

## Interrogating boundaries against animals and machines: Human speciesism in British newspapers

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### ABSTRACT

Humans favor and venerate their ingroups, while disregarding outgroups to the degree of dehumanizing them. We explore the social construction of such boundaries and its associated speciesism toward two nonhuman outgroups: animals and machines. For this, we analyzed UK newspaper coverages of the binaries *Human–Animal* and *Human–Machine* between 1995 and 2010. We quantified if and how tolerance toward ambiguous concepts that challenge and expand definitions of humanness (e.g., nonhuman primates, cyborgs) varied across time as well as with journalist gender, political leaning, and expertise. In this analysis, the ca. 1100 individual journalists stood as proxies for the British public and therefore as a human-ingroup subset. We found more tolerance toward intermediaries in broadsheet newspapers, females, and subject experts, as opposed to tabloids, males, and subject novices. Moreover, ambiguity tolerance hit a low during the year 2000, likely due to Western sociopolitical turbulence—potentially including wider societal stress over the landmark millennium year itself—attesting that ingroups become more closed during stressful times. Compared with the plasticity of the *Human–Animal* dichotomy, the *Human–Machine* binary was more rigid, indicating that the relative novelty of IT developments triggers increased caution and anxiety. Our research suggests that cognitive mechanisms facilitating human-ingroup protection are deep-rooted, albeit malleable according to changing socioeconomic conditions.

### Keywords

Ingroup, outgroup, bias, prejudice, binary, essentialism, ambiguity tolerance, Human–Animal studies, primatology, cyborg, Human–Machine studies, speciesism, human–computer interaction, AI

The checkered history of human behavior toward conspecifics is replete with empathy, kindness, and cooperation (Decety et al. 2016), but also assault, slavery, murder and genocide (Gil-White 2001). These poles of connection versus ostracism are often exemplified by the binary of ingroup versus outgroup in that humans identify with certain modes of “we-ness” (*entitativity*; Lickel et al. 2000) against “otherness” (*alterity*; Taussig 1993).

Psychologically, this binary rests on stereotypes that perceive social groups as *natural kinds* (Gelman 2003: 14) that possess seemingly unchangeable “birth” qualities (Ross 1951; Fuss

1989). The associated *essentialism* is nourished by the belief that groups have sets of fixed characteristics that make them what they are. It results in nonoverlapping classifications of “us” vs. “them” with rigid boundaries (Maybury-Lewis and Almagor 1989).

To outgroups, we ascribe lower status and reduced intellectual abilities (Aosved, Long, and Voller 2009; Bain et al. 2009), while our own group is cleverer, more genuine, more sympathetic, etc. (Leyens et al. 2001; Cortes et al. 2005). The dichotomy is negotiated and maintained through the psychological process of *infracumanization* that perceives the outgroup as less humanized than one's ingroup (Leyens et al. 2000, 2001; cf. Seshadri 2012). Dehumanizing allows us to deny personhood to others, to *depersonalize* them, making it easier to exploit and, in the extreme, kill conspecifics (Fiske and Rai 2015; Rai, Valdesolo, and Graham 2017). Infracumanization increases when ingroups feel under threat in terms of the status and resources of their social and physical territories (Morton et al. 2009; Hackel, Looser, and Van Bavel 2014).

The concept of enhanced ingroup humanity compared with lesser outgroup humanity makes it possible to objectify other humans by employing dehumanizing metaphors, such as that they are “just animals” or “mere machine.” The animal metaphor signifies the “subhuman” boundary guarding ingroup identity (Haslam 2006), while the machine metaphor guards the “nonliving” boundary.

This kind of discrimination can be subsumed under the term *speciesism*, a term coined by Richard Ryder in 1970 (Waldau 2001, 5, 23–29; cf. Singer 1975), because of the assumption that the human species is superior, set apart by certain privileges as a birthright.

Two narratives may illustrate such boundary constructions. The first refers to the subhuman partition: “‘The first time, you still have a conscience and feel bad,’ says Yoshio Tsuchiya, a former member of the Japanese secret military police, who remembers using Chinese captives for bayonet practice... ‘If I thought of them as human beings, I could never have done it. But because I thought of them as animals, I did it’” (reported in the UK newspaper *Daily Mail*, 16 November 2000). The second refers to the nonliving, automaton partition. As an example, an alleged attempt of requiring employees “having to wear electronic tracking equipment so that their work could be monitored” was criticized by a union representative as reducing the workers to a subhuman state: “We will not stand idly by to see our members reduced to robots” (reported in same newspaper, 7 June 2005).

An interesting mechanism is referred to as the “uncanny valley” effect, whereby humans react particularly strongly to machines that are *too* humanlike and yet somehow uncannily not human (Mori 1970/2012). Consequently, the more human-formed androids are less liked than other forms of robots (Mathura and Reichling 2016). As for animals, a similar reaction is triggered when humans encounter nonhuman primates, such as monkeys, which, along with “animal,” are favorite generic terms to disparage and dehumanize (Bell and Naas 2015). But why would we react most to adjacent categories rather than faraway ones? Perhaps infracumanization is rooted in relatively hard-wired desires to protect our environmental niche most from those “almost” like us, because those will compete for the same resources (Gil-White 2001). Indeed, natural selection acts most strongly on individuals under identical ecological constraints (Darwin 1859). Amplified aversion toward those that

embody gradualist states between “us” and “other” is therefore not surprising, be they great apes or cyborgs, not least because both are considered to be gifted with humanlike intelligence. Encounters with such hybrids of two natural-kind “essences” carry a corresponding cognitive load (Hammack 2005).

