumers to think about the animal origins of meat can disrupt the pleasure derived from meat consumption (Benningstad & Kunst, 2020). Studies have found that, all else equal, presenting raw meat reduces appetite for meat products, relative to cooked meat (Kubberød et al., 2008; Shimp & Stuart, 2004). Raw meat, arguably, resembles a living animal more than cooked meat, which might explain higher levels of distaste at raw meat (Rozin & Fallon, 1987). Red meat tends to elicit more disgust than white meat, which might be due to its greater animal resemblance, or other aspects of its appearance (e.g., a greater presence of blood; Fessler et al., 2003; Kubberød et al., 2006). Including reminders of the animal source can reduce appetite for meat, relative to suitable control conditions. For example, presenting a picture of an animal, alongside a recipe for a meat dish, reduces willingness to consume the meat (Kunst & Hohle, 2016; Tian et al., 2016). Including the head of the animal (e.g., a pig's head for roasted ham) relative to no head, or using "animal terms" instead of "food terms" to describe meat (e.g., "cow" instead of "beef"), have also been shown to reduce appetite for meat products by eliciting thoughts of and/or concern for the animal source (Earle et al., 2019; Kunst & Hohle, 2016; Kunst & Haugestad, 2018). Finally, qualitative studies of meat avoiders have documented reports that vegetarians and vegans often associate the sensorial aspects of meat (e.g., raw flesh, the smell of blood) with the animal and their slaughter (Hamilton, 2006). These studies point to an underlying psychological process whereby thinking about the animal origins of meat can disrupt appetite for meat, whereas *dissociating* meat from the animal source appears to sustain appetites.

Although meat-animal dissociation seems to be an effective mechanism for maintaining consumers' interest in meat, there are some reasons to question its ubiquity as a lever of meat appetite. First, meat-animal dissociation as a self-standing theoretical framework struggles to explain why many meat products that highly resemble animals (e.g., whole roasted turkey in the United States and the UK; "pig leg" [jamon serrano] in Spain; whole cooked fish in Portugal) are highly popular dishes (Díaz-Caro et al., 2019; Einstein & Hornstein, 1970; Madsen & Chkoniya, 2019). Observing food practices across diverse cultural contexts suggests that there may be instances in which consumers find a meat product highly enjoyable *despite* noticing the link between a product and its animal origins.

Second, experimental manipulations of dissociation via animal reminders (e.g., presenting the head of a cooked animal) may conflate animal resemblance with familiarity. A roasted ham with the pig's head attached (Kunst & Hohle, 2016, Study 2a/b) or an uncooked, bloody steak (Kubberød et al., 2008) resemble animals more than a headless ham or well-cooked steak. Critically, however, such high-resemblance products are often less familiar to consumers—that is, they are encountered and consumed less often. Thus, experimental manipulations of meat-animal dissociation may be problematically conflating animal reminders and familiarity, obfuscating their discriminant impact on appetite. This observation is critical in light of the pervasive role familiarity has on food enjoyment, generally, and meat enjoyment, specifically (Foroni et al., 2013; Prada et al., 2017).

Familiarity, or the perceived frequency of encountering a product, is a key determinant of consumer enjoyment of meat as it reduces uncertainty about the risks and taste (Cooke & Wardle, 2005; Pliner & Stallberg-White, 2000). Familiar meat products tend to be rated more favorably on measures of appearance and taste than less familiar meats (Borgogno et al., 2015), and frequent exposure to foods in childhood is directly associated with food preferences in adulthood (Wadhera et al., 2015). Conversely, the *lack* of familiarity with meat of a particular animal (e.g., meat alternatives, such as insect protein or cultured meat) is a principal hurdle to consumer interest (Bryant & Barnett, 2018; Hoek et al., 2011; Possidónio et al., 2019, 2021; Tan et al., 2016).

The status of meat as a potential pathogen vector may explain the strong link between familiarity and appetite—familiarity likely serves as a proximal signal to consumers that a given product is safe to consume, increasing its appeal (Aldridge et al., 2009; Fessler et al., 2003; Navarrete & Fessler, 2003). People who work in the meat industry (e.g., butchers) tend to adapt fairly quickly to the sight and smells of meat products (Piazza et al., 2021). This familiarization or habituation process tends to reduce a person's concern for the animals slaughtered and sustains the appeal of meat, even when it highly resembles the animal source (Piazza et al., 2021). Likewise, individuals from societies that frequently consume meat products with visible reminders of the animal (e.g., the head or limbs intact) tend to show reduced effects of animal reminders on their appetite for meat, relative to consumers from societies where exposure to such images are less common (Kunst & Haugestad, 2018).

In short, familiarity with meat products increases their appeal, and it is possible that familiarity may attenuate the psychological impact that animal reminders have on appetite.

1.1 Overview of the Present Research and Hypotheses

Since many instances of meat-animal association naturalistically coincide with lower levels of food familiarity, methodological efforts to separate the constructs of animal resemblance and familiarity would offer useful insights into how animal resemblance impacts meat appetite. In the current research we conducted three studies designed to disentangle animal resemblance and meat familiarity in a more systematic manner than in previous studies of meat-animal dissociation. Study 1 used an inductive or "bottom-up" method for separating the two dimensions using participant ratings of a large set of meat products. We presented participants with 28 naturalistic meat products that putatively differed along the two dimensions of interest: familiarity and animal resemblance. Participants provided spontaneous associations to the products and, subsequently, rated each product on measures of familiarity, animal resemblance, and appeal as food. The free association task allowed us to unobtrusively explore the extent to which different meat products elicit thoughts of the animal source. The rating task was used to generate a two-dimensional circumplex of the products and examine how each dimension independently contributes to appetite for meat.

Study 1 provided a basis for identifying products unconfounded along the dimensions of interest that could then be used experimentally. In two subsequent pre-registered studies (Studies 2a and 2b), we utilized four products from Study 1 that were normed to represent exemplars from each of the four circumplex quadrants (i.e., high vs. low; familiarity x animal resemblance). Participants were randomly assigned to one of the four products and rated them on familiarity, animal resemblance, and appeal. This enabled us to test the independent contribution of each dimension in a 2x2-crossed experimental design. The images used for Study 2a were based solely on the normed ratings from Study 1, whereas images used for Study 2b had the additional strength of providing some control over the animal source.

We theorized that previous work, by often not de-confounding animal resemblance and familiarity, may have overestimated the extent to which meat-animal associations impact on appetite for meat. Here, we tested an alternative view of meat-animal association that considers how animal resemblance might be *conditioned upon* familiarity. Specifically, we hypothesized that animal resemblance is likely to exert an influence on appetite for meat primarily when meat products are unfamiliar, but less so when a meat product is familiar. We reasoned that familiar meat products involve high levels of psychological adaptation (e.g., Piazza et al., 2021), thus, when meat products are highly familiar, appetites are likely dominated by this familiarity. Conversely, when meat is unfamiliar, the psychological impact of an animal reminder is likely to be greater, since there has not been sufficient exposure for psychological adaptation to occur. By contrast, we did not expect that the impact of familiarity on appetite would be conditioned on animal resemblance. Rather, we expected that familiarity would enhance appetite for meat *independent* of a product's level of animal resemblance.

All research materials and datasets for the studies are available at https://osf.io/6z9sk/?view_only=ced9d396f349447ca8fbe27351b076dc. The studies obtained ethics approval from the Faculty of Science and Technology Ethics Committee at Lancaster University (FSTREC).

2. Study 1

2.1 Method

2.1.1 Participants

Participants were recruited via Prolific Academic (Peer et al., 2017). Participation was restricted to individuals living in the United Kingdom. Vegetarian and vegan participants were removed from the analyses (*n* = 20) since they were likely to exhibit extremely low appetite ratings toward the target products. The final sample included 229 UK participants (65.9% female) aged between 18 and 75 years old (M_{age} = 38.32, *SD* = 12.75). Most participants self-identified as meat-lovers or omnivores (i.e., individuals who included meat, fish, and/or seafood in their diets - 74.7%); 20.1% followed a semi-vegetarian diet (restricted meat or certain meats from their diet), whereas 5.2% were pescatarians (i.e., individuals who included fish and/or seafood in their diets, but no other meats).

2.1.2 Procedure

Data collection took place on 17th December 2020. Participants were invited to take part in a study on the “perception of meat products.” Participants were provided a hyperlink to the study on Prolific Academic and were asked to tick a captcha box to screen out bots. After providing informed consent, participants were directed to the survey hosted by Qualtrics, which involved a free-association task, followed by an image rating task. After providing demographic information, participants were debriefed, thanked, and paid.

2.1.3 Measures and materials

Image selection. The images were retrieved from open-source online databases (e.g., Pexels; Pixabay). The selection criteria were to select images (1) depicting a single meat product, (2) presenting the meat product as it would be eaten, (3) without people or other foods visible (e.g., hands; garnishes). The images were resized (371 x

309 pixels), edited to eliminate or blur other elements besides the meat product, and edited on contrast and brightness. The goal was to select images depicting naturally occurring meat products hypothesized to fall into one of the four quadrants of the familiarity with animal resemblance circumplex, and therefore to cover these four quadrants with images varying on these two dimensions.

