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Editorial

In this third iteration of the first volume of the Cambridge Journal of Human Behaviour, we are thrilled to present a dedicated social anthropology issue. This special issue offers a unique opportunity for intellectual engagement, focusing on the myriad ways human behaviour can be explored through a social anthropological orientation. While the articles in this issue share a disciplinary focus, they encompass a diverse range of methodologies, theoretical perspectives, and cultural contexts, demonstrating the vitality and relevance of social anthropology in today's world.

As a burgeoning publication, the *Cambridge Journal of Human Behaviour* has been eager to expand not only its readership but also its contributing authors. Our Outreach Officer, Ishika Gupta, has done an exceptional job in connecting with a multitude of nationalities and institutions, leading to an outpouring of engagement and collaboration with our Journal. From Utrecht to New York, Dhaka to London, our global reach has truly been energised. This geographical diversity not only signifies the Journal's expanding scope but also reflects the multifaceted potential of social anthropology as a discipline grounded in cross-cultural engagement and comparative analysis.

Although we have received numerous creative and enriching interdisciplinary commentaries from University of Cambridge students, representing psychology, natural sciences, and biological anthropology, we take pride in filling this issue entirely with articles from students at other esteemed institutions. The articles share a social anthropological orientation towards in-depth, specific examples, applied in original and unexpected ways. For instance, this issue features an engaging article on food and identity that weaves in autobiographical elements, providing a fresh perspective on the intricate interplay of personal and collective histories (López Basurco). Another article uses fiction excerpts to advocate for reviving the study of totemism, illustrating the potential for literature to inform anthropological analysis (Weeks). Additionally, an in-depth examination of water contamination by estrogenic compounds in the US not only addresses environmental concerns but also discusses human impacts and policy implications, emphasising the importance of interdisciplinary approaches in tackling pressing global issues (Shrivastava).

Through the variety of styles and themes in this issue, we aim to challenge, provoke, and critically engage with notions of what constitutes "human behaviour". We also take pride in how submissions connect human behaviour with politics and social inequality. For example, an article on the "violence continuum" experienced by refugees in a camp on Lesvos reveals the multiple layers of violence that permeate their daily lives (Franken). Another article investigates the social construction of caste and untouchability in Lalpur village, Bangladesh, highlighting the lasting impact of social stratification on individual and group identities (Das).

This issue is also special as it marks the final publication under the inaugural editorial team. It has been a privilege to collaborate with Sofia Ferreira, Kitty Beck, Liam McClain, and Edoardo Chidichimo to launch this undergraduate publication and showcase work we are proud to share with a wider audience. Edoardo's unwavering commitment to the Journal has been particularly inspiring, and we are all warmly grateful.

As we prepare for the handover to the new editorial team, we are excited by the growing momentum of the publication. With numerous outstanding submissions under review or awaiting revisions, our inboxes have transformed from sparsely populated to positively bustling. We are confident that the new team will effectively harness this momentum, fostering creativity and promoting interdisciplinary engagement, while cultivating a vibrant and inclusive space for exchanging ideas across various disciplines.

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CAMBRIDGE JOURNAL OF HUMAN BEHAVIOUR

SOCIAL ANTHROPOLOGY

On Food and Culture: A Migrant's Experience

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This article explores the importance and impact of gastronomical practices in the development of a migrant's cultural identity in a new foreign—or an "Other"—setting. I critically engage the concept of "cultural identity", emphasising the concepts of nationalism, borders, and sense of belonging. I later portray food as a symbolic resource available to migrants for the proper development of their cultural identities. I present one case in which food practices may bring two peoples together and one in which it appears to do the opposite; namely, fusion cuisine and the gentrification of food practices, respectively. Before providing my concluding thoughts, I provide personal experiences of how food practices have shaped my own migrant identity using an innovative method of autoethnography.

INTRODUCTION

Marinate the chicken pieces in Indian spices and yoghurt and roast them. While the chicken cooks, heat up some water and cook the Basmati rice. Meanwhile, prepare a thick curry sauce with pureed tomatoes, cream, coconut cream, and coriander; all brought together by the *garam masala* spice mix. Add the chicken pieces to the sauce and serve with rice and *naan* bread. This recipe is nothing but a personal interpretation of the famous Chicken Tikka Masala. Variations of the dish include lamb, fish, or cheese, making it one of the most versatile and popular international recipes. In regard to Chicken Tikka Masala, former UK Foreign Secretary, Robin Cook, stated:

> Chicken Tikka Masala is now a true British national dish, not only because it is the most popular, but because it is a perfect illustration of the way Britain absorbs and adapts external influences. Chicken Tikka is an Indian dish. The Masala sauce was added to satisfy the desire of British people to have their meat served in gravy. (Cook, 2001)

Chicken Tikka Masala was claimed by the United Kingdom as their national dish, in an attempt to emphasise the multiculturality that has characterised the country since the second half of the 20th century. However, British South Asians argue that the roots of this dish can be traced back to India, and that Chicken Tikka Masala has been subjected to a process of gentrification by the British people to compensate for the countless hate crimes and discrimination that South Asians suffered following their mass arrival in the 1950s and 1960s, through the appreciation/appropriation of their gastronomy (Buettner, 2008). While this example can be considered as a celebration of multiculturalism or a clear example of fusion cuisine, it can also be interpreted as a case of cultural appropriation through the gentrification of South Asian cultures by the British. Whichever interpretation one may find more suitable to this specific case, the sociocultural importance of food and food practices, especially in a migratory context, remains undeniable.

Gastronomy and cultural food practices are one of the many components that constitute an individual's cultural identity. Although this cultural identity may be taken for granted in one's native country, it may take a more prominent role in the context of migration. In the intensifying process of globalisation, individuals have become obsessed with finding their personal sense of belonging when living abroad (Ceuppens & Geschiere, 2005). Nonetheless, this feeling of "non-belonging" and alienation is not exclusive to global societies nowadays, as it can be argued that it was rooted in the implementation of modern borders. Indeed, McKeown (2008) argues that, during the imperial era, Western nations constructed artificial borders that satisfied their political and economic interests while making the separation of peoples and cultures the consequences of collateral damage. Borders were therefore unprecedented physical barriers that responded to the need to separate "us" from the "other", the Western from the non-Western, the civilised from the uncivilised. There is no common understanding on the formal creation of borders, as some authors argue they arose after the Peace of Westphalia, in the aftermath of the French Revolution, or during the consolidation of imperialism in the 19th century (Laine, 2015). Nonetheless, border studies gained prominence in the late 20th century, following public concerns of a "borderless" world with migratory freedom of movement (Kolossov & Scott, 2013). The tendency to see migration as something that overcomes, rather than interacts with, borders—as if human mobilisation did not exist prior to the implementation of borders—oversimplifies the identity struggles of migrants (McKeown, 2008). Following Appadurai (1990), we must reconsider the binary views of the world, embedded particularly during colonial history. Rather than understanding these issues as matters of Global North vs. Global South, East vs. West, First World vs. Third World, we must "globalise" our views and comprehend how our cultures continuously interact and overlap with one another.

This article will examine the cultural practices regarding food production and its subsequent consumption among migrants. Namely, what role(s) do food and gastronomy play in defining the cultural identity of a migrant? How can food create contact points between two seemingly independent cultures? How do new culinary traditions develop in new

contexts? In order to answer these questions, this article will first provide an analysis of what cultural identity can be to a migrant, emphasising the creation of this concept through the origins of the nation-state and the implementation of modern borders. It will later address the issue by narrowing the concept and focusing on migrant food practices, providing different examples and situations where food is employed to preserve one's cultural identity and as a means to better adapt to a new country. Before concluding, I will conduct a brief autoethnography in order to analyse my experiences with food and cultural identity as a young middle-class migrant in the Netherlands. This way, I hope to provide more insightful context to the topic under discussion.

"WHO AM I?": CULTURAL IDENTITY AND SENSE OF BELONGING IN MIGRATORY CONTEXTS

Although the many different elements that compose one's cultural identity cannot be traced back to a specific moment in history, the concept of cultural identity itself and its political utilisation can be attributed to the creation of the nation-state. However, while there is general consensus that nation-states and nationalism are worldwide phenomena, there are intense scholarly debates on the origin, meaning, and scope of these terms. For instance, some authors argue that states came into being when specific groups of people found common objective traits that led to bonds of cohesion and mutual loyalty, such as language or religion (Hazony, 2018). In opposition to this argument, authors including Renan (1996) and Yack (2012) emphasise that it is the will of the people which can build a state and the feeling of nation. On this latter point, take Switzerland: here, multilingual communities are said to have a stronger feeling of unity rather than being a nation built solely on a common language and other arbitrary objective factors. Some authors highlight the subjective factors that can form a nation, such as historian Seton-Watson (1977), who argue that a nation is created when a number of people within a community see themselves as part of a nation, behaving as if they formed one. Benedict Anderson's (1983) definition—perhaps the most influential in political anthropology—of a nation as an "imagined community" aligns with the subjective understanding of the nation, where one imagines themselves as belonging to and within a group that is, in turn, comprised of people who are largely unknown to them.

Malešević & Trošt (2018) argue that by emphasising the cultural cohesion of their populace, nation-states were founded on the base of unique and special objective characteristics that differed them from other nation-states. Importantly, the ideological structure of a nation-state conceives the idea of cultural homogeneity within its citizenship. Making the nation the unique expression of a cultural collective being emphasises the importance of nationhood on individuals, making it stand above other group allegiances (ibid.). It is important to note that some nationalist feelings may come before the creation of the nation-state, and could in fact be one of the forces that sees its reification (Kedourie, 2002). Given that the nation exists prior to the state, nationalism appeals to the shared cultural heritage of a people, highlighting their common language, economy, territory, and cultural identity (as Gellner's (1997) theory of nationalism supports)—the last of these including shared religion, ethnic descent, or collective customs such as gastronomy. Once the nationalist feeling has been established, the nation can organise itself and turn into a nation-state (Malešević & Trošt, 2018). However, with the consolidation of the nation-state came the politicisation of cultural differences, which emphasised the supremacist attributes of nationalism and was followed by the implementation of modern borders and border policies (ibid.). Here, I have given particular attention to the arguments of Malešević & Trošt (ibid.) in conversations about nations and nationalism due to their own emphasis on the importance of objective factors towards the building of the nationalist feeling. These, as will become clear, neatly complement my understanding of gastronomy and foodways.

McKeown (2008) explained how the consolidation of nation-states and borders was a consequence of a widespread retreat into protectionism, nationalism, and racism, following the insecurities and change caused by international socioeconomic interactions, from early 15th century colonialism till today. This way, the erection of border controls became a physical barrier not only to safeguard national security borders, but also to segregate the cultural macro-categories that divided the world. The division between the East and the West, between the civilised and uncivilised, was given a physical form (McKeown, 2008). Interestingly, while nation-states felt the need to protect their identity, they were also politically and economically motivated to engage in the colonial practices of the time. Nowadays, nation-states that have a history of colonial expansion can perceive their past reflected in their immigration trends and history (van Amersfoort & van Niekerk, 2006). And, while the military and economic relevance of borders has been drastically reduced in the past decades, the boundaries that they stand for are arguably stronger than ever (Andreas, 2000).

Mexican-American and feminist scholar Gloria Anzaldúa (1991) thoroughly reflected on the sociocultural impact of borders, focusing on the Texan/Mexican border through her personal experiences. Following the Mexican defeat in the U.S.-Mexican War, an artificial border was created in southern Texas, leaving 100,000 Mexicans "jerked out by the roots, truncated, disemboweled, dispossessed, and separated from [their] identity and [their] history." (Anzaldúa, 1991, p. 8). Anzaldúa understood the "borderland" as the physical space where two or more cultures edge over each other; a space where multiple races and traditions occupy the same territory. It is within this space where individuals are in a constant contention to understand their cultural identity, and the many natural and artificial elements that define it (Anzaldúa, 1991). Anzaldúa's mother's experience is of special relevance to this article. Anzaldúa stated the pride her mother felt when her recipe for *enchiladas coloradas* was included in a cookbook for Mexican women in a region on the U.S. side of the border (ibid., p. 9). While her mother's cultural identity had been divided by the imposition of the border, she was able to start building a new dual identity as a Mexican-American woman, constructed through and between her food and her new socio-geographical situation.

Appadurai (1990) refers to globalisation as the scope of interconnections across the globe in terms of people, things, and ideas. As these go over national boundaries, they continuously shift the social landscapes in which contemporary citizens find their lives embedded within (ibid.). In a highly globalised world, who belongs where? Nationalist discourses have re-emerged in order to protect the "ancestral lands" against those who might threaten the autochthonous identity of its people and culture (Ceuppens & Geschiere, 2005). As a consequence of this, contact between an immigrant with the dominant or host community can lead to a process of assimilation and deculturation, in which an individual experiences the loss of cultural identity (Bhugra & Becker, 2005). In such a process, one cultural group often dominates and "hosts" the other, thus establishing, inculcating, and regulating norms within its borders, reifying a certain Gramscian cultural hegemony (Bates, 1975). We might call this process, as does Bhugra (2004), a form of deculturation. Here, Bughra identifies five domains that can be linked to deculturation: language, religion, entertainment, food, and shopping habits (other areas are more difficult to identify, such as cognitive styles and behavioural patterns). These become a form of "sanctuary" to which migrants turn to when they feel their cultural identity is at risk. For example, the practice of one's native language abroad, the celebration of a familiar religious festivity, or the preparation of traditional dishes can become supportive tools during the process of adaptation.