Yet, as history moves on, the boundaries separating us from the classic outgroups animals and machines have shifted and are constantly shifting (cf. Bryson 2017; Sorgner 2019; Thompson 2019). Evolutionary sciences demonstrate more and more that “differences [are] of degree, not of kind” (Darwin 1871: 35), whether in genetic or cognitive landscapes. Simultaneously, rapid progress in information technology renders it increasingly difficult to tell artificial intelligence apart from human brainpower. In this line, Welsch (2017), for example, argues that posthuman studies would do well to incorporate evolutionary anthropology into its conceptual frameworks.

Contemporary humans, particularly in Western societies, are thus increasingly challenged to reconsider their speciesism and boundary constructions and instead consider greater inclusivity. Some of us cope better with this challenge than others. The ability not to think in black and white, but instead accommodate “fuzzy” states, has been termed *ambiguity tolerance* (Frenkel-Brunswick 1948). It indicates the capacity to hold oppositional viewpoints and one’s comfort with such equivocation. Thus, while ambiguity intolerance is “the tendency to perceive (i.e. interpret) ambiguous situations as sources of threat,” tolerance of ambiguity is “the tendency to perceive ambiguous situations as desirable” (Budner 1962: 29). Accordingly, ambiguity intolerance might result from essentializing thought patterns. If concepts are perceived as either/or, black-or-white with no middle ground or intermediaries—for example, either animal *or* human; either machine *or* human—then comfort levels with “gray area thinking” will be reduced. Conversely, people with high ambiguity tolerance have been shown to be more open to novel experiences (Furnham and Marks 2013), which also implies more cognitive flexibility—and therefore less reliance on essentialized states.

The investigation presented here is part of a larger project that explores if and how polarized thought patterns and corresponding classifications are protected or made malleable. It thus complements earlier work on infrahumanization (Cortes et al. 2005), dehumanization (Harris and Fiske, 2008), essentialism (Gelman 2003; Haslam 2006) and speciesism (Gil-White 2001; Bastian et al. 2012; Dhont, Hodson, and Leite 2016; Caviola, Everett, and Faber 2019). Specifically, our research explores the dynamics of ambiguity tolerance with respect to “intermediary” concepts of humanity/nonhumanity that seemingly violate the essentialist stance. By analyzing UK newspaper coverage over a 16-year period (1995–2010), we focus on a specific cultural context of intermediary concepts that question the traditionally rigid *Human–Machine* and *Human–Animal* binaries and undertake a novel comparison. We reason that journalist opinions will reflect the social construction of categories and underlying socioeconomic conditions (Miljan and Cooper 2003), as well as revealing potential changes to such sentiments. Our sample includes close to 2000 newspaper articles written between 1995 and 2010 (details in *Methods*; cf. Bryson, Soligo, and Sommer, 2019). The selected newspapers include more “serious” *broadsheets* as well as more “sensationalist” *tabloids*, which can also be grouped as politically more *conservative* or more *liberal* outlets. The at least 1081 individual journalists who wrote the pieces include both

males and females, as well as experts and relative novices to the covered subject area. However, it is important to note that this article is not a “media studies” analysis. Instead, given that journalists do not operate in a cultural vacuum (Fowler 1991; Miljan and Cooper 2003), they stand as proxies for the British public and function as a human-ingroup subset. This assertion is supported by a 2017 analysis of 150 years of trends in UK periodicals (Lansdall-Welfare et al. 2017). Moreover, there are intra-cultural effects between the United Kingdom and the United States, and therefore what would seem at first to be more parochial sociopolitical events (for example, 9/11) would affect both (Chadha and Kavoori, 2000; Lindoso 2012; Sznycer et al., 2012; Foster, 2014).

We digitally mined our newspaper pool for articles that referred to *Human–Animal* (HA) or *Human–Machine* (HM) intermediaries. Once our sample was in place, we classified the writings as to whether the journalists’ sentiment toward the intermediate states came across as *positive*, *negative*, *neutral*, or *mixed*. For example, in terms of the HA dichotomy, a 1995 article referred to an enmeshment via xenotransplantation as *positive* by describing a pig that “carries a human gene in her immune system which means her heart could one day be successfully transplanted into a human.” A classification as *negative* is found in this 2005 article: “Uncharitable chimps: It seems that chimpanzees and humans are different from each other in one important respect: chimps don't give a monkey's about their friends.” In terms of the HM dichotomy, a *positive* reference to computers replacing human beings is exemplified in this 1995 article: “Another advantage is that the computer picks truly random sets of numbers—something experts say humans are incapable of doing.” A year 2000 article embodies a *negative* assessment of computer replacements: “Some may think that the goggle box is already filled with two-dimensional characters bereft of personality, but this trend for artificial humans goes beyond TV... In the manufactured world of pop, such creations might seem burdened with a little too much character, but nevertheless they're busy colonising there too.” Our aim was to quantify the resilience or plasticity of the common binaries HA and HM in relation to a set of variables encompassed by our newspaper sample. We measured the degree of ambiguity tolerance (AT) with respect to several sets of predictors.