Each image was given a brief descriptive caption that identified: (a) the name of the meat product (e.g., "chicken liver pate"), (b) its geographic origins and prevalence (e.g., "Northern and central European cuisines"), and (c) how it is typically prepared, cooked and/or eaten (e.g., "Chicken livers are ground down and mixed with butter, spices and herbs"). This was done to increase participants' capacity to identify the product beyond what they could discern from the image alone. See Supplemental Materials (Table S1) for all 28 images and their descriptive captions.

Free association task. First, we presented the 28 images, without the descriptive caption, one at a time, in a randomized order. Participants were asked to write in a text box what was the first thing that came to their minds when viewing the image.

Image rating task. Participants viewed the same 28 images a second time, in a new randomized order, this time with the corresponding descriptive caption. For each image, participants were asked to evaluate the product on three dimensions, measured on 7-point rating scales: (1) familiarity - "How often do you encounter this product in your everyday life?" (1 = *Never,* 4 = *On occasion,* 7 = *Very frequently*); (2) animal resemblance - "How much does this product resemble an animal?" (1 = *Not at all,* 4 = *Moderately like an animal,* 7 = *Very much like an animal*); and (3) appetite - "Hypothetically speaking, how positive or negative would you feel about eating the meat depicted in the photo?" (1 = *Very negative*, 4 = *Neutral*, 7 = *Very positive*). The measures were presented below the image/caption.

2.1.4 Data analysis plan

Free associations. The data retrieved from the word association task were analyzed based on the procedure used in Graça, Oliveira, et al. (2015) and Possidónio et al. (2021). A total of 6412 associations were retrieved (i.e., associations from 229 participants x 28 products). Separate association lists were generated for each meat product. To ensure that the meanings expressed by the participants were maintained, associations with the same meaning were grouped (e.g., “nice” with “delicious”), and related words/concepts were merged into semantic categories (e.g., “unappealing” with “odd” to create a category of negatively valenced associations). Conceptually relevant categories that were mentioned by at least 10% of the participants were retained for the analysis and interpretation of themes and clusters (i.e., 81 categories that were mentioned 6128 times; see Supplemental Material, Table S2).

Clustering of products defined by animal resemblance and familiarity. All analyses were performed using SPSS Statistics (version 23, IBM©). To group and organize the meat products within the two-dimensional space (circumplex) organized by the key variables, a hierarchical cluster analysis (HCA) was performed with the ratings of familiarity and animal resemblance as the organizing dimensions. Next, a k-means cluster analysis was conducted to obtain the cluster membership of each product and its distance from the cluster center.

Dimensions predicting appetite. Correlations were calculated to explore the relationship between the three measured variables. To analyze how strongly each dimension independently predicts appetite for meat, a regression was conducted with familiarity and animal resemblance as simultaneous predictors of appetite ratings. This analysis modeled the contribution of each dimension at the level of the different meat products to capture variability in the perception of familiarity and animal resemblance between the different products. We also ran a second regression analysis using the participant-level ratings to examine the contribution of each dimension at the level of *individual (participant) tendencies* to perceive familiarity and animal resemblance across all 28 products.

2.2. Results

2.2.1 Free Associations

Categories identified across the meat products. Based on the pattern of participants' association responses across the 28 meat products, we identified six main categories (in order of prevalence): *negatively valenced associations*, which referred to negative sensorial and emotional responses (e.g., "unappealing", "odd"; emerging in 82.1% of the products, 37.6% of associations); *positively valenced associations*, comprised of positive hedonic and emotional responses (e.g., "nice", "appealing", "appetizing"; 67.9% of the products, 27.6% of associations); associations about the *identification/naming of the animal* (64.3% of the products, 22% of associations); associations concerning *sensory attributes* of the meat (50% of products, 8.2% of associations); associations related to the category *ethics* and *health issues* (e.g., "nutritious", "diseases"; < 15% of products, 2.5% and 2.1% of associations, respectively). In short, the most common associations referred to sensorial and affective features in response to the meat products. Animal-related associations were also common (see Table 1).

Hierarchical cluster analysis of the familiarity and animal resemblance ratings and categories identified across clusters. The two predictive dimensions, familiarity, and animal resemblance were not significantly correlated but had a largely orthogonal relationship, $r(27) = -.16$, $p = .422$, which ruled out any concerns about multicollinearity. Figure 1 presents the results of the hierarchical cluster analysis using familiarity and animal resemblance ratings as the organizing dimensions. Cluster 1 contained products categorized with high resemblance and low familiarity. It included animals not conventionally used as food in the local food practices (e.g., scorpion, crocodile, octopus), often presented whole. This cluster showed the biggest presence of negatively valenced associations from all the clusters. As expected, this set of products also produced a high level of identification and naming of the animal, emerging in 100% of its products (see Table 1).

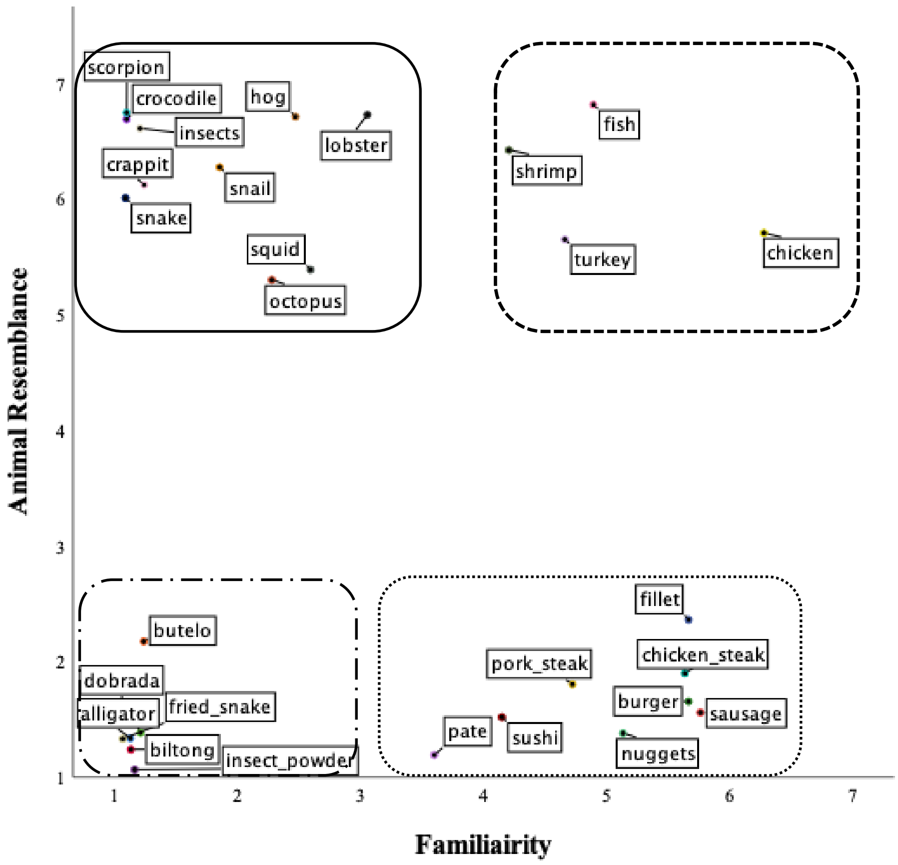
Cluster 2 contained products categorized with high resemblance and high familiarity. This included four whole-cooked animals, conventionally used as food in the local food practices (e.g., turkey, chicken, fish). Positively valenced associations dominated this cluster, emerging in all four products. This cluster also had high levels of identification and naming of the animal, among 100% of the products.

Cluster 3 contained products categorized with low resemblance and low familiarity. It included less conventional products, where the identification of the animal was less apparent (e.g., insect powder, kangaroo biltong, fried snake). Negatively valenced associations dominated this cluster. Associations related with sensory attributes and health were also common.

Finally, cluster 4 contained products with low resemblance and high familiarity. This included meat products conventionally used in the local food practices, again where the identification of the animal was less apparent (e.g., nuggets, burger, sausage). This cluster, like cluster 2, tended to elicit positively valenced associations. Half of the products also induced associations related with sensory attributes.

Figure 1

Projection of the four clusters on the circumplex between animal resemblance and familiarity



Note. Each cluster represents a group of products grouped by the circumplex between animal resemblance and familiarity. The border of each group is represented by a specific pattern: Cluster 1 —— (n = 10); Cluster 2 --- (n = 4); Cluster 3 -·-·- (n = 6); Cluster 4 ···· (n = 8).