Having given a particular analysis of the struggles modern migrants experience with their cultural identities and their sense of belonging, some context into the historical and more current tendencies of this phenomenon have been illuminated. I now turn to expand the idea of food and culinary practices as an element of a migrant's cultural identity.

FOOD AS A MEANS TO SALVAGE CULTURAL IDENTITY

As this article has shown, the association of food with the migrant experience is a complex one, and has become an independent field of study within anthropology. Food can be a crucial part of an individual's culture and identity. Food can also be a reflection of one's socioeconomic standing, as well as a political tool—its smells, appearance, or modes of consumption can contribute to xenophobic and racist warfare, as well as to nationalist and supremacist pride (Kershen, 2017). It has been

subject to politics of segregation, and, in some cases, forced to adapt to specific dietary traditions in regional and national contexts. Food traditions are also crucial to the practices of most religions, often offering a symbolic resource that can bind individuals to their faith (Feeley-Harnik, 1995; Bloch, 1989/2020). While it is not possible to illustrate all the vast ethnographic possibilities in this article, a more general approach to the diverse roles of food in the migrant experience will follow.

As anthropologist Lévi-Strauss stated *The Origin of Table Manners*:

> … cooking, it has never been sufficiently emphasized, is with language a truly universal form of human activity: if there is no society without a language, nor is there any which does not cook in some manner at least some of its food. (1978, p. 471)

Food and culinary tradition are as fundamental to human behaviours as language; and, in a similar fashion, food is deeply influenced by regional traditions, the past, and the present. Food practices are in no way static, as the human need for adaptation and incorporating external elements make them one of the most dynamic traits of human culture. The uniqueness of food for each individual makes it a fruitful strategy to cope with the strangeness and disorientation migrants experience in new spaces (Parasecoli, 2014). By recreating a sense of home around food production, its preparation, and posterior consumption, a personal and collective cultural sense of comfort is achieved.

Fabio Parasecoli (2014) emphasises the interaction between a migrant and "Otherness" (where this refers to the new country and society a migrant enters) in relation to food. Interestingly, he opts to reframe "Otherness" and ascribe it to the unfamiliar environment that the migrant finds themselves within as opposed to the migrant themselves. Indeed, much anthropological literature has sought to focus on the migrant "Other" as though the settled land were the given reference point. This approach, however, duly recentres the migrant and their unfamiliarity. Parasecoli's main argument is that, however unsettling an unfamiliar environment may be for a migrant, eating is an inevitable component of daily life which will force the migrant to interact physically, emotionally, and even economically, with the "Otherness" (ibid.). It is through these forced interactions that a migrant sometimes starts giving a significant and cultural meaning space to the previously threatening environment. In a way, food, in its most basic context, acts as an active agent towards the confrontation of a migrant with the "Otherness".

This idea does not thus imply that the migrant will consume local foods, but rather that the migrant will attempt an approach to the "Otherness" using hunger and the physical need for food as a pretext, even if it is to cook familiar dishes. Once migrants become familiar with the new environment, and accept that any element can potentially become part of their diet, they take a more open and non-protective approach to their food practices, though still carefully safeguarding them as a vital component of their cultural identity (Parasecoli, 2014). In Morasso and Zittoun's (2014) study of food as a means to adjust to life in London, we find a notable example of interaction between a migrant and "Otherness" via food practices. In their research, Petra, a Polish migrant, uses food to represent her willingness to adapt to the multicultural community of London, by exchanging recipes and learning dishes from other countries with her friends (Morasso & Zittoun, 2014). Looking at this practice from a broader lens, the gifting and exchange of food and culinary knowledge can be interpreted as a way to give back to the host country, as well as an excuse to celebrate the multiculturalism of migration in a sociocultural setting.

Gift giving is an intriguing universal behaviour that has fascinated anthropologists since the establishment of the discipline, and has been subject to thorough debate following Malinowski's (1922) and Mauss' (1974) discussion on the complexity of gift exchange. A social conduct based on reciprocity and exchange, gift giving entails a symbolic transaction in which objects act as mediators carrying significant cultural meaning (Sherry, Jr., 1983). As Barcellos Rezende argues (2007), food gifting follows the same general and basic rules of gifting: to give, receive, and reciprocate. However, under the context of migration, this kind of gifting entails an intimate and personal exchange that can go beyond the usual nature of the gift. Taking Parasecoli's (2014) approach to "Otherness", food gifting from migrants who find themselves in the vulnerable position of facing an unknown society carries deep value and meaning. By inviting someone home to cook for them, one opens themselves to "Otherness", and the simple process of preparing and consuming a meal becomes a cultural and social action which can be representative of such personal efforts.

As I have discussed, food is able to create an umbilical link between where one is from and where one is now. This way, recipes and dishes have travelled and crossed borders to provide new ways to perform old and new senses of home within new spaces, providing migrants with a better understanding of *who* they are now (Agyeman & Giacalone, 2020). Understanding foodways as performative acts allows for a broader comprehension of the meaning of food for a migrant: buying the ingredients at an expat store, the particular methods of preparation with the available tools, or specific traditions in the consumption of the foods all come together in a particular performance that takes place in the specific personal context of an individual's migration experience (Kirshenblatt-Gimblett, 1999). The rediscovery, protection, and promotion of one's own food practices provides a shared sense of belonging to migrant communities, found in the material culture that unites them (Parasecoli, 2014). Nonetheless, it is also of great interest to analyse how these cultural communities can open themselves to interact with the local community. When "locals" are allowed to participate, and the label of *outsider* is not used by any of the two parties to alienate either group, food can act as the perfect adhesive between two peoples, two cultures.

Uniting two peoples, two cultures: fusion cuisine

For this section, I will focus solely on fusion cuisine that derived from the contact between two cultures under the context of migration. While numerous culinary practices emerged from the colonial era, and also served as a means to bring coloniser and colonised together, this fusion can be considered to be forced and directly resulting from the colonial period. Therefore, although Filipino cuisine can be considered as one of the best examples of fusion cuisine, its Spanish-American heritage excludes it from this analysis. What is of most interest is the postcolonial cohesion between two cultures through culinary practices.

There are innumerable examples of this postcolonial union through food: Tex-Mex cuisine, American-Chinese cuisine, or Anglo-Indian cuisine (which emerged in the United Kingdom following massive flows of South Asian migration in the mid-20th century), to name a few. While the mentioned cases can be traced back to a clear colonial or violent past (e.g., Mexican-American War, British Raj), I argue that the fusion of their gastronomic cultures takes place in the aftermath of colonialism. Therefore, even if a direct cause of a colonial past, the examples provided took shape under the context of modern migration. A personal favourite example of fusion cuisine is *tacos al pastor*. Considered one of the most popular dishes worldwide, and the undisputed flag bearer of Mexican cuisine, it originated following the arrival of Lebanese migrants in the early 20th century,[1] who, when attempting to recreate Lebanese *shawarma*, combined their heritage with Mexican cuisine and created the modern version of *tacos al pastor* (García Garza, 2011).

One of the best examples of migrant-originated fusion cuisine can be found in Peru, in Nikkei gastronomy. As described by Takenaka, "Nikkei food symbolizes the perfect harmony between the Japanese and Peruvian cultures; it is not Japanese food with Peruvian ingredients, nor Peruvian food with Japanese ingredients, it is the result of a unique cultural mixture" (2017, p. 125). When they first arrived in Peru, Japanese migrants were highly discriminated against in terms of socioeconomic standing and race. During the decades following their establishment in their new home, Nikkei Peruvians struggled with their identity, as they felt neither Japanese nor Peruvian enough. However, as the second generation of migrants developed, they were able to start finding their sense of belonging and integrating themselves in Peruvian society, where Nikkei cuisine played a crucial role (Takenaka, 2017).

The gentrification of ethnic foods

Gentrification can be understood as the conversion of marginalised

and working-class communities of the central areas of a city for middle class and privileged residential use (Zukin, 1987). While there is no clear consensus on the understanding of "gentrification", I take Zukin's approach to develop my following argument. If we extrapolate this concept into this article's subject matter, gentrification invites cultural appropriation of "authentic" and "ethnic" foods, which can become exoticised and appropriated by the dominant culture of the host country (Agyeman & Giacalone, 2020). Ceuppens and Geschiere (2005) argue that a great majority of the Western population, especially in the last decades of the 20th century, thought of "indigenous peoples" (even if living in the same city) as "Others" whose cultures were weak entities that could only survive if awarded special protection. This paternalistic approach could be interpreted as a Western defence to one's national identity, under threat by the arrival of migrants with distinctive cultural traditions, including gastronomy.

Agyeman and Giacalone (2020) argue that Whiteness has provided alternative food concepts of "local" or "health" that negate Black, Brown, and Indigenous communities and heritage. As mentioned before, ethnic food has been employed as a political and xenophobic tool. It smells and looks different, and it can be consumed in many different ways. To narrow this idea to a specific example, let us focus on the example of Anglo-Indian migration in the United Kingdom and Chicken Tikka Masala. South Asian migrants in the UK have reportedly experienced xenophobic and racist discrimination on the basis of their food practices back in the 20th century (Buettner, 2008). The spices they use may have caused an "unpleasant" odour to the average British citizen, and the fact that they sometimes used their hands to eat could be "unsettling". However, a few decades later, South Asian second and third-generation migrants were experiencing the whitewashing of their identity. Not only were they heavily discriminated against on the basis of their food practices; now it had been institutionally "appropriated" by the British with Chicken Tikka Masala, disguised as a celebration of multiculturalism.

PERSONAL EXPERIENCES WITH FOOD: THE AUTHOR'S AUTOETHNOGRAPHY

In an attempt to explore food in contemporary migration between Australia and the United Kingdom, scholars Christine Knight and Jessica Shipman (2021) used the method of co-constructed autoethnography, or "duoethnography". Given the singularity of every migrant's journey, I find here an opportunity to share my own personal experiences, suitable in contributing to the contemporary understanding of food, belonging, and diversity in the migration experience. In order to do so, I will briefly reflect on my time as a young White middle-class Spanish expatriate in the Netherlands.

I, Pablo Bernardo López Basurco, was born in Madrid to Spanish parents, where I have lived my whole life up until 2021. In August 2021, I moved to Utrecht, the Netherlands, to pursue an undergraduate degree in Liberal Arts & Sciences, with a focus on anthropology and international relations. During my upbringing in Spain, I was not as aware of my national and cultural identity as I am now. While this identity has not been constructed abroad, the circumstances I have been exposed to have favoured its revelation. My reflections on my personal experiences will provide another unique understanding of food and cultural identity in a migratory context.

Back in 2021, during my first academic year in Utrecht, I did not give much importance to food. My food practices were reduced to my survival, as I did not feel like food could provide me with a special sense of belonging, which, back then, I did not feel like I was in need of. Facing the "Otherness" that Parasecoli (2014) described was not a personal issue, as I had found my "home" in two of my best friends: Olivia, an Argentinian senior student, and Andrés, a Mexican freshman;[2] I was therefore not alone when "facing" the Dutch or the Netherlands. During our time together, we really emphasised our own personal cultural identities, benefiting from their Hispanic similarities and amused by their unique differences and traits. Even though food did not play a primary role in our relationship, it did act at times as an excuse to get us, and other friends, together. I organised several dinners where my *tortilla española* was the main dish, in which I took great pride. On different occasions, we baked Argentinian *alfajores*, or cooked Mexican *sopa de tortilla*. Similar to the descriptions offered by Morasso and Zittoun (2014), I experienced the sharing of our own national dishes as a celebration of multiculturalism, and I can think of specific moments and people with whom I developed a great relationship, particularly when attending to my food. While food practices were not pivotal to my identity and sense of belonging during my first academic year, they were indeed a component of a broader personal culture.

However, everything changed back in September 2022, when neither Olivia nor Andrés returned to university. While Olivia did stay in the city of Utrecht, Andrés dropped out and went back home to Mexico. Suddenly, the Netherlands did not feel like the home it had been for me just a few months back. Now, I had to face the "Otherness" on my own, and whilst my personal identity within the university was not shattered, it was deeply affected. These two people were my day and night for a year, and I was now "alone". Suddenly, in September, I felt like starting to cook more elaborate dishes in comparison to last year. I called one of my culinarily-talented aunts, asking for advice on Spanish recipes that I could easily recreate in the Netherlands on a student budget. I quickly took pleasure in cooking these dishes, and I weirdly felt more connected to my "Spanishness", my broader cultural identity. Although these dishes reminded me of home, I had not actually eaten some of them at all in the past. Even if some did not transport me back to my family or my home, I felt more connected to my roots: I was bringing a piece of my home, Spain, to the Netherlands. I started sharing everything I cooked with my friends and, without pretending it, food quickly became again an excuse to meet up with other people and celebrate multiculturalism.