*i. Temporality.* Our sample years (1995, 2000, 2005, 2010) cover a millennium change along with economic turmoil and a post-Cold-War shift of Western politics to the right, as well as the September 11 events and ensuing military conflict. Given that turbulent times are likely associated with reduced AT (Furnham and Ribchester 1995; Biernat, Kobryniewicz, and Weber 2003; Haslam 2006), we therefore predict a year-2000 dip in AT for both dichotomies.

*ii. Newspaper format.* Those with access to more information likely display more AT (Rosch et al. 1976; Tanaka and Taylor 1991). We therefore expect less binary determinism in broadsheet articles, which are considered serious and well-researched, than in sensationalist and information-impooverished tabloids (Sparks and Tulloch 2000).

*iii. Newspaper political leaning.* Liberals (aka left-wingers) have been found to be more ambiguity-tolerant than conservatives, who think more in stereotypes (Kanai et al. 2011; Mooney 2012; Thorisdottir and Jost 2011). We predict this to be mirrored in articles about HA and HM dichotomies.

iv. *Journalist gender*. The literature about levels of AT in women versus men is ambivalent (Erten and Topkaya 2009; Weissenstein et al. 2014). Therefore, it is difficult to make predictions in regards to this particular variable when applied to HA and HM intermediaries. Still, there is some evidence that more powerful individuals (here, men) resort to increasingly essentialist reasoning during social change (Morton et al. 2009).

v. *Journalist expertise*. Sampled articles were often written by scientists or oft-quoted pundits in the fields of evolutionary studies and biology or, similarly, in artificial intelligence and computing, while others were by relative novices. Some research suggests that experts display more AT (Bobo and Licari 1989). Similarly to broadsheet versus tabloid, we therefore expect increased AT with less HA and HM essentialism from the more “educated” experts than from relatively naïve novices.

## Methods

### *Sampling newspaper articles*

We measured the rigidity of the dichotomies *Human–Animal* (HA) and *Human–Machine* (HM) via UK newspaper reports. A substantial part of our investigation concerns categorical boundaries related to science, including biology and computer research. This explains our UK focus, because (i) British newspapers regularly report on new scientific findings and (ii) English is the native language of the first author, KB, a dual UK/US citizen, who can detect linguistic, political, and social subtleties reflected in the article pools.

Our sample includes 1728 newspaper articles written by 1081 individual journalists during four years, 1995, 2000, 2005, and 2010. We reasoned that zooming in on individual years separated by 5-year gaps—established practice in social science longitudinal studies (Ruspini 2000)—would reveal both shifts and stasis in the categorical boundaries as these are sensitive to societal narratives (Abercrombie 1996). This explains our selection from 1995, because the period saw the gear-up to (i) a millennial turnover with its anticipatory hype in the wider arena of doomsday cults and expectations of sudden change (akin to medieval chiliasm: Jenkins 2000); (ii) the astronomical growth of the Internet (relevant in particular to the HM dichotomy); (iii) a unique scientific time marker, the draft-sequencing of the human genome in the year 2000 (relevant in particular to the HA dichotomy); (iv) geopolitical upheavals brought about by a post-Cold-War shift of Western politics to the right, reinforced by the September 2001 attacks and the ensuing military and economic conflicts. Our analyses follow a repeated cross-sectional respectively pseudo-longitudinal design, resting on six different newspaper groups, which can be evenly divided between tabloids and broadsheets as well as between outlets considered liberal and conservative:

i. *Daily Mail/Mail on Sunday* = CT-M (conservative tabloid “Mail”);

ii. *Sun/Evening Standard/News of the World* = CT-E (conservative tabloid “Evening”);

iii. *Daily Mirror/Sunday Mirror* = LT-D (liberal tabloid “Daily”);

iv. *Guardian/Observer* = LB-G (liberal broadsheet “Guardian”);

v. *Independent/Independent on Sunday* = LB-I (liberal broadsheet “Independent”);

vi. *Times/Sunday Times* = CB-T (conservative broadsheet “Times”).

In terms of political leanings, CT-M, CT-E, and CB-T is the order from more to less conservative (broadly akin to right-wing) newspapers, whereas LB-G, LT-D and LB-I is the order from more to less liberal (broadly akin to left-wing) newspapers (British Broadcasting Corporation 2009).

The research necessitated searching for keywords within a vast array of text. This was only possible starting in 1995, the earliest digital archival year of the selected newspapers enabled by *NexisUK*, the UK-centered branch of *LexisNexis*—at the time the world’s largest private electronic database (*Nexis.com*, 2011–2016).

We identified articles where ambiguity was already present with respect to the HA and HM dichotomies by mining the *NexisUK* digital pool for relevant keywords while employing a Boolean search string (dates of collection: 14 May 2011–1 October 2012, with some substitutions made until 22–23 December 2013). (i) For the HA dichotomy, we searched for articles that mentioned “apes” OR “primates” OR “monkeys” AND “humans,” asking whether humans were perceived as animals of these kinds. (ii) For the HM dichotomy, we searched for articles that contained “machine” AND “human”; “virtual reality” AND “human”; “robot” AND “human”; “computer” AND “human”; “Internet” AND “human”; “digital animation” AND “human”; “gaming” AND “human”; “World Wide Web” AND “human”; those articles that used “prosthetic” OR “half human” OR “half man” OR “half woman” OR “half machine” in the same sentence as “human”; and articles that merely contained the words “cyborg” or “cybernetic” or “bionic man” or “bionic woman.”