Table 1

Frequencies and Percentage of Mentions (%) of the Categories Identified in the Free-Association Task across Clusters

		Familiarity Low				**Familiarity High**				**Total**			
		n	%	*f*	%*f*	*n*	%	*f*	%*f*	*n*	%	*f*	%*f*
High Resemblance	Negative valence	10	100.0	1406	53.1	3	75.0	182	18.3	13	92.9	1588	25.9
	Positive valence	4	40.0	204	7.7	4	100.0	402	40.4	8	57.1	606	9.9
	Animal identification	10	100.0	699	26.4	4	100.0	360	36.2	14	100.0	1059	17.3
	Ethics	3	30.0	153	5.8	0	0.0	0	0.0	3	21.4	153	2.5
	Sensory attributes	4	40.0	186	7.0	2	50.0	51	5.1	6	42.9	237	3.9
	Health	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Low Resemblance	Negative valence	5	83.3	419	47.1	5	62.5	297	18.6	10	71.4	716	11.7
	Positive valence	3	50.0	214	24.1	8	100.0	870	54.5	11	78.6	1084	17.7
	Animal identification	0	0.0	0	0.0	4	50.0	291	18.2	4	28.6	291	4.7
	Ethics	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Sensory attributes	4	66.7	156	17.5	4	50.0	112	7.0	8	57.1	268	4.4
	Health	3	50.0	100	11.2	1	12.5	26	1.6	4	28.6	126	2.1
Total	Negative valence	15	93.8	1825	51.6	8	66.7	479	18.5	23	82.1	2304	37.6
	Positive valence	7	43.8	418	11.8	12	100.0	1272	49.1	19	67.9	1690	27.6
	Animal identification	10	62.5	699	19.8	8	66.7	651	25.1	18	64.3	1350	22.0
	Ethics	3	18.8	153	4.3	0	0.0	0	0.0	3	10.7	153	2.5
	Sensory attributes	8	50.0	342	9.7	6	50.0	163	6.3	14	50.0	505	8.2
	Health	3	18.8	100	2.8	1	8.3	26	1.0	4	14.3	126	2.1

Note. n – number of products where the category emerged; *%* - proportion in which the category is presented in the quadrant; *f* – number of associations related with that category mentioned in the quadrant; *%f* - proportion in which the associations related with that category were mentioned in the quadrant.

2.2.2 Familiarity and animal resemblance as predictors of appetite

Rating dimensions of the four clusters. Table 2 presents the mean ratings of familiarity, animal resemblance, and appetite for the four clusters. Ratings for each meat product are available as Supplementary Material (see Table S3). Repeated-measures comparisons of the mean appetite scores showed that clusters 2 and 4, defined by high familiarity, did not differ in their level of appeal, $MD = -.07$, $SE = .06$, $p = 1.000$, 95% CI [-.24, -.10]. Both clusters revealed higher appetite ratings in comparison with clusters 1 and 3, defined by low familiarity (all comparisons, ps $< .001$). Cluster 1, defined by high resemblance and low familiarity, as expected, had the lowest appetite score (see Table 2; all comparisons, *p*s < .001). This is consistent with the conditional hypothesis that we test further in Studies 2a-2b: variation in animal resemblance did not significantly impact on appetite within clusters where familiarity was high. However, when familiarity was low (clusters 1 and 3), high animal resemblance was associated with lower appetites than when animal resemblance was low, $MD = -.29$, $SE = .06$, $p = <.001$, 95% CI [-.46, -.13] (see Table 2).

Table 2

Mean Familiarity, Animal Resemblance, and Appetite Scores by Cluster

	Familiarity				Animal resemblance				Appetite			
			95% IC for Mean				*95% IC for Mean*				*95% IC for Mean*	
	M	*SD*	*LB*	*UP*	*M*	*SD*	*LB*	*UP*	*M*	*SD*	*LB*	*UP*
Cluster 1	1.80	0.60	1.72	1.88	6.26	0.80	6.15	6.36	2.54^{a}	1.08	2.40	2.68
Cluster 2	5.01	1.06	4.87	5.15	6.15	0.74	6.05	6.25	5.15^{b}	1.27	4.98	5.31
Cluster 3	1.16	0.34	1.11	1.20	1.42	0.56	1.35	1.49	2.83^{c}	1.24	2.67	2.99
Cluster 4	5.04	1.06	4.90	5.18	1.67	0.86	1.56	1.78	5.22^{b}	1.08	5.08	5.36

Note. Different superscripts (^{a,b}) indicate mean differences between clusters on appetite ratings.

Product-level analysis. Correlations at the level of the 28 meat products revealed that familiarity and appetite ratings were highly positively correlated, $r(27) = .95$, $p < .001$, such that the more familiar the meat product, the greater its appeal.[1] Although marginal, animal resemblance and appetite revealed a weak to moderate, negative relationship, $r(27) = -.30$, $p = .062$.

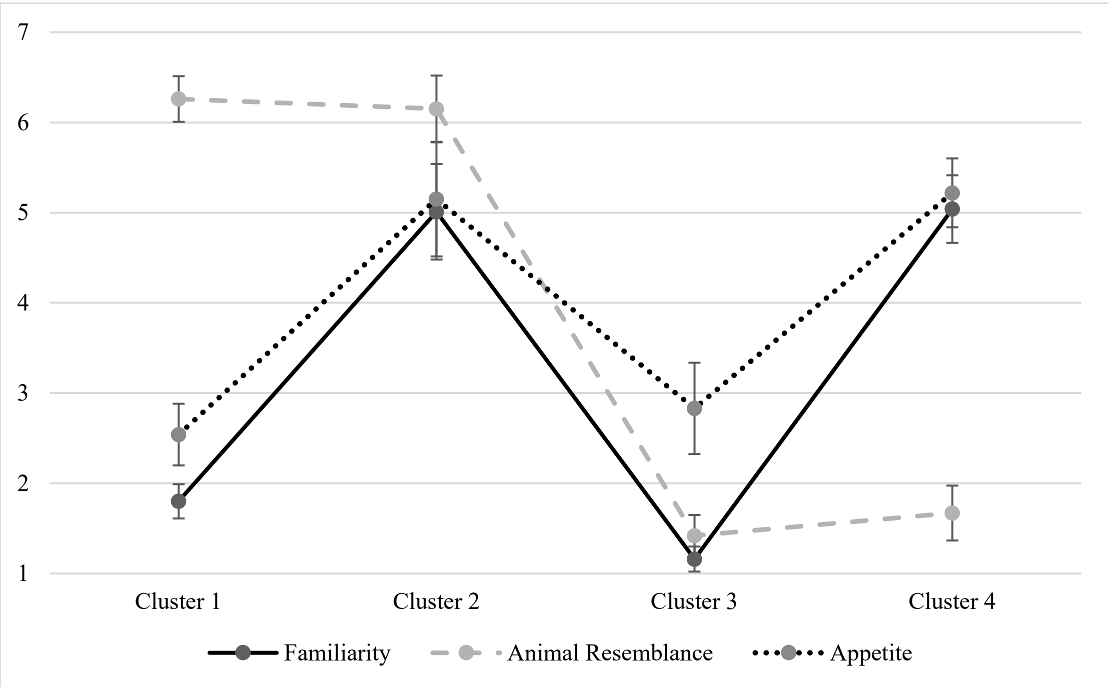
When familiarity and animal resemblance were entered together into a regression model predicting appetite ratings across the 28 meat products, this analysis revealed familiarity to be a strong independent predictor of appetite, $\beta = .93$, $t(25) = 16.48$, $p < .001$. Animal resemblance was also a significant independent predictor in this analysis, with greater animal resemblance associated with lower appetite ratings, β = -

[1] The strong correlation between familiarity and appetite holds when omitting dishes from Clusters 1 and 3 that scored very low on familiarity, $r(14) = .94$, $p < .001$.

.15, $t(25) = -2.69$, $p = .013$. The overall model was significant, $F(2, 25) = 150.19$, $p < .001$, and explained 92.3% of the variation in appetite.[2] A Fisher's Z test revealed that the relative size of the relationships with appetite differed significantly, $Z = 7.52$, $p < .001$. The tighter fit between familiarity and appetite, than between animal resemblance and appetite, can be visually observed through the pattern of means displayed in Figure 2.

Figure 2

Mean Familiarity, Animal Resemblance, and Appetite Scores by Cluster (N = 28 meat products)



Note. Error-bars represent ±1 standard error from the mean.

Participant-level analysis. We conducted a secondary analysis, using the participant-level ratings to examine the contribution of each dimension at the level of

[2] In a mixed-effect linear model that included cluster alongside animal resemblance and familiarity as independent fixed effects, only familiarity emerged as a significant predictor of appetite, $F(1, 24) = 69.31$, $p < .001$ (resemblance: $F[1,24] = 0.95$, $p = .34$; cluster: $F[1,24] = 0.10$, $p = .75$).

individual tendencies. The results were quite consistent with the product-level analysis and can be found in Supplementary Materials (S4).

2.3. Discussion

Study 1 revealed that familiar meat products tended to elicit more positive associations than less familiar meat products. By contrast, the relationship between animal resemblance and appetite for meat was weak. Nonetheless, animal resemblance did significantly reduce appetite ratings, when focused on unfamiliar meat products, and high-resemblance meat products elicited more animal associations than low-resemblance products. These initial findings suggest that animal resemblance does generate animal associations, but its impact on appetite may be more noticeable when the meat is unfamiliar.