CONCLUSION

Every individual migrant carries a complex and unique cultural baggage that creates an intimate link between where one is from and where one is now. This baggage can provide a sense of belonging when one needs it most, or it can be employed as a tool to facilitate integration in a new space. It can take the form of language, religious practices, entertainment, humour, music, clothing, hairstyle, habits, dances, and, of course, food (although this is certainly not an exhaustive list). Food provides the perfect stage for the performance of transcultural identities, as it is a fundamental element in our lives which we have to engage with on a daily basis. Food is not unique and static; it often is converged and explored with other cultures. Contrary to the idea of borders, food can be often imagined not as a physical separation of two peoples, of two cultures, but as a space of interaction between these two entities. While the study of food practices is a much broader field, and there is extensive literature on the topic, supported by various and diverse specific case studies, this article has sought to provide a more general overview of the impact of food in the migratory context. Namely, food can act as a component of one's cultural identity; it can be a means to find one's sense of belonging when facing the "Otherness" of a new country; it can be the perfect excuse to bring people together and learn from each other; or it can be the pretext to create a community of culturally-alike people in need of comfort. Referring back to Lévi-Strauss' quote, I would like to, on this final note, emphasise the power of cooking and food as a universal language that can facilitate the understanding and cultural enmeshment of diverse peoples and cultures, especially in a time of globalisation and continuous sociocultural exchange.

NOTES

1. Lebanese migration to Mexico took place primarily during the last two decades of the 19th century and the 20th century, following Ottoman repression of Lebanese Christians through forced famines and difficulties to commerce (Alfaro-Velcamp, 2006).
2. In the interests of maintaining anonymity, Olivia and Andrés are pseudonyms.

Interdisciplinary Commentary

PSYCHOLOGICAL & BEHAVIOURAL SCIENCES

You are what you eat? The macropsychology of food choices

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Food is an important part of life as a human being, because its extraction and preparation involves significant labour and time. This commentary discusses three macro-scale influences on food choices: *political conflicts*, *policy regulations*, and *geographical availability of agricultural terrain*. These in turn will be related to psychological investigations on outcomes for individuals, and to policy interventions to promote more sustainable food choices.

Introduction

Food is intrinsic and necessary to humans for physical sustenance, and its cultivation and preparation can be used to carve out an identity and a place in society on an individual, as well as collective, level (Kreklau, 2017). The extraction of food has taken many forms across the centuries and continents of the planet, for example by foraging, hunting, agriculture, and pastoralism. The historiography of food can be used to map changes and continuities in human behaviours and preferences over time, which reflect the tension between societal influence and individual preferences. Food is often imbued with cultural, religious, and moral values, which dictate customs around consumption of foods and liquids; for example, mussels in Italy were initially perceived to be disgusting, before being marketed into the status of a delicacy (Vianello, 2017). These values can be studied cross-culturally on large scales to identify patterns, and to map changes in customs and preferences which may go beyond bodily needs and sensory palatability.

This commentary does not include an exhaustive list of influences on food choices, but will focus on 3 macro-scale influences on food choices, and how these in turn can affect psychological outcomes. Namely, (1) *political conflicts*, (2) *policy regulations*, (3) *geographical availability of agricultural terrain*.

Political conflicts

The history of humankind is filled with events of conflict and warfare, and food restrictions are an unfortunate, but often a necessary side-effect for the parties involved (i.e., domestic rationing). However, more extreme forms of food restrictions have been purposefully inflicted on occupied or enemy territories. For example, the Dutch Famine of 1944 was caused by the occupation of an area in Holland by the Nazis, which resulted in over 18,000 deaths by starvation (Roseboom et al., 2006). Psychologists Roseboom and colleagues (ibid.) were able to investigate the effect of poor maternal nutrition on infant outcomes in a cohort of over 2,000 individuals born around the time of the Dutch famine. They found that the effects of famine on offspring health outcomes were related to the timing of exposure relative to gestation, whereby exposure during early gestation was associated with the most severe health outcomes (ibid.).

Contrastingly, another study by Stanner and Yudkin (2001) was conducted on survivors of the Leningrad (modern-day St. Petersburg) Siege, which similarly investigated the effects of insufficient maternal nutrition and risk factors for coronary heart disease (CHD) in offspring. They compared 196 individuals exposed to gestational starvation during the siege, 192 individuals born in Leningrad before the siege, and 188 control individuals born concurrently with the other two groups, outside the area of the siege. The researchers found no association between intrauterine starvation and risk factors for CHD, except for some non-systematic differences in diastolic blood pressure and clotting factors (ibid.). The difference in findings between the two studies may be explained by the *thrifty phenotype hypothesis* (Roseboom et al., 2006; Stanner & Yudkin, 2001), where a mismatch between the intrauterine and extrauterine conditions can result in maladaptation to the environmental conditions. The Dutch Famine lasted under a year, whereas the Leningrad Siege lasted from 1941–1944; thus, conditions of starvation in the Dutch example were more likely to lead to a mismatched situation between gestation and infancy. The mechanisms which were necessary for survival during famines may prove maladaptive in periods with adequate food access.

Policy regulations

While political conflicts tend to reactively change food availability (usually a decrease), policy regulations can proactively change food availability, and influence the nutritional choices of people. For example, Pell and colleagues (2021) investigated the effect of an intervention carried out in the United Kingdom in 2018, which introduced a two-tier tax on soft drinks according to their sugar level. The low tier targeted soft drinks with sugar concentration of ≥5 g to <8 g sugar/100 mL, whereas the high tier targeted those with ≥8 g sugar/100 mL. The taxes of £0.18/L and £0.24/L (respectively for the tiers) were collectively found to have no effect on the volume of soft drinks sold, but the sugar content in the drinks were 10% lower per household per week (ibid.). This suggests that people are sensitive to price changes in food items, and regulations in the food industry can encourage people to consume the foods they find palatable in more adequate quantities.

Research indicates that individuals tend to accept the default option as a heuristic for decision-making; and thus, interventions can be designed to encourage people's dietary choices by reducing friction and increasing the variety of meals available. For example, an experimental field study conducted in 3 Cambridge college cafeterias measured the effect of doubling the proportion of vegetarian meals available to students (Garnett et al., 2019) on over 94,000 meal purchases. The new configuration of 2 vegetarian meals out of 4 options of food resulted in proportional increases in vegetarian meal consumption by 61.8%, 78.8%, and 40.8%, respectively for each college, with the largest effects observed in individuals with the lowest prior levels of vegetarian food selection (ibid.). The effect observed was not accompanied by decreased overall sales or rebound effects (more meat consumption at other meal times), over several months. The increase in vegetarian meal consumption can be an important policy regulation area, because food consumption patterns in Western, educated, industrialised, rich and democratic countries (so-called WEIRD countries; Henrich et al., 2010)—especially in the United States—result in a disproportional environmental impact.

Geographical availability of agricultural terrain

The types of food that people can nurture in their geographical areas require different types of skills, which in turn are associated with different personality traits. For example, inhabitants living or originating from labour-intensive paddy rice-growing areas in China appear to think more holistically and to be more interdependent, regardless of actual participation in agricultural work (Talhelm, 2020; Talhelm et al., 2014). This finding is mirrored in how Turkish farmers were found to be more holistic-thinking than non-farmers (Uskul & Over, 2017). On the other hand, individuals from wheat-growing areas appear to be more independent thinking, and to be more analytical in comparison (Talhelm et al., 2014). People that deal predominantly with animals show a slightly different personality profile; Japanese fishers appear to have higher self-esteem and more independence than farmers (Uchida et al., 2019); meanwhile, Arab herders are said to be more holistic thinking, but

also more assertive in order to keep track of their easy-to-steal livestock (Talhelm et al., 2020).

Findings such as these have supported the *"collective activity" hypothesis* (Uchida et al., 2019), whereby the frequency and prevalence of collective activities, such as farming, influence the extent to which people are interdependent. Thus, in geographical areas where grains that require a lot cooperation and nurture are grown (i.e., rice paddies), having a good reputation (i.e., *social capital*; Pretty, 2003) is more important, because it facilitates neighbours' cooperation.

Conclusion

This commentary discussed three factors which influence the choices individuals make when they decide to consume food. Political conflicts tend to reduce the availability of food, and can have especially adverse health effects for neonates. Policy regulations and interventions can guide individuals to make more sustainable and healthy food choices. The geographical terrain influences the type of subsistence practices people can undertake, and the cultivation process has been associated with cognitive styles and personality traits.

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SOCIAL ANTHROPOLOGY

Insignificant, Outmoded, or Profound? Totemism as a Social Classification System

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The term "totemism" was initially used to consider the relationship between the human and nonhuman, conceiving of non-humans as intermediaries of human-to-human relationships. In this essay, I explore the relevance of totemism within the framework of social classification in an attempt to critically view totemism as a system of thought. I draw upon Claude Lévi-Strauss' (1964, 1966) literature on totemism which uses his principle of structuralism to outline a system of paired oppositions between the human and non-human. I also refer to Philippe Descola's (1996, 2014, 2018) usage of the term as embedded within three other ontologies, reflecting one specific way of experiencing the world. I find similarities and differences between the two scholars' conceptions, but ultimately conclude that totemism is inherently structuralist. I argue, though, that this does not mean that it lacks a place in the ontological anthropology of today. The dynamic, exciting variety of non-human and human relations that totemism can encompass renders it worthy of revival to understand the contemporary lived realities of social classification.

INTRODUCTION

Kafka on the Shore, a novel by Haruki Murakami (2005), traces the intertwining relationships that form the web upon which two antagonists live their dream-like existences, although never meeting one another. The first antagonist, Kafka Tamura, leaves home at 15, propelled by an empty feeling felt since his mother left home with his sister. The reader quickly finds that most of his actions are dictated by a mythical figure, "a boy named crow". The second is Nakata, an illiterate man in his 60s with uncanny abilities; he can speak to cats, and make leeches and fish fall from the sky. The two antagonists then embark on a series of surreal interwoven journeys, without ever meeting each other. The book, as described by Murakami, is his dreams put to paper; there are no explanations for the complex layers of stories that unfold. One of the most confusing narratives seems to portray Kafka's absent father as a murderous cat butcher. When Kafka's father is murdered himself, though, a newspaper report detailing his death contradicts any mention of cats. There is an inherent lack of logic and resolution to this plot; it battles between the rational and irrational. The book's wider plotline, though, can be decoded to follow a logic of binary oppositions. At its most basic, the antagonists oppose each other: Kafka reads for hours every day and Nakata has been illiterate since the age of nine. There is also Kafka's real mother and sister, who are ever-present in his thoughts. During the novel, he meets two women and is convinced that they are his mother and sister, his own mind attaching two pairs of people with similar ages and faces. The antagonists' names, "Kafka" and "Nakata", are also quasi linguistic-transformations of each other. The book undoubtedly has a multiplicity of interpretations. The way *Kafka on the Shore* appears on the surface, though, can be decoded to find underlying codes to the writing which portray it as expressions of possibilities. It is the relations between these abstract oppositions which can portray the book's narrative as logical. In this article, I exemplify structuralism, as formulated by Claude Lévi-Strauss (Lévi-Strauss, 1966), as a way of thinking which aims to decode large, abstract complexities which underpin social life. It can conceive of seemingly illogical things, as centred within the logic of binary oppositions instead (Layton, 1997). As I have demonstrated with Murakami's novel, structuralism—and classification in general—may help make visible and static the relationships between perceptible phenomena.

To advance this, the novel can be interpreted to further contain themes of totemism. At the core of Lévi-Strauss' totemism, he outlines an intellectual system realised through opposing relations. Lévi-Strauss identifies that a set of human relations can be decoded to mirror non-human relations (Lévi-Strauss, 1964). As with *Kafka on the Shore*, Kafka's relation to crows and Nakata's relation to cats is relevant, as both characters can communicate with them. However, totemism can be used to delve further, relating Kafka and Nakata to each other in the same way a crow relates to a cat. Just as the two characters never meet—yet their stories are intertwined—a cat roams the ground and a crow roams the sky; these two rarely meet, yet food webs make the two animals interdependent. I have aimed to exemplify both structuralism and totemism through the plot of Murakami's (2005) *Kafka on the Shore* to provide an introduction to my argument. In this essay, I will discuss totemism through the framework of whether it has use as a system of social classification. I will firstly discuss Lévi-Strauss's definition, arguing that his totemism does classify successfully, yet may ignore ethnographic material that lies outside of binary oppositions. I then argue that a deeper ontological approach may be needed, weighing up Philippe Descola's (1996, 2014) totemism and comparing it with Lévi-Strauss. I argue that Descola may overlook the fact that totemism remains a system of classification in his ontological approach. I then use Marshall Sahlins' (2014) discussion and Rane Willerslev's (2013) ethnography to broaden the argument. Ultimately, though, I return to totemism as an inherently structuralist

phenomenon that arguably deserves a place in the anthropology of today.