Using the above lists of so-called *intermediaries*, we read through the articles returned by *NexisUK*, looking for potential ambiguous connotations. We then sampled the first three articles in terms of date, month by month for all 12 months of each year, from each newspaper group in the data pool. In about 15% of the sample, substitutions were necessary, mostly because (i) the digital archive had gaps or (ii) not enough samples for a particular month were available. If the latter applied, articles up to two months following were sourced, followed by two months previous, followed by either an extra “tabloid” or an extra “broadsheet” from a different publication. For early 1995, it was necessary in rare cases to go as far back or forward as six months. Our final set encompasses 1748 articles (6 [newspapers] × 3 [first entries] × 12 [months] × 4 [5-year periods: 1995, 2000, 2005, 2010]) for each dichotomy.

#### *Coding sentiment toward ambiguity: negative, positive, mixed, neutral*

For HA, intermediaries included publications where humans were explicitly or implicitly considered to be animals, such as humans-are-animals, humans-are-mammals, humans-are-primates, humans-are-monkeys, human-are-apes—plus the more general humans-are-organisms. Intermediaries also went in the other direction, for example, primates-are-humans, animals-are-humans. Intermediaries also included hybrid states such as chimerism and xenotransplantation as well as metaphorical “interanimalistic” equalizations (Merleau-Ponty 1968) of humans-as-animals (zoomorphism) or animals-as-humans (anthropomorphism).

For HM, intermediaries typically included explicitly or implicitly a both-ways concept of enmeshment, such as machine-into-human (tiny submarines in arteries, human biotechnology and nanotechnology) and human-into-machine (virtual reality; interactive Internet experiences). Intermediaries also included hybrid states such as cyborgs, prosthetics, and bionicity, as well as metaphorical equalization of humans-as-machines or machines-as-humans and reference to robots replacing humans, suggesting interchangeability.

Once our pool of intermediaries was in place, we classified the writings as to whether the journalists' authorial sentiment toward the intermediate states came across as positive, negative, neutral, or mixed. "Positive" meant that a writer approved of the featured intermediary, while "negative" indicated disapproval or denunciation. The "mixed" and "neutral" codes enabled us to operate in a less binary/essentializing manner. Importantly, we were *not* coding negative attitudes toward animals/machines/humans themselves. Thus, an article could very well be pro-animal or pro-machine or pro-human, and yet negative regarding intermediary states. Instead, we aimed to assess the degree of boundary control regarding liminality and thus a wider human ingroup protection.

The following examples provide illustrations for each of these classifications in terms of the HA and HM intermediaries (for paper acronyms, see above).

*Human–animal* coding examples:

*Classification: negative.* Paper: LT-D/Date: 29 June 1995/Author: Gill Pringle (female)/Expert–Novice: Unknown/Intermediary: humans are animals/Article text: "Deep in the African jungle, the party stumble on the lost city of Zinj which is guarded by gorillas—and suddenly the humans realise it is they who have become an endangered species."-Remark: Article implicitly refers to extinction fears of human ingroup.

*Classification: positive.* Paper: CT-M/Date: 2 October 2005/Author: Philip Hensher/Expert–Novice: Novice/Intermediary: intermediaries via evolution; equalization/Article text: "The image on each is of a monkey... Slowly, a unique and noble beauty starts to impress itself... A painting that alludes to the Last Supper using monkeys might seem... offensive. But Ofili's intentions are more subtle, in fact he seems to be a devoutly religious man. The monkeys are rhesus monkeys, very close to human beings, and through them Ofili may dramatise the animal nature of the flesh."-Remark: Equalizing via evolution (implied), and strongly positive in context.

*Classification: mixed.* Paper: CB-T/Date: 9 October 2010/Author: Giles Coren (male)/Expert–Novice: Novice/Intermediary: intermediaries via evolution; equalization; anthropomorphism/Article text: "You damn fool, Charlie. Smoking isn't cool. Wheezing and coughing in his cage, nicotine patches hanging off his fur... yes, only an ape would take up fags... The funny thing when you look at pictures of Charlie chugging a snout... is that you find yourself looking at two very different outdated phenomena—on the one hand a smoker, and on the other hand a wild animal trained to demean itself for the amusement of humans."-Remark: A mixed response in that there is a disavowal of the equalized behavior, yet protection of the equalized chimpanzee–human intermediary.

*Classification: neutral.* Paper: CT-E/Date: 7 April 2010/Author: Unknown (gender unknown)/Expert–Novice: Unknown/Intermediary: equalization/ Article text: "They [zoo workers] also believe [gorilla] Yeboah may have got Mjukuu, the youngest female, pregnant

before he died, and have been administering human pregnancy tests to find out.”/Remark: Equivalization via female gorillas receiving human pregnancy tests, neutrally presented.

*Human-machine coding examples:*

*Classification: negative.* Paper: L-BI/Date: 3 April 2005/Author: Janet Street-Porter (female)/Expert–Novice: Novice/Intermediary: human enmeshment; replacement/ Article text: “This week, Adidas unveiled an ‘intelligent’ running shoe . . . this must-have footwear contains a ‘brain’ which reads the terrain you run on and adjusts the cushioning accordingly... why learn to read a map when a robot can do it for you?... it is easy to see how gorgeous gadgetry and intelligent shoes have replaced the need to read letters, menus, bills and newspapers.”-Remark: Negative human-enmeshment and replacement intermediary associations in larger-article contexts.