Study 1 generated a set of meat products normed on the two dimensions, which allowed us to subsequently test the conditional hypothesis more directly in Studies 2a-2b by testing for interaction effects between the familiarity and animal resemblance within a targeted 2x2 design. In these studies, we switched to a between-subjects design, to help reduce the possibility that participants might infer the aims of the study and modify their ratings accordingly. Finally, we included a direct measure of meat-animal association alongside our measure of animal resemblance from Study 1 to further confirm that the perception of animal resemblance and meat-animal association co-occur.

For Studies 2a and 2b, we preregistered the conditional hypothesis that animal resemblance would have a stronger impact on appetite for unfamiliar meat products than for products that are familiar. Specifically, we expected to observe a significant interaction of Familiarity x Animal Resemblance, with animal resemblance consistently reducing appetite ratings for unfamiliar meat products. However, when meat products were familiar, we expected appetite ratings to be less swayed by the level of animal resemblance and dominated by their appraised familiarity. By contrast, we predicted that familiarity would enhance appetite ratings, independent of animal resemblance.

3. Study 2a

3.1 Method

3.1.1 Participants

Recruitment occurred again on Prolific so that we could target a similar population as in Study 1. Again, participation was restricted to individuals living in the UK. However, this time we used Prolific's prescreening questions to recruit only those who followed "no specific diet" (omnivores) or a "pescatarian diet", to avoid recruiting vegetarian and vegan participants who did not eat meat and/or fish. Pescatarians were eligible since at least one of the meat products involved fish (whole fish). Individuals who had participated in Study 1 were not eligible. Most participants self-identified as meat-lover or omnivore (89.5%), 8.2% semi-vegetarian and 2.3% pescatarian. Two vegetarian participants who slipped through the prescreening were removed from the analysis. The final sample included 257 UK-based participants (61.9% female) aged between 18 and 70 years old (M_{age} = 36.03, SD = 13.50).

3.1.2 Procedures, measures, and materials

Data collection took place on 29$^{\text{th}}$ March 2021. Participants took part in a study on "perceptions of meat products" with similar procedures as Study 1. A 2x2 between-subjects design was used, such that participants were randomly assigned to one of four conditions: familiarity (low; high) x animal resemblance (low; high). Participants were equally distributed across conditions (samples varying between 63 and 65 participants per condition).

Table 3

Multiple Comparisons Between the Images Used to Represent the Conditions Defined by Familiarity and Animal Resemblance for Study 2a.

Familiarity		Low Whole crocodile *M* = 1.10; *SD* = 0.43	High Whole fish *M* = 4.89; *SD* = 1.69
Low	Alligator bites *M* = 1.13; *SD* = 0.53	$p = 1.00$	$p < .001$
High	Chicken nuggets *M* = 5.13; *SD* = 1.60	$p < .001$	$p = .524$

Animal resemblance		Low Alligator bites *M* = 1.34; *SD* = 0.86	High Whole crocodile *M* = 6.69; *SD* = 1.07
Low	Chicken nuggets *M* = 1.38; *SD* = 1.02	$p = 1.00$	$p < .001$
High	Whole fish *M* = 6.82; *SD* = 0.50	$p < .001$	$p = .376$

Note. Grey cells are meant to differ significantly. Comparisons based on means derived from Study 1.

Participants were asked to evaluate one of four meat images from Study 1. The images were selected based on the ratings derived from Study 1, normed on the two dimensions of interest. For example, high familiarity image ratings did not differ from each other but were significantly higher than the low familiarity images (see Table 3 for the relevant comparisons). This led to the selection of the following images: (1) whole crocodile (high resemblance; low familiarity), (2) whole fish (high resemblance; high familiarity), (3) alligator bites (low resemblance; low familiarity), and (4) chicken nuggets (low resemblance; high familiarity).

The images were presented with the same descriptive caption from Study 1 (i.e., product label, its origin, and preparation/cooking information). Participants evaluated each product on three measures: the familiarity and animal resemblance items from Study 1, plus one additional measure of animal resemblance, derived from Kunst and Hohle (2016). This measure relates more directly to the *psychological state* of meat-animal association that animal resemblance has been empirically linked to: "How much does the picture above remind you of a living being?" (1 = *not at all* to 7 = *very much*). On a separate page, participants rated their appetite for the product, as in Study 1. Participants provided demographic information, were debriefed, thanked, and paid.

3.1.3 Preregistered Analysis Plan

The analysis plan for Study 2a can be viewed here: https://aspredicted.org/blind.php?x=4hr2bf. The animal resemblance and meat-animal association items were highly correlated, $r(255) = .783$, $p < .001$. Thus, as preregistered, we aggregated the items to form an index of animal resemblance and conducted a 2x2 ANOVA on appetite scores, with follow-up contrasts (Tukey's HSD tests).

3.2. Results

Examining the familiarity and animal resemblance means for each condition (Table 4) revealed that our manipulation of animal resemblance was successful, though the whole crocodile was rated as resembling the animal at significantly higher levels than the whole fish. By contrast, the manipulation of familiarity was not as successful as we expected, based on the prior ratings observed in Study 1. Specifically, the whole fish was not perceived as familiar as the chicken nuggets, and its rated familiarity was quite low (M = 2.84). This somewhat limits the conclusions we might infer from the manipulation. Thus, in our analysis, we also sought to compare the *degree* of familiarity and animal resemblance perceived within this (intended) "High x High" condition in predicting appetite ratings.

Table 4

Mean Scores for Familiarity, Animal Resemblance, and Appetite by Condition (Study 2a).

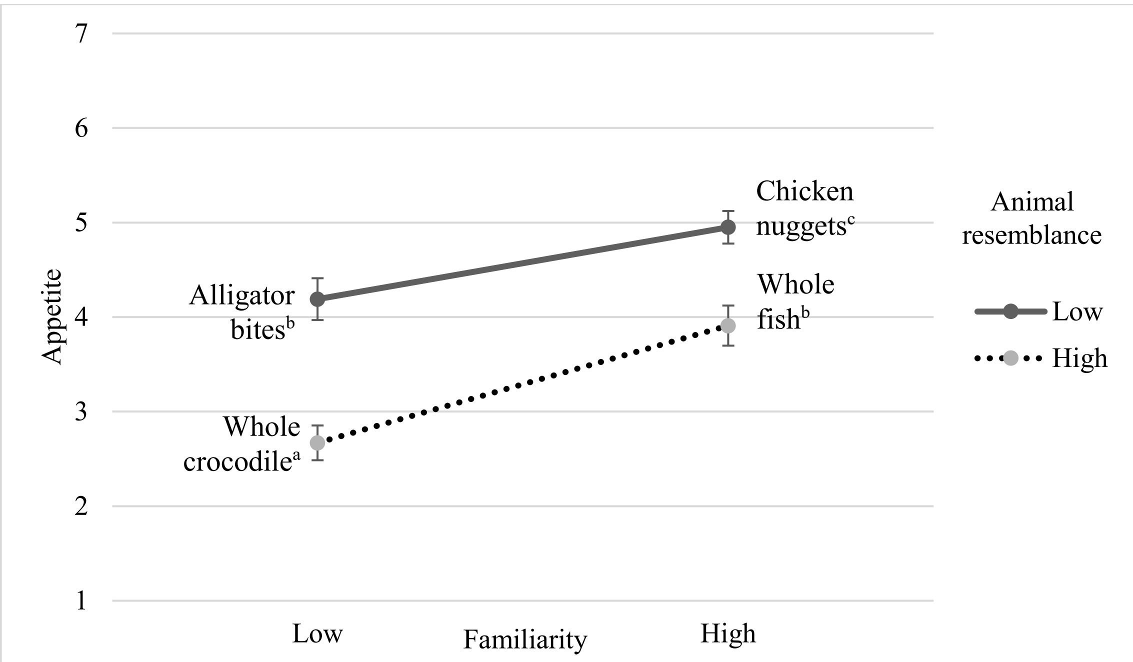
Familiarity	Animal resemblance	Familiarity		Animal resemblance		Appetite	
		M	*SD*	*M*	*SD*	*M*	*SD*
Low	Low (Alligator bites)	1.22[a]	0.78	2.22[a]	1.17	3.91[b]	1.71
	High (Whole crocodile)	1.10[a]	0.43	6.44[d]	0.95	2.67[a]	1.46
High	Low (Chicken nuggets)	4.08[c]	1.54	1.70[b]	0.74	4.95[c]	1.39
	High (Whole fish)	2.84[b]	1.66	5.88[c]	1.11	4.19[b]	1.77

Note. N = 257; Different superscripts ([a,b,c,d]) within a given column indicate mean differences on ratings between products.

A two-way ANOVA 2 (familiarity: low; high) x 2 (animal resemblance: low; high) was conducted. As expected, it revealed a main effect of familiarity on appetite, $F(1,253) = 41.83$, $p < .001$, $\eta_p^2 = .14$, with participants in high familiar conditions reporting higher appetite means in comparison with low familiar conditions, and a main effect of animal resemblance on appetite, $F(1,253) = 25.58$, $p = .001$, $\eta_p^2 = .09$, with participants in low resemblance conditions reporting higher appetite means in comparison with high resemblance conditions. Against predictions, the interaction of familiarity and animal resemblance was not significant, $F(1,253) = 1.43$, $p = .233$, $\eta_p^2 = .006$ (Figure 3).

