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College Student Literacy of Food Animal Slaughter in the United States

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Abstract. Despite the growing influence of food justice and conscious consumption in Western society, Westerners exhibit limited knowledge of non-human animal oppression in the food system. This study asked students in seven classes of Introduction to Sociology offered in a private New Jersey university to estimate how many non-human animals are killed for food every year in the United States. Although students had been exposed to reading and lecture material covering speciesism and non-human animal oppression in the food system, results demonstrate major variation in student retention and awareness. Most students (66%) severely underestimated the magnitude of killing; the median response was just 65 million while the bottom 10% of responses averaged a guess of 24 667. Exam grade was slightly correlated with student responses, but gender was not. These findings support existing research on consumer ignorance and social psychological theories that predict cognitive barriers to understanding large-scale suffering, alerting educators and policymakers to the difficulties in raising food literacy.

Introduction

As non-human animal rights activists can attest, the American populace has a limited understanding of non-human animal treatment in the food system (Colb, 2013). Strong ideological barriers and corporate suppression ensure that Americans put little thought into their food choices beyond presentation and price in stores and restaurants. Adherence to a plant-based diet and veganism as a political position are correlated with greater educational attainment (Margolis, 2013), but it remains the case that most Americans, educated or not, consume the flesh, hair, reproductive secretions, and labour of non-human animals with little awareness to the suffering entailed in these relationships. Beyond the immediate harm imposed to farmed non-human animals, animal agriculture is linked to zoonotic disease outbreaks, antibiotic resistance, a variety of preventable and life-threatening dietary illnesses, climate change, the extermination of free-living non-human communities, and race, class, and gender oppression in production practices. The variety and potency of these problems seem to have little impact on levels of awareness. Activists and policymakers alike have been vexed by the difficulty in raising consumer consciousness to the political nature and social consequences of animal-based food systems.

This study does not purport to solve this multifaceted mystery, but it does contrib-

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ute to existing vegan demographic studies by offering a brief quantitative analysis of one American university's food literacy. A number of psychological barriers and structural constraints ensure that consumers' food literacy remains rather low, and, as the results of this brief study demonstrate, isolated educational attempts may not be sufficient to overcome this issue. Segregation, socialization, and social psychological conditions ensure that ignorance to non-human animal suffering remains high, even though participants had been exposed to contradictory evidence. Results indicate that individualized attention to food illiteracy may not be the best investment of resources. Instead, a structural approach that targets consumers through influential institutions and agents of socialization will be necessary.

Literature Review

The Politics of Sight

Food consumption is a deeply personal and physically intimate human behaviour, and yet the structures that govern it are taken for granted and have become largely invisible. It is the nature of systems to remain out of sight and out of mind until they are disrupted, with this disruption subsequently forcing the attention of consumers. Timothy Pachirat explores this phenomenon in *Every Twelve Seconds: Industrialized Slaughter and the Politics of Sight* (2012), whereby the societal civilizing project has introduced a highly limiting and impermeable system of bureaucracy. Bureaucracy divides and separates society while also shrouding the distasteful aspects of production. With production segmented and dispersed, food literacy is baffled, and often intentionally so given the likelihood that consumer consciousness will lead to disenchantment and abstention. Consumers might only become aware of this bureaucratic structure when disease outbreaks surface and tracing contagions to the source proves difficult. This same structure hides violence against non-human animals (and vulnerable workers who are often undocumented, poor and female), compartmentalizing and dispersing production across many states, factories, and distribution centres. As with food-borne illnesses, it is difficult to attribute a source to the animal products that fall into the plate many miles from their origin. What is more, few of these products in any way resemble the cows, chickens, and other animals from whom they were taken. For consumers, what they see at the point of consumption has been greatly manipulated and what they do not see in the production process is tightly controlled.[1]

Indeed, Paul McCartney (2014) once observed that 'if slaughterhouses had glass walls, everyone would be a vegetarian.' It is this deliberate obfuscation that is precisely functional for a system that arguably runs counter to the sensibilities of many empathetic human consumers. Sociologists have offered a more sophisticated analysis regarding the politics of sight, noting that visibility is only one of many senses that is confused by institutional food practices (Cole and Stewart, 2014). While senses (sight, sound, smell, taste and touch) are all objectively registered, they are *subjectively* experienced. It is culture that ascribes meaning. Subsequently, rationalized, regimented and segmented societies that categorize non-human animals as commodities and machines ensure that they will not be interpreted as feeling or suffering. In fact, they do not 'exist' at all. Non-human animals, once objectified, are absorbed into rationalized systems and removed from human sensibility. Disruption to the cultural logic is needed to restore non-human animals to fields of awareness.

Scientific research, critical journalism, and social-movement activity are all potential sources of disruption given their ability to raise awareness to hidden systems and illuminate social problems. This has certainly been the case as food justice popularized in the late twentieth twentieth century and the non-human animal rights movement entered its second wave. Cultural concern with food production is not a modern phenomenon of course, and reaches at least as far back as the food safety acts of the early twentieth century. This legislation was spawned, in part, by the investigative work of journalists such as Upton Sinclair, whose 1906 *The Jungle* opened a window to the cruelty and violence of the American slaughterhouse system. A century later, Eric Schlosser's 2001 *Fast Food Nation* and Michael Pollan's 2006 *The Omnivore's Dilemma*, among others, would reinvigorate public interest in the ethics of food production. Some animal-centric investigative pieces, such as Ruth Harrison's 1964 *Animal Machines*, also commanded the attention of the public and inspired policy changes (Sayer, 2013).