*Classification: positive.* Paper: LT-D/Date: 12 February 2010/Author: David Edwards (male)/Expert–Novice: Novice/Intermediary: robots, cyborgs/Article text: “ASTRO BOY... Passable animation about an android called upon to defeat an evil robot. Great for kids.”- Remark: Positive—while the fully machine robot is “evil,” the intermediary has positive qualities; androids are specifically name-checked.

*Classification: mixed.* Paper: LT-D/Date: 24 September 1995/Author: Malcolm Bradbury (male)/Expert–Novice: Expert/Intermediary: machine-enmeshment; virtual reality; replacement/Article text: “By 2020, we could be on the sunlit uplands of a great leisure revolution, freed from most manual and domestic work by technological breakthroughs. Machines won’t just do most of the work; they’ll generate the economic energy, too... Meantime, cities will be vast, the world population exploding. They’ll be high-tech, multi-cultural and probably much more dangerous places, if the world of rich and poor continues to split.”- Remark: Classified as “mixed” response toward mentioned intermediaries: humans could be doing well in the future, though that same future could be “dangerous.”

*Classification: neutral.* Paper: LB-I/Date: 1 November 2005/Author: Karla Adam (female)/Expert–Novice: Novice/Intermediary: humans as machines/ Article text: “Japan is renowned for its hi-tech gadgets but it has crossed a new frontier with the prospect of remotely controlling humans... A headset that can move people from left to right at the flick of a joystick... [A] reporter who tried out the headset at NTT’s research centre in Japan said he found the experience ‘unnerving and exhausting’ and likened it to being drunk. It felt like an ‘invisible hand’ reaching inside the brain, he added. The technology builds on similar research by the Cyberkinetics company, which helps paralysed patients play video games through the electrical currents created by thoughts.”-Remark: Neutral treatment of humans-as-machines intermediaries, despite connotations of control of humans; lack of free will.

Classification rules:

We divided article authors into additional binomial categories: *male* versus *female* and *expert* versus *novice*. The first referred to whether the journalist’s background was that of a scientist or researcher (e.g., in evolutionary or computer sciences) or an oft-quoted pundit regarding the relevant wider topic (e.g., “animal rights activist Damien Aspinall”). In a few cases, articles were written by author teams of both males and females or both novices and experts or it was not possible to identify gender or expertise reliably. Those articles were



excluded from the corresponding descriptive statistics and coded as missing data in the regressions.

In regard to HA classification in general British folk taxonomy, the word “ape” in a newspaper article generally is intended to mean “great apes excluding humans,” and the word “primate” often means “monkeys and nonhuman apes” (with apes additionally often miscategorized as monkeys). Similarly, “animal” usually implies “all organic nonhuman, nonplant, nonfungal, nonbacterial life.”

For HM classifications, we did not specifically search for the intermediary “android” (which resembles a human), although it would have likely been picked up via the term “cyborg” (part human and part machine). Also, we noted that “biotechnology,” “bioinformatics,” “human cloning,” “cyberspace,” and several other potentially relevant terms appeared via other searches. Conversely, the mere mention of the search-word “Internet,” “World Wide Web,” or “computer” was not enough to consider it as an intermediary, unless the article mentioned interface or connectivity (e.g., a human “wired in” to the Internet; computers representing embodiment, enmeshment, or human agency).

Articles with obvious *pop culture* terms were not coded (e.g., the musical group “New York’s Secret Machines,” the group GLC’s single “Half Man Half Machine,” or the James Brown song “Sex Machine”) unless they specifically thematized intermediaries.

Potential biases:

Our samples are permeated by a systematic bias because the default framework of popular newspaper reporting is anthropocentric with regard to both the HA and HM alterities. This means that articles typically will simply *assume* the human pole of the dichotomy, without spelling this out. For example, the term “human” will often only come up as a “normal” alterity whenever animality is discussed—it is the pole of the dichotomy that, at least implicitly, is viewed as a veering off that needs explanation. Therefore, our coding of ambiguity often starts from a standpoint that is pejorative (or at least “othering”) toward all animal and machine categories. However, this bias is systematic, and while it might affect absolute scores, it will not distort the direction of longitudinal trends or cross-sectional comparisons.

By the same token, all articles were classified subjectively by the lead author (KB). Again, since the temporal changes and weights of specific variables were measured rather than a sum total, as long as her own biases remained constant, the results too would remain robust. To ascertain a consistent level of subjectivity, the classification exercise was repeated two years after the initial 2012/2013 codings for 100 masked sampled articles randomly selected across all four years (1995, 2000, 2005, 2010; Bryson 2017). The rate of variation in repeat classification was low, at 0.04, meaning that biases, if any, remained consistent through time.

Our statistical treatment assumes independence of observations, which introduces a small risk of increased Type 1 error. This is due to the fact that we did not aim to limit journalists to one article each, for three reasons. (i) Opinion pieces are particularly good sources of

information, but their authors are at times anonymous. (ii) The 1728 (864 per dichotomy) sampled pieces were written by at least 1081 different named journalists (while 24.2%, i.e.,  $N = 262$ , had anonymous authors). This ratio of about 1.5 HA and 1.2 HM articles per named journalist is reasonably close to one piece per journalist. The extreme outlier was a single science editor with 32 articles in the HA dichotomy—albeit this amounts to only a fraction (3.7%) of the total 864 articles. (iii) Articles by repeat authors may cover the entire 16 years of investigation, during which period the writers may well have shifted their sentiments toward ambiguous states.