Figure 3

Effects of Familiarity and Animal Resemblance on Appetite (Study 2a).



Note. Different superscripts ([a,b,c]) indicate mean differences on appetite between conditions defined by animal resemblance and familiarity (interaction effect). Error-bars represent ±1 standard error from the mean.

Despite the non-significant interaction, we continued with our preregistered plan to analyze the simple effects for appetite scores (Tukey's HSD comparisons). As expected, familiarity increased appetite for meat products both when animal resemblance was high (whole meat), $t(125) = -5.28$, $p < .001$, $MD = -1.52$, $SE = 0.28$, 95% CI [-2.09, -.95], $d = -0.936$, and when resemblance was low (bites/nuggets), $t(128) = -3.83$, $p < .001$, $MD = -1.05$, $SE = 0.28$, 95% CI [-1.59, -.51], $d = -0.672$ (see Table 4). Also as expected, when familiarity was low, animal resemblance had a significant effect on meat appetite, $t(126) = -4.41$, $p < .001$, $MD = -1.24$, $SE = 0.28$, 95% CI [-1.80, -.68], $d = -0.779$, with animal resemblance reducing appetite for unfamiliar meat (see Table 4). Unexpectedly, animal resemblance also significantly reduced appetite for familiar meat (whole fish), $t(127) = -2.74$, $MD = -0.77$, $SE = 0.28$, $p = .007$, 95% CI [-1.32, -.21], $d = -0.482$. However, as noted earlier, our high familiar / high resemblance condition (whole fish) was somewhat problematic, due to its quite low familiarity ratings. Because of this issue, we also ran a focused regression for this condition, contrasting ratings of familiarity and animal resemblance as predictors of appetite.[3] Results revealed a significant model, $F(2,61) = 10.00$, $p < .001$, with the predictors explaining 24.7% of the variation in appetite. Both familiarity, $B = .395$, $t = 3.51$, $p = .001$, and animal resemblance, $B = -.243$, $t = -2.16$, $p = .035$, were significant predictors.

3.3. Discussion

Study 2a provided partial, initial support for the conditional hypothesis regarding animal resemblance. Though the predicted interaction effect of familiarity and animal resemblance was not significant, animal resemblance had a relatively larger effect on appetite for unfamiliar products than familiar products. Scrutiny of the familiarity ratings for the whole fish revealed that it was not rated as familiar as in our previous study ($M = 2.84$ vs. 4.89), despite sampling from a population quite similar to that we based our selection criteria upon. In Study 2a, we incidentally sampled relatively fewer

[3] We did not run comparable regression analyses in the other conditions since at least one of the dimensions has ratings at floor, making comparative analysis unfeasible.

semi-vegetarians and pescatarians than in Study 1, which could have contributed to this difference. As a result, the whole fish was not rated as familiar as the chicken nuggets, which complicated their comparison. The whole fish was also, overall, rated as resembling an animal less than the whole crocodile (see Table 4), though the resemblance mean rating for whole fish was quite high and not as problematic as its familiarity rating.

As a first step towards correcting this limitation, we explored the ratings of familiarity and animal resemblance as predictors of appetite for the whole fish condition. Both familiarity and resemblance ratings independently predicted appetite ratings in this condition. To more fully address this limitation, in Study 2b we replaced the whole fish image with a different stimulus from Study 1 (whole roasted chicken) that might better typify the high resemblance x high familiarity condition. This selection had the added advantage of standardizing the type of animal along the familiarity dimension (i.e., high familiarity = chicken vs. low familiarity = alligator), whereas Study 2a held constant animal type only within the low familiarity condition (alligator).

4. Study 2b

4.1 Method

4.1.1 Participants

The sample included 257 UK participants (58.4% female) aged between 18 and 88 years old (M_{age} = 36.12, *SD* = 14.97). Participation was restricted to individuals living in the UK who followed “no specific diet”. Vegetarians and vegans were not eligible to participate. Pescatarians were also not eligible, as there were no seafood products in Study 2b. The invitation for this study was not shown to participants who had taken part in Studies 1 and 2a. Most participants self-identified as meat-lover or omnivore (89.5%) and 10.5% followed a semi-vegetarian diet. Two participants identified as pescatarian or vegetarian, and thus were removed from the analysis.

4.1.2 Procedures, measures, and materials

Data collection took place on 1st April 2021. Procedures were the same as in Study 2a. As before, participants were randomly assigned to one of four conditions, with participants equally distributed across conditions (samples varying between 63 and 65 participants per condition). The main difference was the replacement of the high familiar x high resemblance meat product (i.e., whole fish in Study 2a vs. whole chicken selected from Study 1). The rationale for this replacement was two-fold: (a) to select a product that would have suitably high familiarity and animal resemblance ratings and (b) control for the type of animal within each level of familiarity (i.e., high familiarity = chicken; low familiarity = alligator). All other materials were identical to those used in Study 2a.

4.1.3 Preregistered Analysis Plan

The analysis plan was identical to Study 2a and can be viewed here: https://aspredicted.org/blind.php?x=xj4yj8. As before, the two animal resemblance/ meat-animal association items correlated highly, $r(255) = .885$, $p < .001$, and therefore were aggregated.

4.2. Results

Table 5

Mean Scores for Familiarity, Animal Resemblance, and Appetite by Condition (Study 2b).

Familiarity	Animal resemblance	Familiarity		Animal resemblance		Appetite	
		M	*SD*	*M*	*SD*	*M*	*SD*
Low	Low (Alligator bites)	1.08[a]	0.32	2.04[a]	1.18	3.58[a]	1.79
	High (Whole crocodile)	1.14[a]	0.56	6.04[c]	1.34	3.03[a]	1.70
	Low (Chicken nuggets)	4.19[b]	1.78	1.53[a]	0.69	4.90[c]	1.69

High	High (Whole chicken)	6.00[c]	1.10	4.48[b]	1.40	5.69[b]	1.31

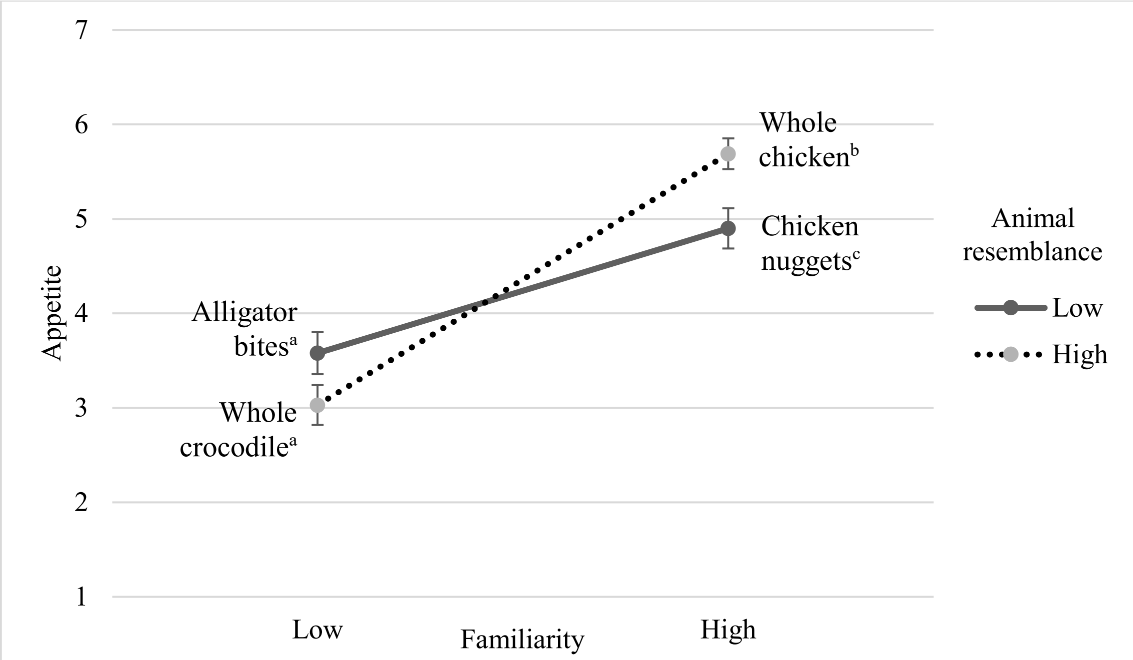
Note. N = 257. Different superscripts ([a,b,c]) within a given column indicate significant mean differences on ratings between products.

The manipulation of high familiarity/ high resemblance (whole chicken) was more successful in producing high familiarity ratings, compared to Study 2a (see Table 5), with ratings even higher than in the other High Familiarity condition (chicken nuggets). The animal resemblance ratings for the whole chicken condition were not as high as in Study 1 (M = 4.48 vs. 5.71) and were significantly lower than when compared with the other high resemblance condition (whole crocodile; see Table 5). As in Study 2a, we conducted a regression analysis, focused on the High/High condition, to contrast the contribution of familiarity and resemblance ratings on appetite in this condition.