DEFINING TOTEMISM: FROM DURKHEIM TO LÉVI-STRAUSS

Initially, the term totemism was defined by Émile Durkheim (1912) as a type of religion. The totem group, the non-human, was seen to have a certain power over the humans who associated with it. Durkheim (ibid.) assumed that natives could not order their own reality, and that totemism was a way for them to directly model their own social structures from the orders of animal and plant species. In current anthropology, this would be defined as ethnocentric. Ethnocentrism entails an anthropologist using their own culture as a benchmark for gathering knowledge about other ways of being (Baylor, 2012). Rane Willerslev (2013) presents a hypothetical statement, "I am a bear". Durkheim could not, essentially, see statements such as "I am a bear" as one of a metaphor, and rather see it as a literal difference in logic between him, as the observer, and the observed. Lévi-Strauss discredits Durkheim's view as a totemic "illusion" (Willerslev, 2013). As with structuralism, Lévi-Strauss defines totemism to represent a natural inclination of the human mind to order through oppositions. I argue that Lévi-Strauss' logic still holds today, and that it can be useful and relevant to current anthropology.

It is useful to fully unpack Lévi-Strauss' totemism through an example. In Edward Evans-Pritchard's (1980) ethnography of the Nuer peoples, twins are perceived as "children of god" or "persons of above", making them superior to normal humans who are "persons of below". Twins are also perceived by the Nuer as birds. This is because birds exist above humans in their external resemblance. Previous scholars would have ended analysis here, envisaging that birds are a metaphor for twins. Lévi-Strauss takes this further, however, clarifying that it is also because birds are also categorised as "birds of above" and "birds of below". The internal homology of this twin-bird relationship is that twins are, as birds of above also are, an intermediary between God, and humans/birds of below (Lévi-Strauss, 1964). His logic reminds me of a question in non-verbal reasoning tests which reads "__ is to __ as __ is to __". It is also defined as analogical thinking, in which similar differences are paired in a structuralist shorthand (Chandler & Munday, 2020). Lévi-Strauss looks at the "is to" as the object of his concern. In this framing, "twins are to humans, as birds of above are to birds of below". From this, totemism can appear as a system of social classification. The humans relate to others through totemic relations, just as systems of classification identify relations between phenomena. In this instance, totemism demonstrates a useful form of classification in allowing wider understanding of human/environment relations.

Lévi-Strauss himself, though, fails to truly define whether his totemism is a system of classification or not. In the paragraph above, I interpret that his system creates distinctions between paired phenomena to decode them and, in turn, classify them. These totems function to mediate nature and culture relations. Lévi-Strauss, however, has stated that totemism is "not even a mode of classification, but an aspect or moment of it" (Lévi-Strauss, 1966, p. 218). Catherine Laudine (2016), for example, distinguishes Australian Aboriginal "use" classifications with totem classifications, stating that the latter is based on complex associative thinking and the former is more akin to scientific classification, such as taxonomy. She uses the example of food classifications, where—as I interpret it—there is no binary opposite to "an apple". Food is instead ordered through classifying different foods by physical appearances and tastes. Totemism therefore cannot be compared to scientific modes of classification, based on equidistant distinctions, when it classifies through differential relations. Lévi-Strauss is therefore correct in perceiving his totemism to be only an "aspect" or different type of classification, when compared to scientific modes.

However, although Lévi-Strauss successfully debunks the so-called totemic "illusion" and deems totemism to be a distinct type of classification, Valerio Valeri (1994) argues that he leaves the field of totemism "disappointingly empty" (pp. 101–102). Totemism, in the period after Lévi-Strauss, had little further interpretations about more complex aspects; for example, the way in which totems became totems in the first instance. Lévi-Strauss' analysis provided an "intellectual comfort" (ibid., p. 103) in determining totemism to be an ordering of the world as all human minds are inclined to do. However, it prevents further ethnographic insights from being gained if, as Lévi-Strauss defines, totemism is reduced to the fixed universality of humans rather than intentional systems of differences. It could then be argued that the field of totemism cannot move forwards as a current theory if it might ignore complexities that escape the category of binary oppositions.

CONSIDERING TOTEMISM AS AN ONTOLOGY

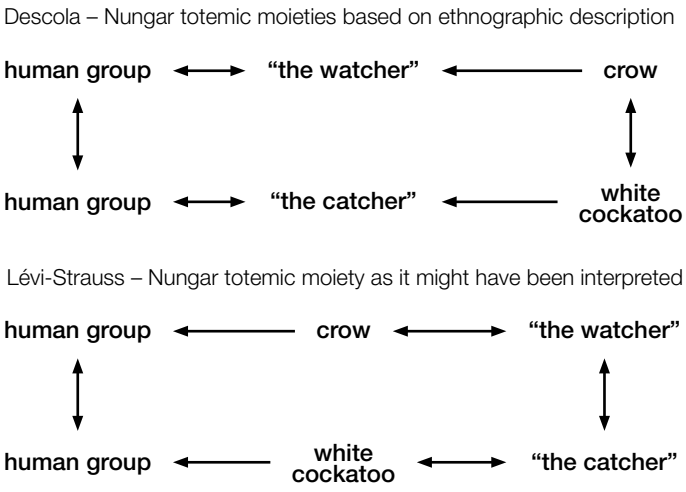
More importantly, then, does an inherently structuralist formulation of totemism have a place in current anthropology? Presently, anthropology can be said to have gone through an "ontological turn". Here, we might take Eduardo Kohn's (2015) definition of ontology as the study of reality and all subjective, human-constructed worlds. Thus, rather than focusing on ontology, Lévi-Strauss places concern upon the epistemological problem of ethnocentrism found in Durkheim's definition of totemism, which he then aims to clear (Nunti, 2009). Epistemology thus questions the nature of knowledge and can consider the origin of knowledge differences (Holbraad & Pedersen, 2017). Lévi-Strauss corrects Durkheim's rudimentary way of classifying totemism; however, he stops short at making totemism a unified ontology, which would allow for the changeable, practical aspects of living alongside non-humans. One can argue that this is what anthropology already is; however, this might just encompass what has been termed "good" anthropology (Kohn, 2015). For the anthropologist, it requires questioning all preconceived assumptions of what the world is, and the validity of these assumptions. Ontology is not fixed in its definition, yet fundamentally aims to go beyond questioning received anthropological knowledge, like kinship structures, to question the nature of everything (Holbraad & Pedersen, 2017). Therefore, it can be argued that the way structuralism totalises systems of differences as variants of a larger framework of logic gives equal precedence to all ways of being, which is at the motivational core of the ontological turn. Lévi-Strauss' totemism, thus, can have relevance today as a structuralist phenomenon.

Structuralism can perform a symmetrisation of all variations of a phenomenon within a set. This is an intellectual claim made by Philippe Descola (2018) who, it can be argued, aims to develop Lévi-Strauss' totemism. As totemism is just one way that humans interact with non-humans, Descola posits that all human–environment interactions can be summarised within four overarching ontologies. He conducts a "symmetrisation"; that is, puts each ontology on equal footing, so that all differing experiences of the world are level variations of each other. The four ontologies are as follows: *analogism*, *naturalism*, *animism*, and *totemism* (ibid.). Descola conceives each human to be made up of an "interiority" and a "physicality", and their worlds to be made up of how these attributes relate to the world around them. "Interiority" concerns mental states: the way humans consider the continuities/discontinuities in non-human minds. "Physicality" encompasses the material: the way physical attributes are seen to differentiate/connect between humans and non-humans (ibid.). The differing ideas about these two states are paramount to Descola's conception of how humans experience the environment around them differently.

Descola's (ibid.) four ontologies seem to encompass four distinct ways of *Being*. *Analogism*, firstly, finds that, upon encountering non-human phenomena, the human's interiority and physicality is entirely distinct from non-humans. This relates to the cosmological model prevalent in the Middle Ages and Renaissance, whereby each entity in the world is separated by minute but distinct differences in ranked systems. *Naturalism* parallels Modernity as an ontology. It denotes humans as relating to the non-human through similar physicality, seeing humans as part of the evolutionary continuum, and sharing similar physical attributes, such as cell structures, with non-humans. Non-humans, though, lack similar interiority through attributes such as culture, soul, or moral conscience. *Animism* relates humans to non-humans through their interiority but not through physicality. The non-human lives alongside them, within social kin structures and villages, however they engage with the world through dissimilar bodily structures (Kohn, 2009). These ontologies are all distinct from *totemism*, allowing totemism to be a singular theory but

Figure 1

Diagram Demonstrating Exemplified Differences in Totemic Classification of Nungar Totemic Moieties According to Descola and Lévi-Strauss



Note. Descola, 2014 (based on ethnographic description); Lévi-Strauss, 1912 (possible, retrospective interpretation)

embedded within the three other ontologies (Descola, 2018).

In Descola's framework, totemism determines that humans within this ontology find the non-human to be analogous with their interiority and physicality. This would mean that humans would see no mental or bodily differences between themselves and non-humans. This is the opposite to analogism because totemic differences create relations, whereas the analogic ontology purely aims to create differences between all phenomena. Descola conceives of this totemism as differing from Lévi-Strauss' framework of abstract totem terms. He reasons that a characteristic better signifies a group's qualities, rather than any morphological or behavioural attributes associated with the species-specific totem term. The totemic relationship is made, instead, to a set of qualities. To exemplify totemism, Descola (ibid.) uses the Nungar of South-Western Australia, where totemism is most prevalent as a singular worldview, rather than in many other places, he emphasises, where cosmologies of both animism and totemism appear to be used. The Nungar divide themselves into two totemic moieties: "the catcher" (*maarnetj*) and "the watcher" (*waardar*). These are respectively symbolised by the white cockatoo and the crow. The abstract qualities of "the catcher" and "the watcher" seem to more accurately embody the properties of each group, representing the group's characteristics (Descola, 2014). We might contrast Descola's real interpretation of the Nungar with what Lévi-Strauss might have concluded through my interpretation of his totemism (**Figure 1**).

The difference in classification is quite minor yet sketches out how Lévi-Strauss' totemism might carve out more of a direct connection between the human and non-human. In Descola's diagram, the humans relate through the difference between a crow and white cockatoo, yet it appears to be better articulated through the terms "the watcher" in opposition to "the catcher", as shown by the single-headed arrows. In my idea of Lévi-Strauss' interpretation, the abstract human qualities are identified, those of "the watcher" and "the catcher", and given more concrete labels through the parallel distinction of the crow and white cockatoo, also shown by the single-headed arrows. From the diagram, I interpret that totemism's addition to the three other ontologies defined by interiority/physicality is confusing when compared alongside Lévi-Strauss' totemism. Within Descola's own example, Descola's totemism seems to remain as a metaphorical system of differences. In fact, he seems to set the human further apart from the non-human by setting their terms of opposing relations as embedded in explicit characteristics of personality, e.g., "the watcher/catcher". Lévi-Strauss would instead consider these characteristics to be implicit in totemic non-human/human relations. Descola (2014) has aimed to create four unified ontologies which allow for all engagements with the non-human. However, I argue that it appears as if totemism is the outlier, remaining at the level of a metaphor rather than an explicit form of being.

DOES TOTEMISM HAVE A PLACE ALONGSIDE ANIMISM?

To explain further, Descola's previous work seems to outline a more Lévi-Straussian definition of totemism which I am more inclined to agree with. His article, "Constructing natures" (1996), deems animism and totemism to be inversions of each other. Animism uses very human categories, such as kinship relations, to create a wide social network of all living beings. Totemism is then seen as an inversion of this, using the distinctions between non-human groups as useful differences for structuring human group differences. Conversely to animism, totemism does not outline social relations between humans and non-humans (Descola, 1996). Descola then moves on from this in his later work, "Beyond nature and culture" (2014), outlining the four ontologies. Totemism and animism cannot be inversions of each other if their "interiorities" are the same—seeing non-humans as having the same souls/spirits—but their "physicalities" are different. Totemism sees animals as having no bodily differences to humans whereas animism acknowledges physical differences. This move in his later work shifts totemism from its initial Lévi-Straussian definition—as a system of social classification—to an ontology which takes totemic relations as much more literal (Descola, 2014).

One can return to Willerslev's (2013) hypothetical statement presented earlier: "I am a bear". Descola unmistakably diverges from Durkheim's ethnocentric interpretation by fully embracing this as a reflection of a worldview—totemism. Non-humans and humans are the same on the inside and outside. When exemplified, as Descola (2014) does through the Nungar peoples, totemism still seems to be a system of differential relations classifying the social divisions of humans. To me, this seems inconsistent. Totemism is a system that separates human groups through meaningful parallel distinctions between non-humans. At the same time, these humans see themselves as mentally and physically analogous to non-humans, yet totemism does not seem to convey any social relationships through creating distinctions. Why, then, if non-humans and humans saw themselves as highly similar, is totemism not also a system of social interaction? I therefore see Lévi-Strauss' definition as more suitable for analytically reviving totemism, as it reduces totemism to a more decipherable phenomenon portraying totemism as a system of logical thought. Rather than an ontology defined by "interiorities" and "physicalities", I return to the view that totemism is inherently structuralist. Its use in current anthropology must therefore remain in the scope of structuralism.