### *Analysis and statistics*

The resulting classifications were analyzed both *longitudinally* (across 1995–2010) and *cross-sectionally* (for all years). For this purpose, we broke up the article sample into several other, often binary, batches to explore potential influences on the degree of displayed ambiguity: *temporality* (year), *political leaning* (conservative vs. liberal), *format* (tabloid vs. broadsheet), *journalist gender* (male vs. female), *journalist expertise* (expert vs. novice).

*Descriptive statistics* were our first analytical step. Here, we did not control for potential distortions caused by potential linear relationships between explanatory variables, such as the bias that two of three tabloids are politically conservative, while two of three broadsheets are politically liberal.

In addition, *multinomial logistic regressions* were conducted with and without inclusion of the dichotomies as predictor variables in order to generate the best overall models and to establish the nature of differential responses to each dichotomy separately. For these regressions, we identified the *minimum adequate model* (MAM—the most informative model that explains as much variation as possible with the smallest number of predictor variables), based on the Akaike information criterion (AIC). The AIC is a likelihood value penalized for the number of variables in a model:  $AIC = 2k - 2 \ln(\hat{L})$ , where  $k$  is the number of estimated parameters in the model and  $\hat{L}$  is the maximum likelihood value. The MAM is derived by eliminating, one by one, variables that do not contribute significantly to the model, as long as their elimination does not result in a higher AIC value. In addition, each set of analyses was repeated twice, once with each of two strategies for categorizing publications (*newspaper group*; *political leaning and format*), due to collinearity between the two types of categorization. Once a MAM was established, the baseline categories for multinomial variables were altered to allow for a more in depth exploration of the specific effects within the models.

Analyses were conducted in R Version 3.0.3 (R Core Team 2014). Multinomial logistic regressions were done with the package “nnet” Version 7.3-9 (Venables and Ripley 2015). Significance thresholds were set to 0.05 (\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ ).

## **Results**

We classified the degree of ambiguity tolerance (AT) as displayed in articles published in UK newspapers (detailed in *Methods*). For this purpose, we focused on ambiguous reporting

toward the dichotomies *Human–Animal* (HA) and *Human–Machine* (HA) for a sample of 1728 articles (864 per dichotomy) published between 1995 and 2010. We analyzed the proportions of AT classification (negative/positive/mixed/neutral) in relation to various predictor variables. At first, we employed descriptive statistics (Figure 1, Table 1), followed by multinomial logistic regressions that included full models and minimum adequate models (Tables 2–7).

### *Trends according to descriptive statistics*

The four classificatory scores (negative, positive, mixed, neutral) fluctuate in a regular pattern over the four years, and most of these variations are statistically significant (Figure 1). Thus, across both dichotomies and for all five variables (*all papers, liberal papers, conservative papers, broadsheets, tabloids*) we invariably observe an increase of negative classifications from 1995 to 2000, with a corresponding decrease in positive classifications. In fact, the year 2000 always represents the highest negative and the lowest positive classifications. Moreover, the peak in negative classifications always declines again toward 2005, with almost always a further reduction till 2010. Correspondingly, the 2000 low of positive classifications is always followed by a recovery toward 2005 and almost always by a further increase toward 2010.

A closer look at the raw proportions of AT classifications detail the underlying dynamics further (Table 1). Thus, journalist attitudes across the 16-year period resulted, for HA, in 37.8% positive classifications alongside 18.6% negative, resp. 28.4% mixed and 15.2% neutral; and, for HM, in 34.7% positive, 32.5% negative, 19.4% mixed, and 13.3% neutral. Thus, in more than half to two-thirds of the pieces (HA: 56.4%; HM: 67.2%), the journalist took a distinct negative or positive stance.

As detailed in the following, the data segment on positive versus negative classifications confirms our predictions for 19 out of 20 comparisons of AT scores. *Temporality.* During the millennial year 2000 with its associated psychological uncertainty, positive scores dipped to their lowest level (HA: 30.1%; HM: 27.3%) while negative scores peaked (HM: 25.9%; HM: 38.4%). As a result, while in 1995, positive scores outnumbered negative (for HA by 20.8%, for HM by 6.5%), this preponderance was greatly diminished (for HA to 4.2%) or reversed (for HM, to -11.1%).

*Newspaper format.* In the more information-rich broadsheets, positive scores outnumbered negative (for HA by 20.6%, for HM by 5.6%). In the more sensationalist tabloids, this preponderance was diminished (for HA to 17.8%) or reversed (for HM, to -1.2%).

*Newspaper political leaning.* In liberal papers, positive scores outnumbered negative (for HA by 18.4%, for HM by 4.3%). Our prediction of diminished AT in conservative papers was only confirmed by a somewhat lower positive preponderance for HM (0.2%), but for HA, positive preponderance was actually slightly higher (19.8%).

*Journalist gender.* Our prediction was confirmed in that female journalists had higher positive scores (for HA by 23.0%, for HM by 4.1%) than male journalists (for HA by 14.6%, for HM by -2.3%).

*Journalist expertise.* Our prediction was confirmed in that experts had higher positive scores (for HA by 30.7%, for HM by 25.0%), which in novices were greatly reduced (for HA to 10.6%) or reversed (for HM by -5.9%).