The two-way ANOVA revealed, as expected, a main effect of familiarity on appetite, with participants in the high familiar conditions reporting higher appetite means in comparison with low familiar conditions, $F(1,253) = 96.05$, $p < .001$, $\eta_p^2 = .28$. Different from Study 2a, there was no main effect of animal resemblance on appetite, $F(1,253) = 0.35$, $p = .556$, $\eta_p^2 = .001$. However, this time the predicted interaction effect was significant, $F(1,253) = 10.76$, $p = .001$, $\eta_p^2 = .04$ (see Figure 4).

Figure 4

Interaction Effect between Familiarity and Animal Resemblance on Appetite (Study 2b)



Note. Different superscripts ([a,b,c]) indicate mean differences on appetite between conditions defined by animal resemblance and familiarity (interaction effect). Error-bars represent ±1 standard error from the mean.

Simple-effects tests were carried out in accordance with the analysis plan. Animal resemblance significantly increased appetite when meat was familiar (meat from chicken, $t(126) = 2.95$, $p = .004$, $MD = .79$, $SE = 0.29$, 95% CI [.30, 1.32], $d = 0.522$. This effect is opposite than what would be expected if animal resemblance exerted an effect on appetite independent of familiarity. Also different from Study 2a, when meat was unfamiliar (i.e., meat from alligator), animal resemblance did not significantly impact on appetite, $t(127) = -1.78$, $p = .077$, $MD = 0.55$, $SE = 0.31$, 95% CI [-1.15, .06], $d = -0.314$, though the pattern of means was in a similar direction as in Study 2a. As in Study 2a, familiarity reliably increased appetite for meat at both levels of animal resemblance – high (whole meat): $t(128) = -10.02$, $p < .001$, $MD = -2.66$, *SE*

= .27, 95% CI [-3.19, -2.14], *d* = -1.753; low (bites/nuggets): *t*(125) = -4.29, $p < .001$, *MD* = -1.33, *SE* = 0.31, 95% CI [-1.94, -.71], *d* = -0.758 (see Table 5).

A regression analysis was used to further explore the High/High (i.e., whole chicken) condition. Results revealed a significant model, *F*(2,62) = 6.84, *p* = .001, with the predictors explaining 18.1% of the variation in appetite. Familiarity ratings independently predicted appetite ratings, *B* = .409, *t* = 3.56, *p* = .001, whereas animal resemblance did not, *B* = -.11, *t* = -0.96, *p* = .340.

5. Mini meta-analysis

Studies 2a and 2b presented slightly different results for the effect of animal resemblance on appetite within the low familiarity (alligator bites vs. whole crocodile) and High Familiarity (chicken nuggets vs. whole fish/chicken) conditions. Hence, we ran a mini meta-analysis, to obtain weighted mean scores across the studies, and get a better sense of the estimated size of the effect of resemblance for these two comparisons, using procedures suggested by Goh et al. (2016). Consistent with the conditional hypothesis, animal resemblance had a moderate size, negative impact on meat appetite when familiarity was low, *r* = -.264, $p < .001$, and a non-significant effect when familiarity was high, *r* = .006, *p* = .891 (see Table 6). Additionally, the effect of animal resemblance on appetite was highly heterogenous when the meat products were familiar, but less heterogenous for low familiar products.

Table 6

Meta-Analysis: Effects of Animal Resemblance on Meat Appetite at Low and High Levels of Familiarity

		t	df	p	*Cohen's d*	r
Low familiarity						
Study 2a (N = 257)	Whole crocodile -alligator bites	-4.41	126	< .001	-0.779	-.366
Study 2b (N = 257)	Whole crocodile -alligator bites	-1.78	127	.077	-0.314	-.156
$M\ r_z$						-.270
$M\ r$						-.264
Combined Z						-4.181^{***}
I^2						98.03
High familiarity						
Study 2a (N = 257)	Whole fish - chicken nuggets	-2.74	127	.007	-0.482	-.236
Study 2b (N = 257)	Whole chicken - chicken nuggets	2.95	126	.004	0.522	.254
$M\ r_z$						.009
$M\ r$						.006
Combined Z						0.891
I^2						144.1

Note. M r_Z = weighted mean correlation (Fisher's z transformed). $M\ r$ = weighted mean correlation (converted from r_Z to r). Positive Cohen's d and positive correlation coefficients indicate that high animal resemblance meat products have higher appetite ratings than low animal resemblance meat products. I^2 index was generated using a spreadsheet by Neyeloff, Fuchs and Moreira, (2012) and should be interpreted with caution when based on few studies.
$^{***}p < .001$, two-tailed.

6. General Discussion

The present studies sought to disentangle familiarity and animal resemblance as naturally co-occurring inputs into meat appetite. Our findings showed that animal resemblance had a limited role in appetite for meat once familiarity was accounted for. This suggests that product familiarity can attenuate the psychological impact that animal reminders have on appetite, and possibly account for some of the effects ostensibly attributed to animal resemblance in the psychological literature.

Study 1 had participants evaluate meat products. It was found that meat products that highly resemble the animal source tended to elicit more animal-identification associations than meat products with a low animal resemblance. This is consistent with the idea that animal resemblance is indeed a source of animal association. Though it is worth noting that the rate of animal associations, even within the high-resemblance products, was below 50%. On the one hand, this may suggest that animal associations are not very common even for high-resemblance products. On the other hand, it might also have been the case that participants were aware of the animal association but did not report it in the free association task because other associations (e.g., hedonic sensory experiences) were more prominent.

Efforts to inductively separate the two dimensions of interest in Study 1 were largely successful. The image ratings returned a two-dimensional circumplex with images falling into one of four clusters, representing products appraised as high or low in familiarity and high or low in animal resemblance. Exploration of the features of the four clusters produced initial evidence for the conditional hypothesis: animal resemblance reduced appetite for meat products, but only when familiarity with the product was low. Appetite ratings were thus highly influenced by product familiarity, but the influence of animal resemblance was more conditional. Animal resemblance affected appetite mainly when the meat product was unfamiliar.

Studies 2a-2b drew upon the normed familiarity and animal resemblance ratings gathered in Study 1, to identify products suitably separated on the dimensions of interest and applied a 2x2 experimental design. In Study 2a, animal resemblance *reduced* appetite for familiar meat, whereas in Study 2b it *enhanced* appetite for familiar meat. Notably, these differences coincided with the degree of familiarity attributed to the "familiar" meat used in each study (i.e., higher levels of familiarity in 2b than in 2a). A mini meta-analysis of the two studies suggested that the effect of animal resemblance on appetite was moderate and significant for unfamiliar meat (i.e., *reducing* the appeal of unfamiliar meat), but nonsignificant for familiar meat (the weighted mean *r* was close to zero). By contrast, product familiarity consistently and robustly increased appetite for meat.

Implications for Theory and Practice

Our findings help unite and clarify two lines of research on meat appeal. The first line of research has shown that when people psychologically associate meat with its animal origins, their appetite wanes (Benningstad & Kunst, 2020; Earle et al., 2019; Kunst & Hohle, 2016; Tian et al., 2016). Yet another line of research has found that individuals can become desensitized to animal reminders with repeated exposure to them, such that when exposed to high-resembling meat products, consumers show diminished appetite disruption than consumers with less exposure to such products (Kunst & Haugestad, 2018; Piazza et al., 2021). The present findings help reconcile these two lines of research by illuminating how familiarity and animal resemblance interact to impact on appetite. Our findings suggest two novel conclusions: (1) animal resemblance has its greatest impact on appetite when familiarity with meat products is low; and (2) animal resemblance loses its influence on appetite when familiarity is high not because animal associations are suppressed, but because they seem to be unproblematic for appetite.

That animal resemblance had its strongest influence on appetite when meat products were unfamiliar can be understood in terms of the uncertainty surrounding unfamiliar products. When a food product is familiar, consumers can trust it will meet their expectations (Borgogno et al., 2015; Tuorila et al., 1994), which are anchored on past sensory experiences. By contrast, the uncertainty caused by unfamiliar products requires consumers to use other aspects, for example, related to a product's appearance or description, to inform taste expectations. In the domain of meat, animal resemblance is one such aspect that can impact on consumer enjoyment. Indeed, as shown in our mini meta-analysis, it is when meat products were unfamiliar that animal resemblance most consistently exerted an impact on appetite.

The present findings also give insight into the mechanism by which animal resemblance loses its impact on meat appeal. We observed that high animal-resembling meat products can retain their appeal to consumers even though they remain as reminders of the animal. That is, familiarity did not dispel the meat-animal association—at least, not fully—as observed in the free associations and meat-animal association ratings of the high-resembling products. Participants in our studies appeared to be aware of which products resembled animals and which did not. Despite the animal association being active, it often failed to disrupt participants' appetite for familiar products. This finding is interesting because it suggests that familiarity softens or neutralizes the psychological power of meat-animal associations rather than preventing them from emerging.