Or perhaps a problem is found in the overwhelming emphasis on theory. Lévi-Strauss' totemism may sketch binary oppositions that, once identified, remain static. Willerslev (2013) argues that a lack of conceivable differences between humans and non-humans in his ethnography with Yukaghir peoples mean they often have to mark these differences through everyday practices. This entails using a practical form of animism rather than navigating the world through conceptual differences. They apologise to animals they hunt, for example, and laugh at animal spirits as ways of differentiation (2013, p. 50). The Yukaghir do not actively aim to differentiate themselves, and still engage in relational activity to make sense of the world (Swancutt, 2022). However, their dynamic modes of relation would make it unsuitable to formulate static totemic relations between themselves and non-humans. This example therefore limits totemism's use as a system of classification; it can't be used to describe all human/non-human relations when humans continuously change the way they relate to non-humans. This might be why Willerslev (2013) pointedly uses the term animism, instead of totemism, to illustrate his point.

CONCLUSION

To conclude, by considering totemism within the framework of social classification, it allows us to make more sense of contemporary theories of totemism within an anthropology that has since been left behind.

Ordering social relations in the way that totemism does, though, does not necessarily mean culture-specific literature becomes 'time-bound' or ethnocentric. Through exploring the literature of Claude Lévi-Strauss and Philippe Descola, I have demonstrated that totemism has the potential to be revived through a structuralist lens. It captures a unique way that humans engage with their environment without direct social interaction. Ultimately, anthropology can benefit from a framework that can bring ethnographies out of the local and specific; identifying trends without generalising, and furthering the anthropology of human-environment relations.

Interdisciplinary Commentary

ANTHROPOLOGY & ARCHAEOLOGY

Totemism, animism, and other ontological "isms": A literature review

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This is a brief literature review intended to contextualise and complement the above article by exploring several of the theoretical frameworks of ontological studies. The prevalence of shamanism amongst totemic cultures is demonstrated by utilising case studies from Siberia and Israel. A study by Pedersen (2001) compared Northern and Southern North Asian ontologies, revealing a relationship between totemism, shamanism and defiance of hierarchical structures. On an interdisciplinary level, research into homuncular flexibility may elucidate complex animal-human relations as well as the importance of indigenous knowledge for science. Cassidy's (2012) discussion on climate change and Cipolla's (2021) posthumanist critique demonstrate the importance of indigenous multivocality in the anthropological ontological field. As the frameworks of ontological "isms" are most often drawn from indigenous case studies, the future concerns of archaeological and anthropological fields—be it climate change or advancing technology—need to consider and centre indigenous voices in the discussion.

Introduction

The above article introduces the reader to Lévi-Strauss's concept of totemism and differentiates it from animism and other theoretical frameworks of ontological studies. To expand upon the author's exploration of totemism as a means of social classification, this literature review will explore totemism and other ontological approaches to animal-human relations case studies. The author primarily discusses Lévi-Strauss's understanding of totemism in Australian Aboriginal communities, and uses Descola to exemplify the application of totemism. This brief literature review will discuss further anthropological case studies that utilise totemism and compare its uses to applications of animism and other ontological approaches. Ontological frameworks are often applied to indigenous case studies; thus, it is important to briefly review the uses of totemism in modern anthropological work and critiques of the posthumanist approach in archaeology and anthropology.

Interpreting animal and human relations

As the author has already provided a detailed exploration of the complexities of defining totemism, this commentary will move to analyse different applications of the theoretical approach to animal–human relations. The above article discussed totemism in Aboriginal Australian communities and therefore this article will discuss examples of totemism in different indigenous societies. As a theoretical concept, totemism seems to have largely fallen out of fashion between the eras of Lévi-Strauss and Descola. In the 1990s, totemism reemerged but was underpinned by concepts from "symmetrical" archaeology. A 2014 article by Robert Miller II continues this idea through a discussion of totemism in Iron Age Israel. The "flying-man" (**Figure 1**), discovered in Dothan, is Miller's (2014) focus for examining totemic symbolism. The artefact appears to combine the image of a clam with that of a man with his arms outstretched; however, it is the hybrid depiction of a person and an animal that creates the image of a "flying man".

If the diagram illustrated by Weeks is utilised in understanding the Iron-Age artefact, the "flying-man" is interpreted through the relationship between a "man" (the human group) and a "clam" (the animal group). As the clam is a non-native species, the suggested interpretation is that the lamp invokes "distant lands" of "supernatural entities" (Miller, 2014, p. 34). The examples from the above article are drawn from ethnographic studies of the Nungar Aboriginal people of Australia; thus, the totemic relationship is discernible. The issue with the archaeological example from Israel is the lack of context or comparative examples to support the totemic interpretation. Indeed, Miller compares the style of the "flying man" to that of the shamanic imagery of Siberia (ibid., p. 35). As Miller notes, the evidence for totemism is limited, especially in comparison to evidence for shamanism, necessitating further exploration

Figure 1

The Flying-Man

Note. The flying-man from "Flying-man lamp from Dothan", by R. D. Miller II, 2014, p. 34, https://www.jstor.org/stable/pdf/jwashacadscie.100.4.0021.pdf. Copyright 2014 by Washington Academy of Sciences.

of shamanism and totemism in other North Asian case studies (ibid.).

Although not discussed in the Weeks' article, shamanism often appears to be associated with interpretations of totemism and animism. In the *Journal of Transpersonal Psychology*, Roger Walsh broadly defined, anthropologically, shamans as "specific groups of religious healers" (2001, p. 2), which can include, but are not limited by, "medicine men, witch doctors, sorcerers, wizards, magicians or seers" (ibid.). An article by Morten Pedersen (2001) discusses the varying examples of totemism, animism, and shamanism in North Asian ontologies. The study compares the ontologies of Northern North Asia (NNA) and the ontologies of Southern North Asia (SNA). Pedersen found that NNA societies were predominantly animistic, whereas SNA societies were predominantly totemistic. The SNA grouping largely contained Mongol peoples where totemism and shamanism seemed inextricably linked. Since totemism is based on vertical hierarchies (as discussed in the article above), it is only shamans within SNA ontologies that can move across the totemic structures (Pedersen, 2001). Whilst shamanism is most associated with SNA ontologies, per Miller's comparison to Siberian shamans, the NNA ontologies also relate to shamanism, if less prominently. As totemism is associated with hierarchy, this leads to the question: is shamanism associated with the defiance of totemic structures? Pedersen's case study associates shamans with wild animals, connected through "metamorphosis" in the totemic hierarchy (Pederson, 2001, p. 418). Following the author above's article on totemism, further exploration of the relationship between totemism, animism, and shamanism in human-animal relations is necessary.

Experimental psychology and neuroscience may introduce some nuance to understanding the symbolic representations of human-animal relations. A 2015 article by Won, Bailenson, and Lanier explores homuncular flexibility—i.e., the body's ability to adapt to control the movement of non-human avatars. The article demonstrates the human body's propensity for adapting to novel forms. As computer science technology advances, further research may reveal the extent to which humans can adapt to external human and non-human bodies. Interestingly, anthropological parallels can be drawn between homuncular flexibility, shamanism, and totemism. Are the shapeshifting shamans of the North Asian Indigenous ontologies further evidence of homuncular flexibility? A more interdisciplinary approach may demonstrate interesting links between Indigenous knowledge and current experimental science.

Indigenous studies criticisms

Rebecca Cassidy's article "Lives with others: Climate change and animal-human relations" (2012) analyses the dynamic relationship between humans and non-humans in the past, and the potential consequences of the future. Cassidy elaborates that it is the poorest and most marginalised that will be most affected by climate change: people who are often pastoralists dependent upon animal-human relations. Cassidy (2012) argues that the future of anthropology necessitates a more holistic approach to the study of animal-human relations, potentially including anthropologists assuming a more activist role. Many difficult questions are posed for archaeologists and anthropologists studying animal-human interactions regarding the lens through which their work should be cast. A great debate in the social sciences is the extent to which current politics should affect the angle of discussions, especially how climate change will and does affect animal-human relations now and into the future.

Critiques of ontology fall under the wider critiques of posthumanist thought. A major critique of posthumanist approaches to Indigenous studies is the issue of "flat ontologies". Bruno Latour's concept of a "flat ontology" (1999, p. 304)—the notion that no object (human or non-human) is more privileged in its influence than everything else—was based on actor-network theory where each "actor" affects every other "actor" with no discernment between human or non-human (Harman, 2015). If the flat ontological model is applied to Indigenous archaeologies, the issue is that it may be inconsistent with Indigenous ontology. However, it has been suggested that it may serve anthropologists and ethnographers well to first flatten their own ontological assumptions and subsequently invite and place "methodological faith" in their interlocutors to sculpt their own conceptions of their own ontology and culture, although not unproblematically (Chidichimo, 2022, p. 52). Similarly, a more recent article by Craig N. Cipolla (2021) entitled "Posthuman potentials: Considering collaborative Indigenous archaeology" argues that posthumanist approaches parallel Indigenous collaboration in archaeology and are conversely beneficial to the discipline. Overall, the posthumanist critique introduces important dialogue that centres Indigenous ontologies in anthropological and archaeological studies which are essential to discussions of totemism, animism, and shamanism.

Conclusion

Following on from the above article, this brief literature review highlighted some interesting examples of animal-human relation case studies to expand the discussion of totemism into other ontological frameworks. The comparison between totemistic and animistic societies was intended to demonstrate the potential anthropological relationship between totemism and shamanism. Interdisciplinary approaches that utilise neuroscience and psychology may provide new avenues for the exploration of ontology in the future. Conversely, as seen in the Miller (2014) and Pedersen (2001) studies, Indigenous anthropology and archaeology may equally provide interesting insight for experimental science. Cassidy's (2012) discussion on climate change and Cipolla's (2021) posthumanist critique demonstrate the importance of Indigenous multivocality in the anthropological ontological field. As the frameworks of ontological 'isms' are most often drawn from Indigenous case studies, the future concerns of archaeological and anthropological fields, be it climate change or advancing technology, need to consider and centre Indigenous voices in the discussion.

PSYCHOLOGICAL & BEHAVIOURAL SCIENCES

Human and non-human animals' relations explained through a Terror Management Theory lens

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Terror Management Theory (TMT) proposes that humans are driven by the unconscious terror of death (Solomon et al., 1991). This commentary provides a non-exhaustive application of TMT to three psychological areas that explain human-animal relations: intergroup relations, development of morality, and emotional development.

Terror Management Theory: A brief introduction

Terror Management Theory (TMT) was developed with the aim to provide an organising paradigm for the many phenomena often studied separately in social psychology, such as intergroup relations and morality (Solomon et al., 1991). TMT proposes that humans have more complex abilities to conceptualise the future compared to animals, and with this capacity comes the realisation that death is inevitable (ibid.). It is not necessarily the act of dying that can create debilitating terror (although this, too, can happen for some), but the fear of "absolute annihilation" (ibid., p. 101). Death entails *not living*, where living is a prerequisite for all behaviour; thus, it takes away all opportunities for enjoyment and growth.

If this fear remained conscious, it would inhibit our ability to carry on with our daily activities (i.e., living), because self-preservation instincts cannot save us from the inevitability of death. As our time alive is limited, so are our opportunities to fulfil our goals, and thus goals should be

intentionally prioritised to maximise self-actualisation (Maslow, 1943). Carver and Scheier (1981 cited in Solomon et al., 1991) developed a hierarchy of standards for self-regulation, where maintaining a positive self-image is one of the superordinate goals of human existence. This positive-self image can only be created through self-preservation (i.e., staying alive), which can be achieved directly and symbolically (Solomon et al., 1991). Direct self-preservation is achieved through fulfilling our biological needs (e.g., food, water, shelter); symbolic self-preservation suppresses our conscious awareness of our impending death.

TMT proposes that symbolic self-preservation is achieved through developing a cultural anxiety buffer, which functions through two components: a cultural worldview and self-esteem (Solomon et al., 1991). The authors propose that people derive a sense of personal value through engaging in actions that meet the standards of their culture, such as occupying certain social positions; the extent to which individuals perceive success in meeting these standards helps to develop self-esteem. In sum, people have a life-long occupation of meeting and upholding culturally variable standards of behaviours and roles in their societies, which serve as a distraction from the terror of death (ibid.). I include references for the empirical base of TMT in the "Conclusion and further reading" section, as an evaluation of the theory is beyond the scope of this commentary.

Intergroup relations between human and non-human animals

TMT proposes that the role of the cultural anxiety buffer is to keep the terror of death in the unconscious, to allow humans to proceed with daily activities (Pyszczynski et al., 2015). However, reminders of human mortality have been found to increase dislike of non-human animals (Beatson & Halloran, 2007), support for their extermination (Lifshin et al., 2017), as well as denial of similarities between humans and animals (Pyszczynski et al., 2015). This is hypothesised to show that when threatened, humans tend to distance themselves as much as possible from animals, regarding them as an out-group (Tajfel & Turner, 2001). This finding is moderated by participant characteristics such as personality type (Pyszczynski et al., 2015), belief in mind-body dualism (Heflick et al., 2015), age (Kahane & Caviola, 2022) and most likely cultural background. This behaviour aligns with the predictions of Social Identity Theory (Tajfel & Turner, 2001), which proposes that when we categorise ourselves to be a part of a social group, we identify with their values, creating a clear distinction between those that belong to the social group and those who do not. To maintain self-esteem, the in-group must compare favourably to out-groups, which may be achieved through discrimination: unequal treatment on account of group membership (Williams et al., 2003).