These movements and writers have been impactful. Attitudinal research conducted by non-human animal advocacy groups indicates that Americans have new sensibilities about other animals. Most Americans now believe that some animals are sentient and emotionally sophisticated, while about half believe that farmed animals deserve equal moral consideration as other species (Faunalytics, 2016). Importantly, this change in attitude is matched, at least in part, by behavioural change. Approximately 8 million Americans identify as vegan or vegetarian, and over one-third of the country dines on plant-based meals regularly (Stahler, 2015). Plant-based eating is certainly not a foreign concept in the United States. Many ate little to no animal flesh out of economic necessity prior to the industrialization of the food system. Others were ethically motivated. America hosted a lively and influential vegetarian movement from the mid-nineteenth century through the Progressive Era, which certainly popularized healthful eating and compassion for other animals (Shprintzen, 2015). Following the rationalization of the food system after World War II and heavy government subsidies to support animal agriculture's expansion, however, flesh products became plentiful, abundant, and nearly unavoidable. American sensibility shifted in response. Today, about one in 10 Americans consider themselves former flesh abstainers, while over 80% of Americans have never tried a plant-based diet (Asher et al., 2014).

Food Literacy

While the cultural impact of activism and journalism cannot be overstated, contemporary research suggests that the consciousness-raising they elicit among audiences may be fleeting. Awareness is only half the battle, as rationalized systems make deviance from social norms of behaviour and conventional wisdom both difficult and resource intensive. For instance, one study explored the resonance of Pollan's *The Omnivore's Dilemma* among college students whereby students were assigned the book in tandem with food justice documentaries and integrative homework assignments. Participants reported a marked improvement in food choices, consuming more vegetables having completed the course (Hekler et al., 2010). Another study, however, also explored the impact of *The Omnivore's Dilemma* on college students who had been assigned the book, and found that, within a year, their critical consciousness had dimmed and most behaviour changes had reversed (Hormes et al., 2013).

These results highlight the difficulty of consciousness-raising through cultural disruption, but education has elsewhere been shown to be at least somewhat impactful. Instructors of animal studies courses, for example, have reported significant attitude and behaviour changes (Flynn, 2003; Linné, 2016). The main drawback to this approach is that some degree of selection bias would be expected in humane education programmes, as students who already harbour empathy with non-human animals would be more likely to register for such classes.[2] Research that does not rely on convenience sampling of humane studies classrooms is thus poised for more relevance. Of these studies, findings still indicate that education is impactful. A meta-analysis of student attitudes and perceptions found that education increases receptiveness to plant-based eating and also increases feelings of participant self-efficacy regarding their perceived ability to transition from animal foods (Corrin and Papadopoulos, 2017). Medical research presents similarly positive results. A study of Greek adolescents increased their vegetable intake and decreased their consumption of non-human animal bodies as their food education improved (Tsartsali et al., 2009). One American study also found decreased consumption of 'meat' as food knowledge increased (Yen et al., 2008). Educational channel also matters. An online course administered domestically and internationally by the animal agricultural industry found that online learning was exceptionally effective in shaping consumer attitudes about non-human animal welfare (Carr et al., 2016).

Ultimately, however, despite considerable non-human animal rights work against speciesist food production and a respectably robust vegetarian population, food literacy remains rather low in the United States. Research in other Western nations find similar patterns. Finnish researchers, for instance, have identified only a moderate level of consumer consciousness to 'meat' production's negative impact on the environment. There is also, however, a high level of interest in counteracting this damage with more sustainable consumer choices (Pohjolainen et al., 2016). Although Finland is more progressive than the United States in terms of environmental policy (in 2016, it ranked number one on the Environmental Performance Index), its vegetarian and vegan population is comparable (Vinnari et al., 2009). Likewise, a Swiss study also observed low levels of knowledge about the environmental impact of 'meat' production. These respondents believed that other countries (with presumably lower welfare standards) were to blame for any injustices in the food system (Shi et al., 2016).

A 2005 European Union report underscores this confusion as it relates to the treatment of non-human animals, finding that most respondents assume that welfare standards in Europe are high. Few consumers genuinely considered the well-being of other animals when making food purchases, suggesting that the assumption of high welfare allows the consumer to disengage from the political implications of their food choices. Of interest, the majority of these respondents had visited a 'farm' where non-human animals are exploited, and were thus more likely to demonstrate a concern for the welfare of their victims (European Commission, 2005). Presumably, this visit facilitated the return of their sensibility to other animals. Outside of Europe, a study of Australian adolescents also found limited knowledge of non-human animal welfare (Ronto et al., 2016). Likewise, Brazilian research indicates low levels of knowledge among urban citizens regarding standard factory-farming practices (Hötzel et al., 2017). Research on food literacy as it impacts on non-human animals is rather limited, but does demonstrate that rates are consistently low in regions where animal products are heavily consumed.