If this view is correct, it has important implications for how researchers and advocates might approach meat-reduction interventions, particularly interventions aimed at inducing meat-animal associations (e.g., Kwasny, Dobernig & Riefler, 2021; Mathur et al., 2021). The current findings suggest that it is not enough to evoke a meat-animal association because not all meat-animal associations are problematic for meat consumers. We have seen here that, for familiar meat products, meat-animal associations are not uncommon, yet they have lost their potency to disrupt appetites. Thus, interventions aimed at inducing meat-animal associations should consider the existing relationship consumers have with the meat product. The fact that familiarity had its strongest effects when animal resemblance was high highlights the need to consider familiarity when examining the impact of animal resemblance on appetite.

What, on the surface, may look like an effect of animal resemblance may often be at least partly attributed to the degree of familiarity of the animal reminder.

We would recommend that interventions utilizing animal reminders consider ways of making either the animal reminder or the meat seem less familiar or more unusual. Some animal reminders themselves are unusual (e.g., presenting a roasted ham or chicken with the head attached; Kunst & Hohle, 2016), and so their application to a product would likely reduce its appeal by making it less familiar. But such interventions may be of limited practical value since most consumers will likely avoid products that include such unfamiliar alterations. Other animal reminders are orthogonal to the meat itself (e.g., presenting a photo of a cow at the deli counter or alongside a recipe; Tian et al., 2016). The efficacy of such interventions will likely hinge on the nature of the meat product—how familiar it is to the consumer—but also the familiarity of the animal reminder in relation to the product. If the animal reminder is commonly paired with the product (e.g., commonly seeing an image of a cow at the deli counter), the inclusion of the reminder within an intervention is likely to be ineffective at lowering appetites because the consumer will be habituated to such an association. Thus, effective meat-animal association interventions will consider not only the experience the consumer has with the product but also the animal reminder in relation to the product.

Limitations and Future Directions

There were several limitations with the current methods. We struggled to find products that reliably represented the high resemblance x high familiarity quadrant. This quadrant may be empirically limited because familiarity with high-resemblance meat, such as whole fish or pig roast, may be highly variable across cultures and within. Future studies should continue to explore this dimensional space for suitable stimuli.

Another limitation is that we could not standardize the animal across all four quadrants, and, in our experimental studies, animal type covaried with familiarity (i.e., familiar meat was from a different animal than unfamiliar meat). In Study 2a, animal type was not held constant within the high-familiar condition, because the products used were based on the normative ratings from Study 1. Our approach was to select four products that had suitable distance within the "resemblance x familiarity" circumplex. This empirically-driven selection for Study 2a incidentally led to animal type being standardized for low-familiar meat, but not high-familiar meat. We did not see this as a substantive problem. Nevertheless, we recognized that it was a potential limitation which needed to be addressed in Study 2b. More generally, the coincidence of familiarity and animal type is a genuine empirical constraint that should be recognized when studying meat appetite. We did manage to observe some exceptions to this rule in Study 1 (e.g., butelo and hog roast were unfamiliar meat from pigs, whereas pork steak and pork sausage were familiar). The broad coverage of naturalistic meat products in Study 1 provides us with some assurance that differences in animal type cannot fully account for the influence familiarity has on meat appetite. Nonetheless, continued effort is needed to identify materials that can suitably manage this issue.

Our findings are also limited to the animals that we were able to include in our methods. Many of the animals we used as unfamiliar meat (e.g., alligator, octopus, insects) are animals that individuals have little to moderate moral concern for (see Possidónio et al., 2019). It would be beneficial to extend the current findings with more dishes from mammals as they are animals individuals tend to care a lot about. We avoided using meat from unfamiliar sources that people have high concern for (e.g., dogs, chimpanzees, whales, elephants) because the meat from these animals would be likely rated at floor levels among our UK-based participants, yielding limited variability in the appetite ratings to use in the analyses. Importantly, there could also be practical barriers in finding real images of such meat that are openly available and can be used in research. We chose to use real stimuli to strengthen the ecological validity of our methods, instead of trying to convince participants they were viewing meat from legally protected animals. Given the great variability in cuisine in different cultures, care will be required to develop stimuli that are suitably anchored to the culture of interest, when determining whether our findings might generalize to populations beyond the UK-based samples we investigated.

Our conclusions are also limited to the variables we focused on. One extraneous variable that we did not consider that might impact on meat appetite is the perceived nutritional value of the product. For example, chicken nuggets would likely have been rated lower in nutritional value than the whole chicken, which might partly explain their discrepant appetite ratings. Nonetheless, there are many instances where the less healthy product (e.g., high-caloric 'junk food') is rated more desirable than the perceived healthier product (e.g., Pursey et al., 2017). Thus, future research should examine such third variables as their impact on meat appetite is far from clear.

Finally, as highlighted by Benningstad and Kunst (2020), more research is needed to better understand which aspects of meat-animal associations are problematic for consumers. Research by Kunst and Hohle (2016) suggests that meat-animal associations often elicit empathy for the slaughtered animal, and Hamilton (2006) observed that vegetarians and vegans often associate meat with violence and death. Thus, it may be that representations of slaughter and violence done to animals are particularly off-putting for consumers, as opposed to representations of the living animal. Working out which aspect of the association is particularly problematic is an important direction for better understanding how to construct the most effective interventions.

Conclusion

Connecting meat to animals can be psychologically problematic for some consumers. We have observed that this is most likely to be true when a meat dish is novel and unfamiliar. Meat products that are familiar, that consumers have habituated to, and, thus, have clear expectations about, are less likely to be disrupted by meat-animal associations. For such products, the sensory experience of the dish and its animal resemblance is psychologically integrated in a manner that the product retains its appeal despite its animal connection. This happens not because the animal origins fade from view but because, when it comes to food, “familiarity breeds contentment”, and this is true even for food with a face.

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Table S1

Meat Images and Descriptive Captions

Chicken liver pate
Origin: Northern and central European cuisines.
Preparation/Cooking: Chicken livers are grinded and mixed with butter, spices, and herbs.

Dobrada
Origin: Portuguese dish.
Preparation/Cooking: Made from a cow's flat white stomach lining and usually stewed.

Kangaroo biltong
Origin: Australian origin.
Preparation/Cooking: Kangaroo meat is dried and can be added to soups, stews, and salads.

Snake
Origin: Originally found in Southeast Asian cuisines.
Preparation/Cooking: Snakes are usually skinned, cut into pieces, and then fried.

Alligator meat
Origin: Common in various cuisines of the Southern United States.
Preparation/Cooking: Alligator meat can be eaten fried or grilled.

Insect protein powder
Origin: A food developed in several countries around the world.
Preparation/Cooking: Insects are dried and grinded into powder and commonly used on smoothies, pasta, bread, cookies.

Butelo
Origin: Produced in Portugal.
Preparation/Cooking: Smoked sausage made with pork meat and pork loin from a local breed.

Beef burger
Origin: Originally from the USA.
Preparation/Cooking: Meat from cows is minced and combined with garlic, onions, salt and pepper, then formed into patties.

Sausage
Origin: Originally from Mesopotamia, now eaten around the world.
Preparation/Cooking: It is a meat mixture often stuffed in a casing, usually grilled or fried.

Sushi
Origin: Japanese dish.
Preparation/Cooking: Sushi is a dish traditionally made with raw fish or other seafood (e.g., eel, crab). Sushi rolls are prepared with sweetened, vinegared rice, and may include other ingredients (e.g., vegetables).

Fish fillet
Origin: Eaten in most countries.
Preparation/Cooking: The flesh of a fish which has been cut or sliced away from the bone, usually grilled.

Pork steak
Origin: Eaten around the world.
Preparation/Cooking: Pork steak is cut from a pig's shoulder and usually grilled.

Chicken steak
Origin: Associated with the Southern cuisine of the United States.
Preparation/Cooking: A cut of meat usually thin and selected from the round is breaded and fried.

Chicken nuggets
Origin: Originally from the USA and is now eaten around the world.
Preparation/Cooking: Nuggets are usually made from chicken meat that is breaded or battered, then deep-fried or baked.

Octopus
Origin: Eaten in many countries, mostly in Asian and European countries
Preparation/Cooking: Usually grilled.

Squid
Origin: Eaten from Japan to Portugal, mainly in Spain, Italy, China, Republic of Korea.
Preparation/Cooking: Usually grilled or fried.

Escargot
Origin: Part of the European cuisine, particularly France.
Preparation/Cooking: Snails are eaten whole and cooked.

Crocodile
Origin: It has been used in various cuisines of the Southern United States and has become a very popular meat in Australia.
Preparation/Cooking: Usually fried or grilled.

Scorpion
Origin: Vietnam and certain regions of China.
Preparation/Cooking: Eaten deep-fried from claw-to-tail.

Insects
Origin: Cultures in Central and South America, Africa, Asia, Australia, and New Zealand.
Preparation/Cooking: Insects like grasshoppers and crickets. Usually fried.

Snake
Origin: Generally eaten in Southeast Asian countries.
Preparation/Cooking: The skin is removed, and the snake meat is usually fried or used to make soup.

Turkey
Origin: A popular poultry dish, especially in North America.
Preparation/Cooking: Usually roasted.

Chicken
Origin: Eaten worldwide.
Preparation/Cooking: It can be grilled, breaded or deep-fried.