Discrimination against animals may be based on assumptions that they do not have the cognitive capacity to feel emotions or think, especially if they are less phylogenetically similar to us (Prato-Previde et al., 2022). These assumptions can devalue non-human animals compared to humans, and have been used as a justification for animal maltreatment. However, the perspective of intergroup relations can be used to create more positive relations between humans and animals; for example, some propose that bolstering a sense of human-animal solidarity—"a sense of belonging, psychological attachment and closeness" (Amiot & Bastian, 2017, p. 2)—predicts more positive attitudes and behaviours towards animals. Categorising animals as a part of our in-group may avoid triggering the cultural anxiety buffer; or at the very least, acknowledging the moral nature of all living beings may discourage unfair treatment towards animals.

Child development of morality

The reader may then ask: "*When do we begin to see ourselves as separate from non-animals, if ever?*" Some research suggests that young children are socialised by adults to see moral differences between human and non-human animals (Pallotta, 2008). Ideologies and social practices (i.e., the cultural worldview in TMT) are thought to influence the cross-cultural variation seen in attitudes towards non-human animals, for example if they are regarded as pets, food, research tools, or other categories. Young children do not yet understand the implications and finality of death, so they do not yet contend with the terror of absolute annihilation (Solomon et al., 1991). As they mature, children come to understand that their caregivers, and by extension, themselves, are not infallible in the face of death (ibid.). To deal with this emergent terror, children internalise the values endorsed in the cultural-worldview in their environment; this builds their self-esteem, and helps sustain a sense of their own symbolic immortality as they mature (ibid.).

Although attitudes surrounding non-human animal treatment have been found to differ cross-culturally (Bruder et al., 2022), some researchers theorise that humans use the same underlying moral mechanism when faced with comparing humans and animals: *multi-level weighted deontology* (Kahane & Caviola, 2022). This mechanism applies moral constraints on harming both human and non-human animals, but it is much weaker when considering non-human animals (ibid.). This mechanism is supported by findings that adult humans appear to value human lives significantly higher than non-human lives, even in the absence of the capacity to think and suffer in humans compared to animals (ibid.). However, this differentiation between man and animal is not nearly as pronounced in children. For example, Kahane and Caviola (ibid.) conducted an experiment that gave a moral dilemma to save one human or either one, two, ten or one hundred dogs to US adults and 6- to 10-year-old-children. While adults typically valued the life of a human 100 times more than the life of a dog, 71% of children prioritised 100 dogs over one human. Interestingly, adults' and children's ratings of cognitive and hedonic capacities in both humans and animals were similar. Despite this, children were less morally anthropocentric than adults (ibid.), suggesting that the gradual socialisation of children can create a sharp moral divide between humans and non-humans.

To maintain a positive self-esteem, TMT proposes that people act in accordance with the cultural worldview they are socialised in (Solomon et al., 1991). Depending on the cultural worldview, animals can have symbolic meanings or stereotypes that prompt positive or negative reactions, which likely influences how people behave toward them. Thus, behaviours towards animals that are congruent with the prevalent cultural worldview are reinforced across development.

Emotional development and attachment

Attachment literature indicates that children use caregivers as secure bases during their development, to whom they return in situations of distress (Ainsworth, 1979). A secure attachment between children and caregivers has been found to be beneficial for developing an adaptive internal working model (Bowlby, 1980), which is an internal template on which future relations are built. Thus, positive and secure attachments to caregivers in infancy can translate to mutually beneficial relations between humans and animals, as seen in the well-documented cases of successful pet keeping (Amiot & Santerre-Bélec, 2022).

However, negative experiences with caregivers in infancy can result in an insecure or disorganised attachment, which may impair internal working model formation (Bowlby, 1980). For example, insecure attachment in adults has been strongly associated with animal-hoarding disorder (AHD), where an individual feels the compulsion to "save" as many animals as possible, despite limited ability to take care of them all (Prato-Previde et al., 2022). The accumulation of animals beyond the ability to provide them all with appropriate care results in negative and even fatal consequences for the animals; their caregivers are reluctant to admit that they are not caring for their pets appropriately, and exhibit severe distress upon separation. Disorganised attachment and conduct disorder are two more important correlates of animal mistreatment and abuse, which can start from childhood (ibid.). TMT may explain these links by suggesting that an inappropriate outlet for managing the terror of death leads to inappropriate emotion regulation strategies across development, with more severe consequences for human-animal relations as the human's ability to create harm increases.

Conclusion and further reading

TMT is a useful paradigm that can organise findings across several areas of social and developmental psychology, by suggesting that human

actions are driven by the unconscious terror of death. These findings can be applied to human-animal relations:

- our tendency to prefer in-groups can be leveraged to improve human-animal relations through human-animal solidarity;
- human moral intuitions are deontologically weak with respect to animals, as a result of socialisation in a particular cultural worldview;
- animal treatment can be a reflection of (dys)functional emotional development.

This commentary presents broad, non-exhaustive applications of TMT at the expense of rigorous critiques of the evidence base. For further in-depth discussion, see Pyszczynski and colleagues (2015).

NEUROPSYCHOLOGY

Revisiting the cognitive and neuropsychological basis of animism

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Animist and totemist ontologies have the common principle of attributing sentience to non-human beings and events. In this commentary, two human cognitive traits—*perceptual sensitivity to animation* and *theory of mind (ToM)*—and their potential roles in underpinning this principle are discussed. The former posits that, owing to the importance of identifying animate agents, humans have evolved a strong predisposition to ascribing animacy to anything exhibiting lifelike features; animism is thought to emerge from this bias. This attribution of animacy entails ascribing human-like intentionality, which I argue falls under the latter remit of ToM. In line with this, both cognitive traits place emphasis on the perception and interpretation of motion, involving activation of regions of the brain involved in ToM.

Introduction

Weeks discusses the validity of totemism within contemporary anthropology as a qualified system of social classification and ontology. The discussion presents Sahlins' criticism of Descola's categorisation of totemism as a distinct ontology and argues that totemism is a subset of animism instead. This commentary will hence refer solely to "animism".

Regardless, a core principle shared by most animist and totemist societies appears to be the attribution of sentience, "animation", or "spirit/soul" to non-human beings and phenomena (Swancutt, 2019). While animism is typically associated with non-literate, non-naturalist societies, scholars argue that animist perspectives are also prevalent in literate, naturalist societies, especially in art and literature (Cherry, 1992), making animism a universal phenomenon. Its ubiquity begs the question: is animism inherent in the human psyche, and if so, what are the potential neuro-psychological bases that underpin this? This commentary seeks to revisit this question.

Perceptual sensitivity to ascribing animacy

Guthrie (1995) proposed that animistic ontologies (or more generally, worldviews) emerge from an adaptive perceptual strategy to maximise sensitivity to objects or events of greatest immediate significance, which tend to be *agents* capable of movement, such as animals (as predators or prey) or humans (as partners or foe). When coupled with the inherent uncertainties of the environment and other organisms, along with the prevalence of deceptive strategies in nature such as camouflage, it is argued that the optimal strategy would be to attribute life to *any* object, phenomenon, or even background with features typical of animate beings, especially movement (Guthrie, 1995). The benefits of correctly identifying an animate being significantly outweighs the minimal cost of misidentification; for example, a failure to spot camouflaged predators is significantly costlier than simply misidentifying environmental features for them. It is this evolutionary pressure to interpret the environment for agents that animism is thought to be based on, according to Guthrie (ibid.).

Direct evidence linking animistic worldviews and perceptual biases to ascribing animacy is sparse. Nevertheless, if the predisposition to assigning animacy is as important as Guthrie (1995) suggests, that trait is expected to be positively selected for, such that the perceptual bias *and* the animism that emerges from the former are expected to be ubiquitous within human populations (Schaffner & Sabeti 2008). Hence, evidence for Guthrie's hypothesis is *indirect*, mainly that there is a near-universality of (i) sensitivity to lifelike properties exhibited by inanimate objects, and (ii) ascribing animacy to such objects in human populations.

Arguably the best example of both is that adult humans in literate, naturalistic societies consistently struggle with identifying living things. McDonald and Stuart-Hamilton (2000) found that adults ranging from their twenties to their seventies all make "animism errors", namely by misidentifying non-living items as living beings, even among those undergoing tertiary education. Furthermore, when asked to justify their "errors", study participants often invoke lifelike properties exhibited by these objects, especially movement. Rather than being the consequence of intelligence, these "errors" were suggested to be mostly accounted for by a loss of *knowledge* in defining "life", suggesting that naturalistic perspectives on animacy are learned, not defined by development—contradicting Piaget—but animistic thinking is prevalent even in naturalistic societies.

In sum, Guthrie (1995) posits that, due to uncertainties in perceiving animate agents in the environment, humans have evolved to have a predisposition to ascribe animation to non-human beings and phenomena that exhibit lifelike properties. Consequently, animism is thought to be an emergent property of this evolutionary adaptation. Support for this hypothesis comes from observations on the prevalence of animistic thought in human populations. Despite a lack of direct empirical evidence, the hypothesis provides a paradigm for a cognitive and evolutionary basis for animism, onto which neuropsychological mechanisms could be incorporated.

A role for theory of mind

Animist societies generally interpret sentient or "animated" non-human beings and/or phenomena as goal-directed agents with intentionality; this same perspective is arguably shared within naturalist societies in the arts (Cherry, 1992), or even in advertising, where animistic cues were found to enhance brand favourability (Karpinska-Krakowiak & Eisend, 2021). I argue that, in a sense, ascribing sentience to such beings or events can be interpreted as the product of an extended framework of *theory of mind* (*ToM*)—the attribution of mental states to oneself and other persons—that includes them, with varying degrees of anthropomorphism involved.

While ToM abilities are probably not unique to humans, the complexity of the ToM within humans likely is. Despite recent studies demonstrating that macaques exhibit false-belief attribution, a hallmark of ToM ability (Hayashi et al., 2020), it is likely that their ToM abilities are limited to anticipating the behaviour of others. On the other hand, the (neurotypical) human adult possesses a ToM that behaves as a model for explaining causal relationships involving human behaviour, enabling predictions of the goals and beliefs of others, as well as deception. Extending our mentalising abilities to non-human beings, especially animals, could have numerous advantages in evolutionary terms, namely by allowing sophisticated inferences and predictions on their behaviour. Most notably, while select cognitive deceptive strategies are employed sparsely throughout the animal kingdom for hunting, humans are unique for employing a whole repertoire of deceptive tactics (Moser, 2019), the extensiveness of which I argue can only emerge from our ability to mentalise.

I note that this dovetails with Guthrie's (1995) hypothesis, in that

the latter predicts an oversensitivity to lifelike features *generally*, but ToM could act as a potential mechanism for explaining how *specific*, complex, and human-like intentionality is ascribed to beings exhibiting lifelike features. Both ideas place an emphasis on the role of motion perception in ascribing agency; indeed, an important aspect of the human ToM concerns the accurate inference of intentionality through observing movements. Consequently, motion detection is shown to be linked to ToM and human social cognition at large, as is repeatedly demonstrated with neurotypical individuals (Rice et al., 2016), as well as clinical evidence in individuals with mental impairments (Kelemen et al., 2005), showing that the ability to perceive motion is correlated with performance in ToM abilities.

Evidence in support of the link between motion perception and ToM can be found in neurological studies. Whilst ToM is a complex process involving many neural substrates, the brain regions most heavily implicated in ToM by functional imaging are the cortical midline structures (CMS) and the bilateral temporoparietal junction (TPJ; Mahy et al., 2014). The former is important for self-referential thinking (Shamay-Tsoory et al., 2006; Williams et al., 2005); meanwhile, the TPJ is involved in a broad range of social cognition tasks (Geng & Vossel, 2013), and is implicated in representing the mental states and agency of others (Farrer et al., 2003). Notably, the TPJ is also activated during motion processing, as Lee and McCarthy (2016) found using fMRI that common regions of the TPJ were activated during ToM and motion perception. Whilst the literature emphasises the importance of interpreting motion for social behaviour between humans, I argue here that one might extrapolate this to include our interactions with animated beings at large, such as for discerning between hostile or prey-like behaviour, amenable to future research.

In short, I argue here that extending ToM abilities to non-human agents could act as a primary cognitive mechanism from which a key feature of animism—attributing agency to non-human beings—emerges from, owing to strong similarities between that and the cognitive skills and outcomes of ToM. This can be thought of as an extension of Guthrie's (1995) hypothesis, acting as a mechanism for explaining the complexity and specificity of animistic perceptions, with a particular importance for motion perception underpinning both ideas. Neuroimaging studies suggest that ToM is a complex neural process requiring integration from many brain regions, chiefly involving the CMS and TPJ, with a particular importance for motion processing as an input. Collectively, this suggests that ToM abilities could be an important contributor of animistic interpretations of the world.