Institutional Narratives, Segregation, and Other Barriers to Food Literacy

Educators concerned with the ethical, environmental, and health consequences of low food literacy thus face an uphill battle in shaping the sensibilities and behaviours of their audience. University courses and social movements are ultimately limited in their reach, and these must compete with industry interests that subject Americans to well-funded media campaigns designed to increase consumer trust and patronage. Susceptibility to these messages is heightened given the low food-literacy levels necessary to make informed decisions. American foodways foster complacency and discourage critical thinking, as this lends to a more predictable (and ultimately profitable) system. The knowledge-interest nexus created by 'Big Food' in its collaboration with government institutions systemizes food choices and invisibilizes alternatives. Here, anti-speciesism scholars identify what Acampora (2016) terms 'epistemologies of ignorance' as particularly conducive to anthropocentric social structures and ideologies.

This process impacts consumers at an early age, beginning at the family level and refining in the school system. The archetypal farm of Old McDonald and other cultural myths contribute to this ignorance by facilitating non-truths and cognitive dissonance (Cole and Stewart, 2014). Children are socialized by their parents to accept 'meat' consumption as soon as they are capable of digesting solid foods, while cow's breastmilk is often introduced even sooner despite high levels of indigestibility, especially among children of colour (Scrimshaw and Murray, 1988). Socialization processes carefully obscure the animal origin of food (Bray, 2016). Flesh is most often prepared and described in ways that create dissonance and discourage empathy (Kunst and Hohle, 2016). 'Bacon', for instance, does not physically resemble the pig from whom it came, nor does its name. Language, in particular, conveys shared meanings about the status of other animals, both reflecting and shaping a speciesist culture. Human–non-human relationships are culturally policed in an unconscious manner with the regular use of otherizing and pejorative language (Dunayer, 2001). Speciesism is thus ritualistically upheld through daily discussion, particularly when communicators refer to non-human animals as 'animals', 'meat', or 'it', and when they create insults out of stigmatized non-human identities such as 'cow', 'bitch', 'dog', 'rat', and 'whale'.

Distancing increases non-human objectification and human insensibility, but closeness can disrupt this process. Regular exposure to species that are traditionally treated as food objects can improve awareness to their personhood (Hazel et al., 2015). That said, proximity is not a cure-all. As one study found, while young rural children who have higher exposure to food animals are aware that non-human animals must be killed to produce 'meat', they are unfamiliar with the reality of confinement or killing, even those children whose parents work in agriculture (Meischen and Trexler, 2003). Most humans are structurally distanced from institutionalized violence against other animals throughout their life course. Pribac (2016) has suggested that the segregation of non-human animals institutionalized for food production is a leading prejudicial barrier (as has been shown to be the case in American race relations).

The consumer's 'out of sight, out of mind' position is aggravated by the rise of reduce and reform solutions popular with non-profits and policymakers. These pro-industry approaches are designed to modify suffering, rather than eliminate it. As Cole (2011) observes, 'humane' farming practices purport to increase the visibility of the food system and the non-human persons within it, but in a controlled man-

ner in which producers shape consumer knowledge and awareness in such a way as to maintain the invisibility of the inherent cruelties that remain. 'Free-range' farm narratives will highlight the freedom of movement granted to non-human inmates, for example, but avoid discussing product sourcing, transportation, and slaughter, which must remain hidden due to the unpleasant violence they inherently entail. This industry strategy is useful in deflecting criticism before it arises, astutely shaping the discourse and consumer imagination. Ultimately, this humane-washing has more of an impact on the psychologies of consumers than the actual lives of non-human victims.

Social Psychology and Dissonance

Structural, cultural, and environmental conditions are critical, but human psychology poses its own set of hurdles even without the added manipulation of the state and industries. For one, research on confirmation bias finds that individuals grappling with information, be it new or recollected, gravitate toward that which supports their existing beliefs. Likewise, they are inclined to overlook or dismiss information that contradicts these beliefs as well (Nickerson, 1998). This bias has even been observed among consumers of scientific evidence, which does not bode well for non-human animals who might be spared by research supporting their capacity for suffering.

An individual's interpretation of data is also influenced by their concept of self. In a study measuring the influence of vegan pamphlets, for instance, exposure to information about non-human animal treatment created an increase in concern about speciesism and a desire to eat less flesh among those who had *already* indicated to researchers that they were someone who identified as a caring consumer. This participant behaviour is likely a psychological effort to marry attitudes and behaviours (Prunty and Apple, 2013). This bias is thus useful for those who are already sympathetic to the interests of other animals, but it is not especially applicable to most American consumers who have little sensibility to other animals' conditions.