Hog roast
Origin: Philippines, Puerto Rico, Cuba, United States, Brazil and UK.
Preparation/Cooking: The whole pig is roasted over an open fire or wood fired oven.

Lobster
Origin: Eaten around the world.
Preparation/Cooking: It is commonly served boiled or steamed in the shell.

Shrimp
Origin: Eaten worldwide in Asian cuisines, North America, and Europe.
Preparation/Cooking: Common methods of preparation include baking, boiling, frying, and grilling.

Crappit heids
Origin: Scottish dish.
Preparation/Cooking: Made with (usually haddock or cod) stuffed fish heads.

Fish
Origin: Common dish found in countries from Asia and Europe.
Preparation/Cooking: The whole fish is usually grilled.

Table S2

Number of Associations Mentioned in Each Category for Each Product

	Low Familiarity										High Familiarity							
High Resemblance	**15 - Octopus**		**16 - Squid**		**17 - Escargot**		**18 - Crocodile**		**19 - Scorpion**		**22 - Turkey**		**23 - Chicken**		**26 - Shrimp**		**28 - Fish**	
	Negatively valenced	127	Negatively valenced	105	Negatively valenced	126	Negatively valenced	151	Negatively valenced	153	Positively valenced	123	Animal identification	105	Positively valenced	95	Animal identification	136
	Animal identification	51	Positively valenced	83	Animal identification	67	Ethics	58	Animal identification	58	Animal identification	27	Positively valenced	103	Animal identificati on	92	Positively valenced	81
	Positively valenced	38	Animal identification	68	Sensory attributes	67	Animal identificatio n	57			Sensory attributes	26	Negatively valenced	49	Negatively valenced	61	Negatively valenced	72
			Sensory attributes	37	Positively valenced	29							Sensory attributes	25				
	20 - Insects		**21 - Snake**		**24 - Hog Roast**		**25 - Lobster**		**27 - Crappit heids**									
	Negatively valenced	170	Negatively valenced	179	Negatively valenced	146	Animal identificatio n	103	Negatively valenced	192								
	Animal identification	76	Animal identification	75	Animal identification	59	Negatively valenced	57	Animal identification	85								
	Sensory attributes	30	Sensory attributes	52	Ethics	58	Positively valenced	54										
							Ethics	37										
Low Resemblance	**2 - Dobrada**		**3 - Kangaroo bites**		**4 - Snake bites**		**5 - Alligator bites**		**7 - Butelo**		**1 - Pate**		**8 - Beef burger**		**9 - Sausage**		**10 - Sushi**	
	Negatively valenced	79	Negatively valenced	121	Positively valenced	75	Positively valenced	81	Negatively valenced	111	Negatively valenced	74	Positively valenced	147	Positively valenced	141	Positively valenced	103
	Positively valenced	58	Sensory attributes	71	Negatively valenced	63	Health	50			Positively valenced	67					Negatively valenced	62
	Health	25			Sensory attributes	35	Negatively valenced	45			Sensory attributes	25					Animal identification	33

Sensory attributes	24	Health	25	Sensory attributes	26

11 - Fish fillet		12 - Pork steak		13 - Chicken steak		14 - Chicken nuggets	
Positively valenced	152	Positively valenced	124	Animal identification	98	Positively valenced	50
Animal identification	128	Negatively valenced	36	Negatively valenced	89	Negatively valenced	36
Health	26			Positively valenced	86	Animal identification	32
Sensory attributes	25			Sensory attributes	38	Sensory attributes	24

Table S3

Evaluative Dimensions Ratings per Meat Product

		Familiarity				Animal resemblance				Appetite			
		M	*SD*	*95% IC for Mean*		*M*	*SD*	*95% IC for Mean*		*M*	*SD*	*95% IC for Mean*	
				LB	*UP*			*LB*	*UP*			*LB*	*UP*
Cluster 1	Octopus	2.28	1.46	2.09	2.47	5.30	1.48	5.11	5.49	3.05	1.85	2.81	3.29
	Squid	2.59	1.54	2.39	2.79	5.39	1.50	5.19	5.58	3.36	1.94	3.11	3.61
	Snail	1.86	1.11	1.71	2.00	6.28	1.27	6.11	6.44	2.56	1.79	2.33	2.79
	Crocodile	1.10	0.43	1.04	1.16	6.69	1.07	6.55	6.83	2.09	1.54	1.89	2.29
	Scorpion	1.10	0.55	1.03	1.17	6.75	1.03	6.61	6.88	1.58	1.08	1.44	1.72
	Insects	1.21	0.69	1.12	1.30	6.61	1.24	6.45	6.77	1.90	1.41	1.72	2.09
	Snake	1.09	0.47	1.03	1.15	6.01	1.53	5.81	6.21	1.63	1.23	1.47	1.79
	Hog	2.47	1.43	2.29	2.66	6.71	0.80	6.61	6.82	3.36	2.07	3.09	3.63
	Lobster	3.06	1.60	2.85	3.26	6.73	0.82	6.62	6.84	4.06	2.03	3.80	4.32
	Crappit	1.24	0.66	1.16	1.33	6.12	1.39	5.94	6.30	1.79	1.21	1.63	1.94
	Total	1.80	0.60	1.72	1.88	6.26	0.80	6.15	6.36	2.54	1.08	2.40	2.68
Cluster 2	Turkey	4.66	1.45	4.47	4.85	5.65	1.24	5.49	5.81	5.57	1.39	5.39	5.75
	Chicken	6.28	1.07	6.14	6.41	5.71	1.25	5.54	5.87	5.90	1.39	5.71	6.08
	Shrimp	4.21	1.81	3.97	4.44	6.42	1.04	6.29	6.56	4.49	2.10	4.22	4.76
	Fish	4.89	1.69	4.67	5.11	6.82	0.50	6.75	6.88	4.64	1.90	4.39	4.88
	Total	5.01	1.06	4.87	5.15	6.15	0.74	6.05	6.25	5.15	1.27	4.98	5.31
Cluster 3	Dobrada	1.21	0.80	1.11	1.32	1.38	0.96	1.26	1.51	2.10	1.39	1.92	2.28
	Biltong	1.14	0.59	1.06	1.21	1.24	0.70	1.15	1.33	2.76	1.80	2.52	2.99
	Fried snake	1.07	0.48	1.01	1.13	1.33	0.78	1.23	1.43	2.40	1.58	2.19	2.60
	Alligator	1.13	0.53	1.06	1.20	1.34	0.86	1.22	1.45	3.20	1.80	2.97	3.43
	Insect powder	1.17	0.75	1.07	1.26	1.07	0.47	1.00	1.13	2.81	1.87	2.56	3.05
	Butelo	1.24	0.67	1.15	1.33	2.17	1.43	1.99	2.36	3.73	1.68	3.51	3.95
	Total	1.16	0.34	1.11	1.20	1.42	0.56	1.35	1.49	2.83	1.24	2.67	2.99
Cluster 4	Pate	3.60	1.75	3.37	3.83	1.19	0.75	1.09	1.29	3.95	1.96	3.69	4.20
	Burger	5.66	1.41	5.48	5.85	1.66	1.28	1.49	1.82	5.67	1.50	5.47	5.86
	Sausage	5.76	1.54	5.56	5.96	1.56	1.17	1.41	1.71	5.61	1.67	5.39	5.82
	Sushi	4.15	1.79	3.92	4.38	1.52	1.02	1.39	1.65	4.76	2.22	4.47	5.05
	Fillet	5.66	1.38	5.48	5.84	2.36	1.55	2.16	2.56	5.83	1.42	5.65	6.02

Pork steak	4.72	1.62	4.51	4.93	1.80	1.18	1.65	1.96	5.08	1.62	4.87	5.29
Chicken steak	5.63	1.50	5.44	5.83	1.90	1.24	1.74	2.06	5.75	1.37	5.57	5.93
Nuggets	5.13	1.60	4.92	5.34	1.38	1.02	1.25	1.51	5.10	1.68	4.88	5.32
Total	5.04	1.06	4.90	5.18	1.67	0.86	1.56	1.78	5.22	1.08	5.08	5.36

S4

Participant-level Analysis

Correlation analysis revealed that both animal resemblance, $r(228) = .23$, $p < .001$, and familiarity, $r(228) = .45$, $p < .001$, were positively correlated with appetite. Moreover, animal resemblance and familiarity were also positively correlated, $r(228) = .28$, $p < .001$, which means that participants who tended to be familiar with meat products also tended to think the products resembled the animal source. Regression analysis revealed that familiarity was a significant independent predictor of appetite, $\beta = .41$, $t(226) = 6.72$, $p < .001$; that is, participants who tended to be familiar with meat products tended to rate them more appetizing. Animal resemblance did not emerge as a significant independent predictor of appetite at the participant level, $B = .11$, $t(226) = 1.79$, $p = .075$; that is, participants who tended to see meat products resembling animals did not tend to rate meat products as more or less appetizing. The overall model was significant, $F(2, 226) = 30.00$, $p < .001$, and explained 21% of the variation in appetite. Thus, similar to the product-level analysis, the participant-level analysis revealed a robust relationship between familiarity with meat and appetite; however, the relationship between animal resemblance and appetite was weaker.