Bering (2002) pushes the significance of ToM further to include *all* philosophical–religious theorising in a systematising framework he describes as the *existential* ToM (EToM). Under this paradigm, the ToM's explanatory framework is extended to consider life events as interpretable and affected by agents with intentionality. Akin to Guthrie's (1995) position, the EToM is suggested to have emerged as a response to interpret the uncertainties inherent in the world into readily explainable events, as well as confer a sense of psychological control. It is of my opinion that both EToM and non-human ToM as discussed earlier could complement each other in shaping animistic ontologies or worldviews, as they both reinforce the idea of causal relationships being shaped meaningfully and intentionally.

Conclusion

For this commentary, I contend that animist ontologies can be thought of as an integration of perceptual sensitivity to animation and ToM to hence ascribe sentience to non-human beings or phenomena. Nevertheless, many unanswered questions remain. There are still significant shortfalls in our understanding of the neuropsychological basis of the cognitive processes described here, even within neurotypical individuals. Pattern recognition and visual imagery is likely important but left unaddressed, as they are not the focus of this commentary. More interestingly, the postmodernist perspective that all societies effectively create relationships and hence animate the "objective" world offers enticing possibilities for a unifying neuropsychological model of ontology.

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SOCIAL ANTHROPOLOGY

"Welcome to Europe!": The Violence Continuum and the Refugee Crisis in Lesvos

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Since 2015, Lesvos, a Greek island in the Aegean Sea, has been associated with a humanitarian crisis. The island has become a gate to Europe for more than tens of thousands of migrants who are fleeing wars, conflicts, and violence to seek refuge in Europe, but often get stuck in one of the asylum hotspots in the south of Europe (Iliadou, 2019). During their time in such a hotspot, migrants often experience a continuum of violence, ranging from direct physical violence to invisible structural violence enacted through EU border politics (Topak, 2020). In this paper, I argue that the everyday violence experienced by migrants is intertwined within a broader structural violence, which is at the core of the biopolitics of Europe, through which the lives of migrants are being regulated. The aim of this paper is twofold: to improve awareness of the often-unknown violence encountered by migrants, and to contribute to the academic literature by exploring the violence continuum and how different forms of violence are intertwined (Bourgois, 2004; Scheper-Hughes & Bourgois, 2004). First, I introduce a brief overview of migrants *en route* to Lesvos. Second, I discuss the violence enacted on those people in relation to the concept of *everyday violence* (Bourgois, 2004). Third, I discuss the broader EU border politics in relation to the concept of *structural violence* (Farmer, 2004; Galtung, 1969). These discussions allow us to identify and place the different forms of violence occuring on Lesvos onto a violence continuum.

INTRODUCTION

Camp Mavrovouni, August 2022. It is 2:58 p.m. I am watching the time on my phone, as it slowly passes by. I feel a warm breeze from the seaside, and I look up to the sky. The sun shines brightly and warms the earth. I am turning around to look at the half-closed gate and the elevated fences with barbed wire on top. We are waiting for a bus with around thirty *New Arrivals*[1] to come into camp. About one hour earlier, we got a phone call; a group of migrants[2] is on its way to camp. I hear the familiar sound of a bus coming closer, and so does the police. The bus stops right in front of the gate and people get out under the watchful eye of at least ten policemen. They follow us into camp as we are assigning their new *homes* and give them a sleeping bag, a bundle of clothes, and a hygiene kit. People start coming out of their tents and gather at the metal gates. "Welcome to Europe!" They cheer and applaud for the newcomers. People start crying, laughing, and embracing. People are reunited with their loved ones, but also find out their losses and missing persons.

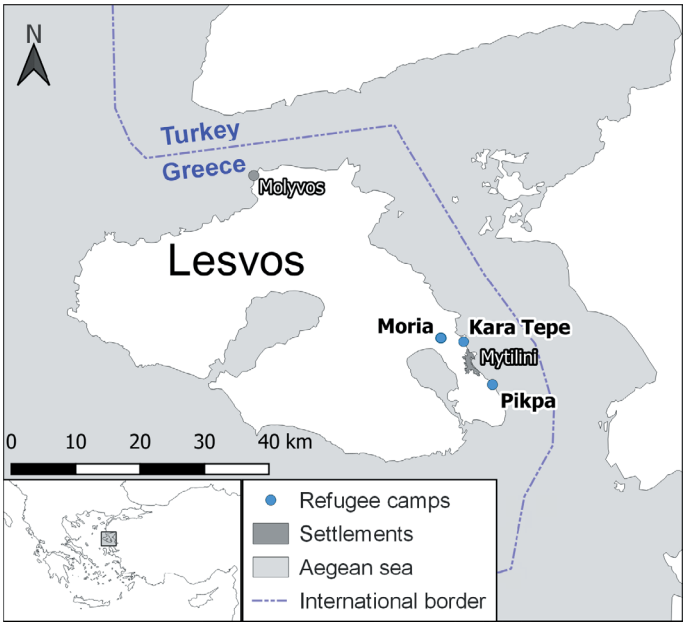
This was a usual day during my time working in the refugee camp on Lesvos[3] in the summer of 2022. I was a volunteer in the quarantine zone, checking in *New Arrivals*. According to the Aegean Boat Report (2022, p. 3), 65 boats with a total of 1,344 people arrived on the island between January and August 2022, far exceeding the other Aegean islands with Samos and Kos in second and third place, respectively—41 boats with 896 people and 41 boats with 1,040 people. These migrants, fleeing their countries for multiple reasons, risk their lives in the hope of a better future in Europe, but far too often get stuck in one of the refugee hotspots in the south of Europe, where they encounter a continuum of violence in violation with International Humanitarian Law (Iliadou, 2019; Topak, 2020).

Therefore, the aim of this paper is twofold: (1) to improve awareness of the obscured violence experienced by refugees on Lesvos as, according to the United Nations High Commissioner for Refugees (2015; UNHCR hereafter), this island hosts the highest number of refugees in Europe's most famous refugee camp; and (2) this paper contributes to the academic literature in that it explores the continuum of violence and how different forms of violence are intertwined. As most academic literature focuses on different forms of violence and their intertwinement in times of war and in places of war (Scheper-Hughes & Bourgois, 2004; Imbusch et al., 2011), the case of Lesvos adds a unique perspective on the continuum of violence by focusing on a place of peace where the side effects of war and its refugee flows are reflected.

The central question of this paper is: how can the violence experienced by migrants on Lesvos be viewed in the continuum of violence in relation to everyday and structural violence? First, I introduce a brief general overview of migrants *en route* to Lesvos and the practices associated. Second, I explore the violence encountered by migrants on the island in relation to the concept of *everyday violence* (Bourgois, 2004). Third, I discuss the broader EU border politics in relation to *structural violence* (Farmer, 2004; Galtung, 1969) and the concept of *necropolitics* (De León, 2015; originally coined by Mbembe, 2003) as part of *biopolitics* (Foucault, 1997), to conclude that the everyday violence faced by migrants is intertwined with the structural violence in a continuum, which is at the heart of the biopolitics of Europe. This continuum of violence ranges "from direct physical assault to symbolic violence and routinized everyday violence, including the chronic, historically

Figure 1

Lesvos and its Main Reception Centres



Note. From *Asylum seekers and migrants in Lesvos, Greece, 2019 –2020*, by J. S. Jauhiainen, and E. Vorobeva, 2020, p. 6. Copyright 2020 by Jussi S. Jauhiainen and Ekaterina Vorobeva.

embedded structural violence whose visibility is obscured by globalized hegemonies" (Scheper-Hughes & Bourgois, 2004, p. 21). A focus on this continuum allows scholars and practitioners alike to understand different forms of violence across social and geographical time (Bourgois, 2004); violence does not remain fixed in one moment or one act. Rather, different forms of violence acquire different meanings, actions, effects, and intertwinings (Scheper-Hughes & Bourgois, 2004).

CONTEXT: *EN ROUTE* TO LESVOS

Since 2015, Lesvos has been associated with the arrival of tens of thousands of migrants into Europe. The route to the island is known as the Eastern Mediterranean migrant route (UNHCR, 2015, p. 11). The island is in the Northern Aegean Sea, situated across from the Turkish coast, and is one of four Aegean islands (among Chios, Samos, and Limnos) hosting EU-funded asylum hotspots (see **Figure 1**). Migrants who venture this route seek to escape across the sea with the help of smugglers. Jussi Juahiainen and Ekaterina Vorobeva (2020) describe how migrants in Turkey are dependent on smugglers to reach the island. Before crossing, the migrants are placed in a holding place to wait until the sea conditions are favourable and the maximum number of border crossers is reached to fill a vessel—usually between 35 and 45 people. Upon crossing, smugglers launch after daylight on boats that are often rigid inflatable boats or wooden fishing boats, without food and water and with life jackets only available to those who can afford them. In these conditions, migrants set off for the shores of Lesvos.

During these crossings, migrants often experience direct physical violence in so-called normalised "pushbacks", orchestrated by the Greek coastguard, a paramilitary organisation— known as the *Harbour Corps-Hellenic Coast Guard*. According to Dimitris Koros, such "pushbacks" entail "the arbitrary removal of third-country nationals without assessing the legality of their entry" (2021, p. 239) with meticulous checking of personal items and on many occasions verbal and physical abuse, after which the boat is pushed back in open waters towards Turkey. Other violent encounters with the Greek coastguard on sea include actively trying to capsize refugee boats and shooting around their boats to make them turn around to Turkey (Koros, 2021). A statement by the UNHCR (2022) claims that since January 2022, more than sixty migrants died on the Aegean Sea when trying to reach Lesvos as a consequence of these violent encounters.[4] In September 2022 at the 77th session of the United Nations General Assembly, President Tayyip Erdoğan of Turkey accused Greece of turning the Aegean Sea into a "refugee graveyard", as the Turkish coastguard regularly pick up desperate migrants on boats that have been floating for days on open waters, or encounter dead migrant bodies off the coast of Turkey (Bathke, 2022). However, until this day, Greece denies any allegation that indicates the practice of "pushbacks" into Turkish waters. In terms of the violence continuum, these "pushbacks" are a form of direct violence, as the Greek coastguard uses physical violence to prevent refugees from reaching the shores of Lesvos.

IN LIMBO: BEING A REFUGEE IN LESVOS

The physical direct violence experienced *en route* to Lesvos continues for migrants in everyday life on Lesvos. Upon arrival on the island, migrants are taken into *reception centres*: these are detention camps aimed at enclosing undocumented people after their arrival, to register, fingerprint, and select migrants who will be relocated to other countries (Guiraudon, 2018). One such reception centre was Moria (see **Figure 1**), recently replaced by camp Mavrovouni—nicknamed by locals as Moria 2.0—as Moria was destroyed by a fire in September 2020. In these detention camps, often overseen by the UNHCR, conditions are considerably below basic living, health, and safety standards, including (1) extremely poor hygiene conditions; (2) insufficient quality of food; (3) serious overcrowding; (4) a lack or limited access to education, healthcare, and employment; and (5) acts of violence and abuse perpetrated by other migrants as well as the police (Iliadou, 2019; Topak, 2020). These conditions can be placed in the structural realm on the violence continuum, as these conditions are structural factors resulting in direct physical violence, which I discuss below.

Acts of violence and abuse are well-documented by Özgün Topak (2020), who conducted field research in camp Moria. One of his interviewees described the camp as a struggle for survival, causing thefts, fights, and other forms of violence, such as domestic and sexual violence. He stated: "[There are] a lot of fights [in the Moria camp]. People killing each other, burning the camp, stealing. On the first week that I came, they stole my phone" (Topak, 2020, p. 1869). Another interviewee stated: "All night there was fighting; in the food line there was fighting. Every night I could not sleep. Maybe someone will kill me, they will kill my son, they will burn my tent" (ibid., p. 1858). In addition to the violence perpetrated by other migrants, Evgenia Iliadou (2019) shows through her fieldwork on the island, among both refugees and non-profit organisations (NGOs),[5] that police brutality is a common phenomenon among migrants. An NGO, operating in former Moria, stated:

> Police violence is omnipresent on Lesbos. It happens in the day, in the night, in the street, in the police station, in Moria prison, and to the people with and without papers. Every day on the island, people are controlled, harassed, humiliated, insulted, and beaten. (No Border Kitchen Lesvos 2017, cited in Iliadou, 2019, p. 79)

As a result of these daily violent encounters, migrants live in a constant situation of fear. According to a 2018 Refugee Rights Europe survey, of the 311 Moria camp resident respondents, 65.7% "*never [felt] safe*, while only 8% felt "*quite safe*" or "*perfectly safe*" (Gallagher et al., 2018, p. 9). Furthermore, 47.1% reported experiencing violence perpetrated by other migrants, while 47.4% reported experiencing violence perpetrated by the Greek police (ibid., pp. 12–13), showing that at least nearly half of the sample has encountered violence on the island. These statistics show that the experienced violence is not unidirectional, with refugees being depersonalised victims; it is a more pervasive issue affecting the entire system of refugee camps, in which a spiral of different forms of violence influence each other.