Awareness to non-human suffering brings with it considerable psychological trauma, and consumers may actively avoid knowledge to prevent this negative affection (Pribac, 2016). Indeed, a number of denial mechanisms are likely to be employed, and these are easily compounded by enlightenment fatigue. As social psychologist Stanley Cohen summarizes, people simply become 'tired of the truth' (2001, p. 187). This reaction has been described as 'willed blindness' (Gjerris, 2015), while some go so far as to term it 'empathetic laziness':

> 'Laziness is present in those who possess a vague sense that animals are treated badly in food-production, but decline to sharpen that awareness into concrete and specific knowledge. When someone declines to read or watch films about the brutality of meat (and milk and egg) production, choosing willful ignorance over knowledge of what the animals experience, they exhibit moral laziness, as well as (often) a kind of cowardice.' (Jenni, 2016, p. 34)

While psychological research has its merits, framing resistance as a matter of blindness, laziness, cowardice, or some other personal failing overly individualizes (in an ableist fashion) what is actually a common and predictable human response to normalized structures of oppression. The sociological research examined above coun-

ters Jenni's incomplete account of individual will or choice. Ignorance to non-human injustice is a toxic mixture of political and economic interests, sociological conditioning, and human psychological tendencies. Human economic structures and human brain structures work together to generate self-reproducing systems that make unimaginable violence quite banal and unremarkable.

Methodology

Again, this study does not attempt to explain how these low levels of food literacy manifest, but it is able to evidence the degree of resistance that exists in American consumers, even relatively educated ones. Data was collected from the results of one extra credit question on a mid-semester exam administered to seven sections of an introductory sociology course in a New Jersey four-year private institution. This question asked: 'Approximately how many land mammals are killed for food in the United States each year?,' and students were given a blank space to write their answer. The gender and test score of the students were also recorded. Because the question counted for two points of extra credit toward their exam score, students were expected to have taken the question seriously. Approximately three weeks prior to the test, the students had been presented with a regular 80-minute lecture on speciesism and the experience of non-human animals in the American food system. The lecture structure was consistent with regular course activity, and speciesism was integrated with disciplinary concepts such as culture, inequality, institutions and socialization. Students were told the estimated number of land animals killed in the United States each year as of 2011 (approximately 10 billion), as well as the number killed globally (approximately 65 billion). This information was listed on a PowerPoint slide for note-taking purposes. The lecture was supplemented by a sociological article written by David Nibert (2003), 'Humans and Other Animals: Sociology's Moral and Intellectual Challenge', which numbered the oppression of non-human animals in the 'millions' or 'hundreds of millions'.

This study is significantly limited in that it explores comprehension of a very narrow aspect of speciesism and draws from only one course offering at one university. There is no control group, as the speciesism lecture is an important element to the course design and I was not prepared to omit it from any classes. This course is primarily taken by first-year students, although students of all academic levels register. Because it is an introductory course that counts for a general education requirement for the university, students of all disciplinary backgrounds choose the class. This university is a private institution with a somewhat conservative student body. Approximately 60% of the student population is female, which is comparable to the national university gender ratio (Corbett et al., 2013). The gender ratio in the sample classes are slightly more skewed, with 68% of respondents being female. About half of the students at the sample university are first generation, which is also comparable to the national average (Staklis, 2010). Located on the Jersey Shore, most students are New Jersey natives and not geographically proximate to agricultural systems. Although the university is in the New York City area and has a moderately active vegan/vegetarian community with a handful of plant-based restaurants, it is not in any way as robust as food justice hotspots in other parts of the country such as Brooklyn, Los Angeles or Portland. This study is not intended to be generalizable, but does expect to contribute to the scientific understanding of consumer awareness to non-human animal suffering.

Results

When presented with a lecture on the topic and incentivized to remember this information in preparation for an exam, do students retain a reasonable estimate of how many non-human animals are killed for food in the United States? A total of 196 students completed the exam, but 41 (21%) did not answer the extra credit question. Averages were employed when the responses given were estimates. For example, if a student wrote, '3 million to 5 million', four million was recorded. Students who did not answer were recorded as 'no answer'. As predicted, the majority (66%) of respondents significantly underestimated the number of non-human animals killed in the United States for food. Only 2.5% significantly overestimated, and the remaining 29% were in the ballpark with responses between 1 billion and 1 trillion. The median response was 65 million, or just 0.006% of the actual number of land-dwelling non-human animals killed in the United States (which is 10 billion). Quite a few students guessed lower than 10 000. In fact, the bottom 10% of responses averaged a paltry 24 667. The lowest guess was just 1,000. Given that thousands of non-human animals are killed just to meet the menu requirements of the campus cafeteria each semester, these results indicate a profound ignorance of the American food system and its impact on vulnerable species.

Recall that some students vastly overestimated the level of American speciesism. Overestimates in the many trillions were common. Although the test question explicitly asked for an estimate of land animals only, estimates in the trillions are more realistic given that the students were likely considering water inhabiting species, and this record-keeping weakness in the official statistic was explained to students during lecture. However, overestimating can also indicate a disconnect from the reality of speciesism if students are guessing large, abstract numbers from of a place of ignorance that is similar to the under-estimators. Due to these exceedingly high guesses, the average response for the entire study was skewed to 328 trillion. The top 10% of responses averaged 2.8 trillion.