### *Multinomial logistic regressions*

When *both dichotomies* were included as predictor variables, with newspapers categorized according to *political leaning* and *format*, the minimum adequate model (MAM) reduced to include *dichotomy, format, year, gender, and expertise* as predictor variables (Table 2). When newspapers were categorized according to *publishing group*, the MAM reduced to *dichotomy, year, gender, and expertise* (Table 3). As the former has a marginally lower AIC value than the latter, this is the overall preferred model. The main implications from the model are as follows. Ambiguity toward the HM dichotomy solicited more negative and less mixed reporting than ambiguity toward the HA dichotomy. Tabloids are generally less likely to respond neutrally to ambiguity, with a shift that is somewhat more pronounced toward negative reporting than toward mixed or positive. This effect is driven primarily by the *conservative tabloids*, as can be seen in the full model by *publishing group*. In terms of *temporality*, the years 2000 and 2010 in particular saw a shift away from neutral reporting compared to 1995, and there was a shift to more positive reporting between 2000 and 2005. In terms of *gender*, male writers are more likely to report mixed or negative views than female journalists. Finally, *experts* are less likely to respond negatively to ambiguity than nonexperts.

When the HA *dichotomy* was analyzed separately, the MAM reduced to include *format, gender, and expertise* as predictor variables when newspapers were categorized according to *political leaning* and *format* (Table 4), and to *gender* and *expertise* when newspapers were categorized according to *publishing group* (Table 5). As the former has a marginally lower AIC value than the latter, this is the overall preferred model. The implications are similar to those of the model including both dichotomies as predictors, except that *year* of publication no longer contributes to the preferred model. *Tabloids* are again less likely to respond neutrally than *broadsheets*, *male* writers' responses are more likely to be mixed or negative, and *experts* are less likely to respond negatively than *novices*. When the HM *dichotomy* was analyzed separately, the MAM reduced to including publication *year, gender, and expertise* as predictor variables whether newspapers were categorized according to *political leaning* and *format* (Table 6) or according to *publishing group* (Table 7). The most pronounced implications are a shift away from neutral reporting after 1995, with increases in particular in mixed responses. As in the previous analyses, *experts* respond less negatively to ambiguity in the HM dichotomy than *novices*.

## **Discussion**

Our analyses of ambiguity tolerance (AT) displayed toward intermediaries of the dichotomies *Human–Animal* (HA) and *Human–Machine* (HT) in British newspaper reporting from 1995 to 2010 generally confirmed our hypothesis-driven expectations about the influence of socioeconomic variables (see the *Introduction*).

*Temporality.* During the millennial year 2000 with its associated psychological uncertainty, positive scores (associated with a higher degree of AT) dipped to their lowest level while negative scores peaked—a trend that reversed toward the years 2005 and 2010. A plausible explanation links this pattern to the “special” year 2000, which evoked impending societal shakiness (doomsday hype). This perspective reduced optimism while increasing anxiety, with corresponding fluctuations in AT (Pulford 2009) and enhanced mental fencing of the ingroup (Harris and Fiske 2006, 2008; Peterson 2013; Murrow and Murrow 2015). This tendency toward inhumanization is known to occur in threat-states (Demoulin et al. 2005). Of course, cause-effect scenarios in a historical timeframe will always remain speculative. That said, the post-Cold War year 1995 appeared more “open-minded” in generalist Western geopolitical terms than the year 2000 (United Nations Development Programme 1994; Goldmann 1997). By 1995, liberal (as opposed to dictatorial and/or conservative) governments had been elected in the United States and Western Europe. In the United Kingdom, then-popular New Labour was gearing up to wrest control from Thatcherism. Our results reflect this, with both HA and HM showing higher AT levels—and therefore less essentialism—toward intermediaries in 1995. However, in the final years of the 1990s and very early 2000s, AT plummeted—perhaps due to unrest that included market crashes in 1998, a contested US election, and psychological upheavals surrounding the millennium (Jenkins 2000; Mitchell 2009). Implicitly, ca. 2000, Westerners began kicking “them” out of the “us” group. The resulting fear-state, which triggered increased protectionism toward the human ingroup, slowly ebbed toward 2005 and 2010, not least because of a subsequent adjustment to the new societal and individual realities brought about by information technology and the increasingly ubiquitous use of the Internet.

*Newspaper political leaning and format.* Although reduced AT has been associated with politically conservative individuals (Jost et al. 2003; Kanai et al. 2011), our findings did not support the corresponding prediction of a generally diminished AT in conservative newspaper outlets. In fact, descriptive statistics of AT levels were close to identical in conservative and liberal outlets. However, our data indicate that, by and large, tabloid journalists display less AT than broadsheets, an effect driven primarily by conservative tabloids. As already noted, broadsheets are more substantive publications and as such may be benefiting from an “expert effect” (see below) associated with higher levels of ambiguity tolerance (Bobo and Licari 1989).

*Journalist gender.* Both descriptive statistics and multinomial regressions suggest that female writers tend to report on intermediaries in a more positive way than male writers, who are more likely to espouse mixed or negative views. The literature is ambiguous in terms of differentiated levels of essentialism between males and females. Males have been found to display more essentialism by, for example, conceptualizing sexual orientation (Hodson, Harry, and Mitchell 2009; Hodson and Busseri 2012) and female gender attributes (Smiler and Gelman 2008) as natal traits. Moreover, compared with females, males in Australia displayed distinct essentialist tendencies, but not so males in more egalitarian Denmark, where men and women showed equal levels of gender essentialism (Skewes, Fine, and Haslam 2018). Thus, a connection between prejudice and essentialism is potentially only brought about when the dominant group is “threatened by the prospect of social change” (Morton et al. 2009: 663). Here, that “dominant group” would be males.