While this article has reviewed the socializing impact of corporations and the state that supports them as well as psychological barriers to persuasion, there are additional spurious variables that may have interfered with student comprehension. For instance, no morally shocking images were utilized in the lecture, although some research suggests that images of non-human animal suffering can have a lasting impact on the viewer's memory (Tiplady et al., 2015) and can reduce audience denial mechanisms (Cohen, 2001). Students will also have variances in learning and test-taking capabilities, and many were first-year students still mastering skills necessary for college success. It should also be noted that the acceptance rate at this particular institution is extremely generous, suggesting that many participants may not have the same levels of commitment or educational advantage that would be expected of the average American university student.

Gender was also considered. While students in this study were all exposed to the same information, I was not able to control for the effect that gender socialization has on the interpretation and absorption of data. Research supports that women are more attuned to the suffering of others (Mercadillo et al., 2011), non-human animals included (Herzog et al., 2015). Men, alternatively, have been encouraged to associate flesh consumption with masculinity and are discouraged from empathizing with weaker groups. Information that conflicts with these masculine values would be theoretically less likely to resonate or retain as consistent with confirmation bias. However, gender did not significantly influence responses, although slightly more

of those who severely underestimated were women (Figure 1). An independent t-test could not confirm a significant relationship between gender and guess (Table 1).

Students with higher test scores were, as one might expect, more likely to report an accurate answer. This suggests a correlation between educational commitment, intelligence, and food literacy. The average exam grade for the sample was 75 (a 'C'), which is precisely 'average' by American university standards. Forty-two percent of A-level students answered within a reasonable range, compared to just 25% of B students, 10% of C students, 11% of D students, and 8% of students who failed. The distribution of responses by grade are presented in Figure 2. A-level students,

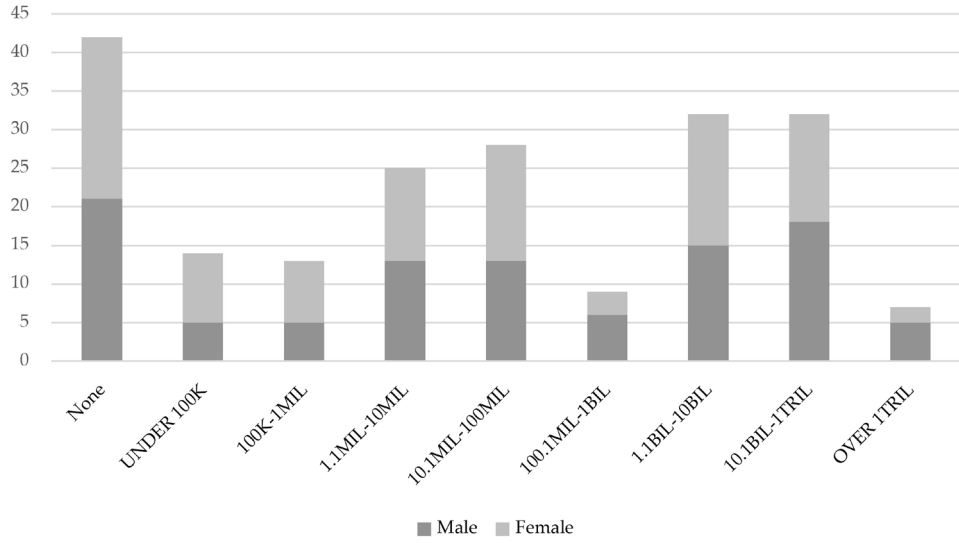

Figure 1. Gender distribution by percentage.

Table 1. Test for relationship between gender and guess (numbers guessed).

a. Group statistics.

Gender	*N*	Mean	Std. deviation	Std. error mean
Male	62	4.04E11	1.757E12	2.231E11
Female	134	1.93E11	1.747E12	1.509E11

b. Independent samples test.

	Levene's test		T-test for equality of means						
	F	*p*	*t*	*df*	2*p**	Mean†	Std. error†	CI‡	
								Lower	Upper
Equal variances assumed	2.220	.138	.786	194	.433	2.112E11	2.688E11	–3.189E11	7.412E11
Equal variances not assumed			.784	118.210	.435	2.112E11	2.693E11	–3.222E11	7.445E11

Notes: * 2-tailed significance; † mean and std. error of difference; ‡ 95% confidence interval of difference.

however, made up only a small portion of the sample. A linear regression analysis rendered an R^2 of just 0.002, such that the student's exam grade only explains 0.2% of their guess (Table 2). This regression also indicated that, for every point an exam

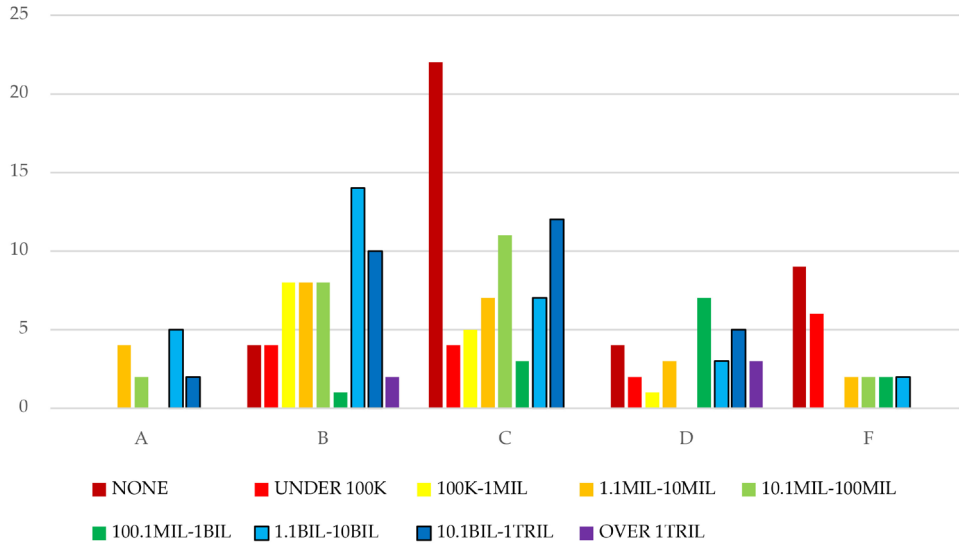

Figure 2. Distribution of student responses.
Note: Scores within a reasonable range (between 1.1 billion and 1 trillion) are shaded in blue and are outlined.

Table 2. Relationship between exam outcome and student response.

a. Model summary.

Model	*R*	R^2	Adjusted R^2	Std. error of the estimate
1	.043*	.002	–.003	1.751E12

b. Anova.†

Model		Sum of squares	*df*	Mean square	*F*	*p*-value
1	Regression	1.083E24	1	1.083E24	.353	.553*
	Residual	5.948E26	194	3.066E24		
	Total	5.959E26	195			

c. Coefficients.†

Model		Unstandardized coefficients		Standardized coefficients	*t*	*p*-value
		β	Std. error	β		
1	(Constant)	7.257E11	7.945E11		.913	.362
	Exam grade	–6.334E9	1.066E10	–.043	–.594	.553

Notes: * predictors: (constant), exam grade; † dependent variable: number guessed.

grade increases, the student's guess decreases by 6.3 billion, but, again this is not significant ($p = .553$).

Cognitive dissonance regarding speciesism and poor instruction might be partly to blame, but student individuality must also be considered. Presumably, students who scored higher were more likely to keep up with assigned readings, attend lecture regularly, and study in advance of exam time, while underestimations can be explained by lower student preparedness. Data overload was also a variable. Some students confused the number of non-humans killed in the United States (10 billion) with the number of those killed globally (65 billion), indicating that the lecture material had been absorbed, but simply confused or partially remembered. That one in five respondents did not even feel confident enough to hazard a guess is also telling. Some of these students may have declined to answer knowing that they could not recollect the exact number from lecture. Some may have skipped the day of lecture. Most of these students were C, D, and F students. No A students failed to answer, and only 7% of the non-responses were associated with B students.

Conclusion

While the dramatic results presented here would be troubling coming from any American demographic, that these results derive from *university students* who have been exposed to lecture material on speciesism in the food system is especially indicative of powerful sociological and psychological barriers to food literacy. University students are expected to have an edge over the general population given that they are trained in critical thinking and are exposed to fundamental concepts of social justice as part of the liberal education provided by most American universities. The results of this study conflict with research that finds food literacy to be positively associated with education. Students are a privileged group, and yet the students in this study remain grossly ignorant of actual killing levels. No control group was utilized in this study, but seeing that so many students estimated non-human animal killing at such low levels, it would be difficult to imagine that students not exposed to the lecture could score much worse. Additional research into the knowledge base of the general public would presumably identify similar, if not poorer, literacy levels. Educators and policymakers must be prepared for diverse audiences and constituents. They must also presume profound ignorance to the truth.

Obviously, most consumers *do* realize that non-human animals must be killed to produce the food that humans eat. Most also have at least a vague understanding that animal agriculture is a stressful, painful and unfair experience for other animals. The results here indicate that awareness of the degree to which this killing takes place is lacking. Complicating this consciousness is the problem that most consumers are not clear on how to link up knowledge and attitudes with the appropriate behaviour (Prunty and Apple, 2013; Cornish et al., 2016). Social movements and educators are fighting to present an alternate view of the social world with the support of scientific evidence, only to be rebuffed by the more powerful forces of social psychology and structural invisibility wielded by industry, state and other agents.

Nonetheless, psychological research does suggest that exposure to a multitude of scientific sources can improve the audience's ability to think critically and acknowledge conflicting information (Stadtler et al., 2013), thus suggesting that greater media and scientific literacy could improve food literacy. Humane educators and policymakers would be advised to explore sustained intervention efforts as opposed

to one-time-only or sporadic techniques. When I debriefed my students after the test and placed their low numbers into context, most students smiled and laughed when they realized how unrealistic their guesses had been. At least for my student respondents, participation in this study may increase their scientific proficiency and put a dent in their dissonance. Additional research on effective strategies of enlightenment and persuasion will be needed to illuminate mechanisms of change and resistance in consumption patterns.

Notes

1. Here the terms referring to sight and vision are intended to be metaphorical in keeping with Pachirat's language; however, this unnecessarily excludes visually impaired persons who also have relationships with non-human animals. For this reason, Cole and Stewart (2014) advocate language of 'sensibility' over 'visibility', particularly as sight is only one way of experiencing other animals.
2. More information on humane education is hosted by the Institute for Humane Education and the Animals and Society Institute.