*Journalist expertise.* Our analyses, on both the descriptive and multivariate levels, clearly illustrate that *experts* are less likely to respond negatively to ambiguity than nonexperts. Increased gathering of topic-relevant information may be a factor at work here (Kanazawa 2010). In support of our finding, higher levels of education are associated with reduced essentialism-loaded discriminatory conceptualizations such as racism, sexism, and homophobia (Bobo and Licari 1989; Caviola, Everett, and Faber 2018). Consequently, better-educated “experts” may experience less cognitive load (Hammack 2005) and thus less stress when evaluating ideas, therefore being less likely to resort to essentialist explanations. This would also align with the conflation tendency of multiple essentialist viewpoints found in individuals who are simultaneously homophobic, racist, sexist, and xenophobic alongside other forms of bias—that is, essentialists tend to be “all-around” essentialists (Aosved and Long 2006; Aosved, Long, and Voller 2009; see also Bastian and Haslam 2006).

*AT differences toward HA and HM.* The dynamics in relation to the above specified predictors follow, by and large, the same direction for both investigated dichotomies. However, on an absolute level, intermediaries associated with the HM dichotomy solicited more negative and less mixed reporting than intermediaries associated with the HA dichotomy. This is dramatically borne out by the descriptive statistics, given that, overall, negative scores for HM (32.5%) were almost double those for HA (18.6%; cf. Table 1), but also by the multinomial logistic regressions (cf. Tables 4–7).

Why are people more worked up by ambiguity related to machines than by ambiguity related to animals? Perhaps there is greater familiarity with the latter than the former, given that humanlike animals such as monkeys and apes are conceptualized in the ubiquitous trope “our closest living relatives”—a perspective to which the British public has grown accustomed since the 1850s, when Darwin published his ideas about evolution. (Still, there can be unease about a term such as “human animal,” given its potential application as a racial slur; Butler 2018.) Moreover, while few humans interact at a personal level with other “humanlike” primates, many engage with pets and companion animals—or, at the very least, are exposed to the typically “friendly” anthropomorphic animals in children’s books and movies (Bruke and Copenhaver 2004).

This situation is very different from the novel encounters with information technology or robotics. These machine-driven developments gathered momentum only in about the 1990s—alas, with breathtaking speed. The ensuing barrage of “information” was both enriching and bewildering (Zakon 1993–2011), and the innovative technological dimensions affected the day-to-day life of virtually every British person. Not unexpectedly, this provoked a new type of technophobia associated with unclear boundaries (Sterne 2000). Spinoffs from the predictable phobia include a backlash against technological “manipulations” such as genetically modified food and a “cyborg-angst” about “unnatural” *Human–Machine* hybrids. We are particularly uncomfortable with ambiguity, once the uncanny valley sensation sets in as robots come close to being perceived as humans—instead of being either clearly robotic or clearly human (Mori 1970/2012; Tinwell 2014).

A prominent example of these forces is the widespread public fear of a “millennium bug.” This alleged code in all binary computers lacked the ability to change numerals denoting years from “19XX” to “20XX.” As a result, planes would drop from the sky, the global stock

market collapse and nuclear reactors melt down—if such computers were not made “millennium-ready” prior to 1 January 2000 (Mitchell 2009). Perhaps because of sustained efforts to reprogram critical software in the run-up to 2000, the dreaded millennium bug never emerged in any substantial way. The bug potentially could be understood—at least in part—as a modern-day chiasm equivalent, complete with pathogen-avoidance reactions embodied by a distaste for the metaphorical creepy-crawly “bug” (Brosnan 2008). Still, we can expect that such reservations will fade away as and when interactions with inert objects become more and more embedded in everyday life (Robinson et al. 2013).

## Conclusion

Our analyses point toward what are probably deep-rooted psychological mechanisms related to our tendency to dichotomize. First, despite a de facto fluidity between us and other animals in terms of anatomy, physiology, and microbiome, as well as our increased enmeshment with nonorganic technological entities, we tend to guard our boundaries. We do this through reification and essentialization of artificial dichotomous poles that construct our human ingroup as being distinct from animals or machines (cf. Bryson 2017; Thompson 2019; Schmitt 2020). Second, the rigidity of our boundary control is not cast in stone, but malleable through exposure to historical socioeconomic frameworks. Both these psychological mechanisms are likely adaptive under specific conditions—because humans are strategic opportunists. Infrahumanization tied to reduced AT is likely to crop up once our ingroup is perceived as being under threat, with the drawback that potentially beneficial transgressions are stifled. Such neophobia will be muffled during more secure situations, when people are willing to survey wider networks with softer borders and more permeability (Reader 2003).

Our findings may thus relate to a general pattern of human mentalizing. In a broader societal context, the challenges and opportunities of AT toward intermediaries are currently explored in various similarist paradigms—under keywords such as nonhuman personhood, transspecies studies, transhumanism, multispecies worlds, or post-*sapiens* (cf., e.g., Haraway 2007; Van Dooren, Münster, and Kirksey 2016; Gray 2017; Sommer 2017; Pietrzykowski 2018). The neologism “ultrahumanization” (Bryson 2017) would seem particularly apt to encompass these evolving binaries that eschew the specificities and biases of human speciesism, with which—in a rapidly changing world—humans inevitably will have to grapple.

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