References

Acampora, R. (2016) Epistemology of ignorance and human privilege, *Animal Studies Journal*, 5(2), pp. 1–20.

Almiron, N. (2016) The political economy behind the oppression of other animals: interest and influence, in: N. Almiron, M. Cole and C. Freeman (eds) *Critical Animal and Media Studies: Communication for Non-human Animal Advocacy*. New York, NY: Routledge, pp. 26–41.

Asher, K., Green, C., Gutbrod, H., Jewell, M., Hale, G. and Bastian, B. (2014) *Study of Current and Former Vegetarians and Vegans*. Olympia, WA: Humane Research Council.

Bray, H.J., Zambrano, S.C., Chur-Hansen, A. and Ankeny, R.A. (2016) Not appropriate dinner table conversation? Talking to children about meat production, *Appetite*, 100, pp. 1–9.

Carr, C., Abrams, K., Velinsky, V., Eubanks, L. and Johnson, D. (2016) Quantifying attitudes and knowledge change toward animal welfare and sustainability of animal agriculture and the safety and healthfulness of muscle foods, *Meat Science*, 112, p. 117.

Cohen, S. (2001) *States of Denial: Knowing about Atrocities and Suffering*. Malden, MA: Polity Press.

Colb, S. (2013) *Mind If I Order the Cheeseburger? And Other Questions People Ask Vegans*. Brooklyn, NY: Lantern Books.

Cole, M. (2011) From 'animal machines' to 'happy meat'? Foucault's ideas of disciplinary and pastoral power applied to 'animal-centred' welfare discourse, *Animals*, 1(1), pp. 83–101.

Cole, M. and Stewart, K. (2014) *Our Children and Other Animals: The Cultural Construction of Human-Animal Relations in Childhood*. New York, NY: Routledge.

Corbett, C., Hill, C. and St. Rose, A. (2013) *Where the Girls Are: The Facts about Gender Equity in Education*. Washington, DC: American Association of University Women.

Cornish, A., Raubenheimer, D. and McGreevy, P. (2016) What we know about the public's level of concern for farm animal welfare in food production in developed countries, *Animals*, 6(11), art. 74.

Corrin, T. and Papadopoulos, A. (2017) Understanding the attitudes and perceptions of vegetarian and plant-based diets to shape future health promotion programs, *Appetite*, 109, pp. 40–47.

Dunayer, J. (2001) *Animal Equality: Language and Liberation*. Derwood, MD: Ryce Publishing.

European Commission (2005) Attitudes of Consumers Towards the Welfare of Farmed Animals, *Eurobarometer*, 229(Wave 63.2). Published online <http://ec.europa.eu/public_opinion/archives/ebs/ebs_229_en.pdf>.

Faunalytics (2016) *Animal Tracker 2016: Contradictions in Public Opinion*. Published online <https://faunalytics.org/animal-tracker-2016-contradictions-in-public-opinion/>.

Flynn, C.P. (2003) A course is a course, of course, of course (unless it's an animals and society course): challenging boundaries in academia, *International Journal of Sociology and Social Policy*, 23(3), pp. 94–108.

Gjerris, M. (2015) Willed blindness: a discussion of our moral shortcomings in relation to animals, *Journal of Agricultural and Environmental Ethics*, 28(3), pp. 517–532.

Harrison, R. (1964) *Animal Machines: The New Factory Farming Industry*. London: Vincent Stuart.

Hazel, S.J., O'Dwyer, L. and Ryan, T. (2015) 'Chickens are a lot smarter than I originally thought': changes in student attitudes to chickens following a chicken training class, *Animals*, 5(3), pp. 821–837.

Hekler, E.B., Gardner, C.D. and Robinson, T.N. (2010) Effects of a college course about food and society on students' eating behaviors, *American Journal of Preventative Medicine*, 38(5), pp. 543–547.

Herzog, H.A. Jr., Betchart, N.S. and Pittman, R.B. (2015) Gender, sex role orientation, and attitudes toward animals, *Anthrozoös*, 4(3), pp. 184–191.

Hormes, J.M., Rozin, P, Green, M.C. and Fincher, K. (2013) Reading a book can change your mind, but only some changes last for a year: food attitude changes in readers of *The Omnivore's Dilemma*, *Frontiers in Psychology*, 4, art. 778.

Hötzel, M.J., Cardoso, C.S., Roslindo, A. and von Keyserlingk, M.A.G. (2017) Citizens' views on the practices of zero-grazing and cow-calf separation in the dairy industry: does providing information increase acceptability?, *Journal of Dairy Science*, 100(5), pp. 4150–4160.

Jenni, K. (2016) Empathy and moral laziness, *Animal Studies Journal*, 5(2), pp. 21–51.

Kunst, J.R. and Hohle, S.M. (2016) Meat eaters by dissociation: how we present, prepare, and talk about meat increases willingness to eat meat by reducing empathy and disgust, *Appetite*, 105, pp. 758–774.

Linné, T. (2016) Tears, connections, action! Teaching critical animal and media studies, in: N. Almiron, M. Cole and C. Freeman (eds) *Critical Animal and Media Studies: Communication for Nonhuman Animal Advocacy*. New York, NY: Routledge, pp. 251–264.

Margolis, R. (2013) Educational differences in healthy behavior changes and adherence among middle-aged Americans, *Journal of Health and Social Behavior*, 54(3), pp. 353–368.

McCartney, P. (2014) *Glass Walls* [Film]. London: People for the Ethical Treatment of Animals. Published online <https://www.youtube.com/watch?time_continue=2&v=JlYMRPwz2NM>.

Meischen, D.L. and Trexler, C.J. (2003) Rural elementary students' understandings of science and agricultural education benchmarks related to meat and livestock, *Journal of Agricultural Education*, 44(1), pp. 43–55.

Mercadillo, R.E., Díaz, J.L., Pasaye, E.H. and Barrios, F.A. (2011) Perception of suffering and compassion experience: brain gender disparities, *Brain and Cognition*, 76(1), pp. 5–14.

Nibert, D. (2003) Humans and other animals: sociology's moral and intellectual challenge, *International Journal of Sociology and Social Policy*, 23(3), pp. 4–25.

Nickerson, R.S. (1998) Confirmation bias: a ubiquitous phenomenon in many guises, *Review of General Psychology*, 2(2), pp. 175–220.

Pachirat, T. (2012) *Every Twelve Seconds: Industrialized Slaughter and the Politics of Sight*. New Haven, CT: Yale University Press.

Pohjolainen, P., Tapio, P., Vinnari, M., Jokinen, P. and Räsänen, P. (2016) Consumer consciousness on meat and the environment: exploring differences, *Appetite*, 101, pp. 37–45.

Pollan, M. (2006) *The Omnivore's Dilemma: A Natural History of Four Meals*. London: Bloomsbury Publishing.

Pribac, T.B. (2016) Someone not something: dismantling the prejudicial barrier in knowing animals (and the grief which follows), *Animal Studies Journal*, 5(2), pp. 52–77.

Prunty, J. and Apple, K.J. (2013) Painfully aware: the effects of dissonance on attitudes toward factory farming, *Anthrozoös*, 26(2), pp. 265–278.

Ronto, R., Ball, L., Pendergast, D. and Harris, N. (2016) Adolescents' perspectives on food literacy and its impact on their dietary behaviors, *Appetite*, 107, pp. 549–557.

Sayer, K. (2013) Animal Machines: the public response to intensification in Great Britain, c.1960–c.1973, *Agricultural History*, 87(4), pp. 473–501.

Schlosser, E. (2001) *Fast Food Nation: The Dark Side of the All-American Meal*. New York, NY: Houghton Mifflin.

Scrimshaw, N.S. and Murray, E.B. (1988) The acceptability of milk and milk products in populations with a high prevalence of lactose intolerance, *American Journal of Clinical Nutrition*, 48(4), pp. 1142–1159.

Shi, J., Visschers, V.H.M., Bumann, N. and Siegrist, M. (2016) Consumers' climate-impact estimations of different food products, *Journal of Cleaner Production*, 172, pp. 1646–1653.

Shprintzen, A. (2015) *The Vegetarian Crusade: The Rise of an American Reform Movement, 1817–1921*. Chapel Hill, NC: University of North Carolina Press.

Sinclair, U. (1906) *The Jungle*. New York: Doubleday, Page.

Stadtler, M., Scharrer, L., Brummernhenrich, B. and Bromme, R. (2013) Dealing with uncertainty: readers' memory for and use of conflicting information from science texts as function of presentation format and source expertise, *Cognition and Instruction*, 31(2), pp. 130–150.

Stahler, C. (2015) How often do Americans eat vegetarian meals? And how many adults in the U.S. are vegetarian?, *The Vegetarian Resource Group* [blog], 29 May. Published online <http://www.vrg.org/blog/2015/05/29/how-often-do-americans-eat-vegetarian-meals-and-how-many-adults-in-the-u-s-are-vegetarian-2/#sthash.rPItyepl.dpuf>.

Tiplady, C.M., Walsh, D.B. and Phillips, C.J.C. (2015) Ethical issues concerning the public viewing of media broadcasts of animal cruelty, *Journal of Agricultural and Environmental Ethics*, 28(4), pp. 635–645.

Tsartsali, P.K., Thompson, J.L. and Jago, R. (2009) Increased knowledge predicts greater adherence to the Mediterranean diet in green adolescents, *Public Health Nutrition*, 12(2), pp. 208–213.

Staklis, S. (2010) *Web Tables: Profile of Undergraduate Students 2007–08*, NCES 2010-205. Washington, DC: U.S. Department of Eduction. Published online <https://nces.ed.gov/pubs2010/2010205.pdf>.

Vinnari, M., Montonen, J., Härkänen, T. and Männistö, S. (2009) Identifying vegetarians and their food consumption according to self-identification and operationalized definition in Finland, *Public Health Nutrition*, 12(4), pp. 481–488.

Yen, S.T., Lin, B.-H. and Davis, C.G. (2008) Consumer knowledge and meat consumption at home and away from home, *Food Policy*, 33(6), pp. 631–639.