What is apparent in the discussion above, is that refugees live in a constant situation of direct interpersonal violence, ranging from verbal and physical violence during "pushbacks" to fights, killings, and abuse by other migrants and the police on the island. Moreover, these violent encounters are embedded in the everyday lives of refugees: "[e]very day

on this island, people are controlled, harassed, humiliated, insulted, and beaten" (No Border Kitchen Lesvos, 2017, cited in Iliadou, 2019, p. 79). Therefore, this violence can be conceptualised as *everyday violence*, described by Philippe Bourgois as "a focus on the individual experience that normalizes petty brutality and terror at the community level and creates a common sense of ethos of violence" (2004, p. 426). Refugees thus adjust to their violent surroundings by adopting survival strategies, such as using backways to become as invisible as possible, suggesting normalised mechanisms to cope with the everyday experienced violence (Iliadou, 2019). Evgenia Iliadou (2019) describes a case in which refugees make use of narrow sideroads along the coast to avoid police encounters on the main roads. In addition, this violent ethos affects different refugees differently; refugee men are more likely to be beaten, scolded, or arrested by the police than women and children (ibid.). Consequently, men more often make use of these backways than women and children, who in turn feel unsafe on the narrow sideroads for fear of being sexually violated and therefore prefer to stay on the main roads (ibid.). As these coping mechanisms show, refugees exert a certain level of agency in coping with the spiral of intertwined forms of violence.

According to Heath Cabot (2012) and Topak (2020), this everyday violence is aggravated by a prolonged state of waiting, as many are not allowed to travel geographically from the island as long as their asylum application is not yet confirmed. Hence, migrants are trapped in a liminality of waiting in-between Turkey and Europe, resulting in psychological violence amongst refugees of all ages (Topak, 2020). A migrant stated: "Everyone is in a bad mood psychologically, and they start fighting for no reason almost" (ibid., p. 1869). Many migrants feel passive, hopeless, anxious, depressed, and even traumatised. Voluntary psychologists and social care workers from diverse NGOs do everything in their power to assist these refugees, but resources often fall short and are only provided to a very limited extent by the Greek government and the European Union (EU), another structural matter on the continuum of violence.

This everyday direct and psychological violence is not an isolated case. As Bourgois (2003) shows how everyday violence, enacted through a violent street culture among crack sellers in East Harlem, New York, is the product of broader invisible structures, so too is the everyday violence experienced by migrants on Lesvos intertwined with broader structural factors. This aligns with Galtung's (1969) argument that visible direct violence is a consequence of invisible structural violence—I turn to such discussion now, particularly to how EU border politics may be embodied in the Dublin Regulation and the EU–Turkey deal.

THE BIGGER PICTURE: EU BORDER POLITICS

The EU has played a crucial role in developing its border politics and procedures applicable to refugees arriving on Lesvos. The EU's Common European Asylum System sets out who qualifies for international protection and covers all aspects of the European asylum process (European Commission, 2020). The groundwork for its procedures is embedded in the Dublin Regulation,[6] a European law first implemented in 2003 (Cabot, 2012; see UNHCR, n.d.). Although some minor changes have been made since, the regulation still determines which EU member state is responsible for examining an asylum application; usually the country in which a migrant first arrives. Consequently, this rule has led to an uneven distribution of migrants among member states, creating so-called "refugee hotspots" across the southern borders of the EU in countries, such as Spain, Italy, and Greece (Cabot, 2012). The southern borders of the EU countries receive most migrants as most migrants migrate from African and Middle-Eastern countries. With the dramatic increase in the number of migrants arriving in these hotspots since 2015,[7] the EU has increased its efforts to externalise migration flows through agreements with countries of origin and transit, such as Turkey and Libya, providing development aid in exchange for return regulations (Iliadou, 2019).

Regarding Lesvos, one such agreement was the EU–Turkey deal, signed in 2016, in which Turkey would use any means necessary to stop people from travelling illegally to Greece in return for €6 billion to improve the humanitarian situation of refugees in Turkey, and visa-free travel for Turkish nationals in Europe (Lehner, 2018). Together with the Dublin Regulation, this deal resulted in Greek liminal open-air prison islands for migrants near the Turkish coast. As previously stated, those arriving from Turkey by boat are placed under geographical restriction: they cannot leave the island until their asylum case has been processed by the Greek government, which can take more than three years of indefinite waiting (Cabot, 2012). Moreover, acting as the gatekeeper of *Fortress Europe*, Greece has hardened its stance on both asylum and border control practices, such as increased detention of migrants, bureaucratic barriers in the asylum process, including the requirement of fingerprints, as well as the earlier discussed normalised "pushbacks" with the help of EU border agency, Frontex (Iliadou, 2019). This hardened stance of Greece on its border politics has resulted in migrants now experiencing even more violence (including its various forms), as they must find illegal and arguably more vulnerable ways of travelling. While in 2015 refugees were received with solidarity from the Greek population, in 2022 refugees were subjected to resentment and hate of the Greek population, as refugees kept coming and tourism had collapsed (Cabot, 2012).

This increased surveillance through confinement in detention camps and the asylum process can be conceptualised as a biometric act, referring to Foucault's (1997) thoughts on *biopolitics*; that is, the way in which governments govern the biological life of people. The ways in which EU border politics, a political system, regulates the life of migrants within and beyond its borders through bureaucratic means is a form of biopolitics, as it concerns techniques for subjugating migrant bodies. Even more, it contains a form of *necropolitics*; that is, the use of power to decide how certain people may live and how others should die in a state of exception (see Mbembe, 2003). Jason De León (2015), taking this idea, argues that the Sonoran Desert between Mexico and the United States has become a state of exception, where the abnormal is normalised through a form of necropolitics, which decides the ways in which some border crossers can live, and others must die. Similarly, Lesvos is a state of exception where the abnormal is normalised through otherwise prohibited practices, such as "pushbacks" and severe living conditions, thereby determining in what ways migrants can live in detention camps or must die at sea. In short, EU border politics not only determines the life and death of these refugees, but also the ways in which life and death are enacted upon these people.

These structures of the EU border politics are a characteristic of structural violence, a concept coined by medical anthropologist Paul Farmer, who defined the concept as "violence exerted systematically—that is, indirectly, by everyone who belongs to a certain order" (2004, p. 307). Johan Galtung similarly defined the notion as "the violence built into the structure and showing up as unequal power and consequently as unequal life chances" (1969, p. 171). Migrants arriving on the borders of Europe experience this violence as these structures of EU border politics allow for brutal indignity and dehumanisation of migrants—they are excluded from obtaining human rights, as designated in the Geneva Conventions of 1949[8] and the European Convention of Human Rights 1950 (Guiraudon, 2018). As mentioned, refugees in detention camps on Lesvos are often denied access to basic living, health, and safety standards (Topak, 2020). Furthermore, the participation of multiple actors in those politics, such as EU member state governments, NGOs, and paramilitary organisations, and the secrecy surrounding its practices, obscure the lines of responsibility through which it often becomes impossible to assign individual responsibility—another characteristic of structural violence (Farmer, 2004). This obscuration of responsibility leads to the deterioration of the wellbeing and safeguarding of migrants. A well-known case entails the failures of European states to investigate reports of abuse and violation among refugees (Human Rights Watch, 2022). Human Rights Watch (2022) documented several reports in which different European countries abandoned their duties towards migrants, including Poland and Belarus. Polish officials repel those who try to cross or push back those who initially succeed in crossing the border. Belarusian officials in turn beat and detain those who return and coerce them to try to cross into Poland again (ibid.). Consequently, refugees end up in a state of limbo on the border between Poland and Belarus, with both countries taking no responsibility for any of these migrants in deteriorating conditions without access to basic humanitarian services—including food and

water—resulting in illnesses and deaths (ibid.).

CONCLUSION

In this paper, I have explored a wide continuum of violence experienced by migrants on Lesvos. Although not every aspect of this continuum could be discussed, migrants on the island encounter violence: ranging from direct physical violence, such as the normalised "pushbacks", fights and abuses of other migrants and the police in everyday life, to psychological violence, because of a state of waiting *in limbo*, to indirect structural violence perpetrated through biopolitical EU border politics. Galtung (1969) argues that these forms of direct violence are an outcome of the structural factors underlying the issue on the violence continuum. As migrants experience radical social exclusion through detention, experience migrant and police brutality, and as they are dehumanised by severe living conditions in conflict with human rights and the psychological harm of indefinite waiting, migrants on Lesvos indeed experience a continuum of violence. In this continuum, violence cannot always be strictly labelled. This intertwinement of different forms of violence, seized in a continuum, allows for a unique perspective on the case of Lesvos through viewing different forms of violence across social and geographical time (Bourgois, 2004). As shown in this paper, different forms of violence and its intertwinements acquire different meanings, actions, and effects, as violence does not remain fixed in one moment or one act.

Rather than being places of safety, after fleeing war-torn countries, the EU fails to offer protection to refugees arriving at the borders of *Fortress Europe*. Violent practices surrounding the refugee crisis are often shrouded in secrecy, as European states have failed to investigate reports of abuse and violation, despite mounting, credible evidence (Human Rights Watch, 2022). Therefore, future research should focus even more on the violence encountered by migrants, on islands such as Lesvos, which now hosts 40 percent of all arrivals by sea to Greece, far exceeding the other Aegean islands (UNHCR, 2022a). With the deteriorating conditions in Somalia through drought and famine, in Uganda with new outbreaks of violent conflict, in Afghanistan with the Taliban in power, and in Sudan with the unpredictability of new outbreaks of violent conflict, the number of refugees arriving in southern Europe already rocketed a new record in 2022 (ibid.). With this prospect in mind, refugee numbers will most likely rise in the coming years. As Matthieu Aikins (2022) illustrates in his book, *The Naked Don't Fear the Water*, by making the refugee journey himself from Afghanistan to Athens, the Eastern Mediterranean migrant route is by far favoured among refugees, as Turkey and Lesvos are only 1.5 kilometres away from each other. Therefore, it is essential to understand the violence continuum experienced on Lesvos to contribute to the improvement of conditions for migrants on Lesvos both now and in the future. However, to say that migrants are passive puppets in this violence is not accurate; they too exert a certain agency while being *in limbo*, including the briefly mentioned coping mechanisms which could be another point for future research.

In sum, there is indeed a bitter "Welcome to Europe!", for at least the ones who survive the "refugee graveyard" and make it to the shores of Lesvos and continue to encounter the continuum of violence. As one interlocutor, Salma,[9] told me on her self-made wooden bench before her tent, watching the golden sun set into the sea: "Earth shares with us the same sunset you see, but Europe doesn't share the same human rights you have, while I'm human too."[10]

NOTES

1. *New Arrivals* is the official name used by organisations in camp Mavrovouni for people just entering camp.
2. There are many terms for people who try to enter Europe without permission, such as *illegal migrants*, *gelukszoekers* (*luck seekers*), *economic migrants*, *real migrants*, etc. In this paper, I adopt the terms *migrants* and *refugees* to describe people seeking a better future in Europe for reasons of their own.
3. The name *Lesvos* or *Lesbos* means the same. In the Greek language, the B is pronounced as a V. Although *Lesvos* and *Lesbos* are used interchangeably in the English language, I maintain *Lesvos* in this paper as, in my opinion, this represents the Greek language.
4. This estimation of the number of deaths is only based on migrants trying to reach the island Lesvos. As practices on the Aegean Sea are often ambiguous and shrouded in darkness, exact numbers are not possible to record.
5. NGOs operate independently of any government to address a social or political issue. Examples of NGOs in the reception centres on Lesvos are *Médecins Sans Frontières* (MSF), EuroRelief, Boat Refugee Foundation (BRF), and the International Committee of the Red Cross (ICRC). Recently, there has been a debate around the independence of NGOs, as most NGOs rely heavily on donations from governments. For further debate, see Williamson (2011).
6. The Dublin Regulation was officially agreed on in 1990 and became in force in 1997. It operates on the assumption that "as the asylum laws and practices of the EU States are based on the same common standards, they allow asylum seekers to enjoy similar levels of protection in all EU Member States" (UNHCR, n.d.) The irony is in the fact that its regulations seek to *benefit* migrants, while the regulations often have been used as an excuse by EU countries to abstain from receiving migrants, as they enter in the south of Europe.
7. The sharp rise in the number of people arriving in Europe was a leading factor for this agreement. In 2015, almost one million refugees arrived in the EU, while more than 3,500 lost their lives while making the journey (International Rescue Committee, 2022).
8. The Geneva Conventions, established in 1949, are agreed upon by all 196 recognised countries in the world, and form the core of international humanitarian law, regulating the conduct of armed conflict and seeking to limit its effects (ICRC, 2014). They are aimed at protecting people who do not fight, such as civilians, and people who are no longer able to fight, such as wounded soldiers.
9. To maintain anonymity, the name Salma is a pseudonym.
10. Personal communication, August 3, 2022.

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CAMBRIDGE JOURNAL OF HUMAN BEHAVIOUR

SOCIAL ANTHROPOLOGY

On "Caste" and "Untouchability" in the Robidas Community, Lalpur Village, Bangladesh

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Caste discrimination remains one of the most severe forms and forgotten violations of human rights of the twenty-first century. In Bangladesh, caste hierarchy and purity operate through the practice of "untouchability". In this article, I focus on the Robidas community of Lalpur village, under the Brahmanbaria district, who are regarded as "untouchables" and given limited access to social life. They face discrimination and racial prejudice in almost all spheres of life, given their descent which is said to absolutely determine their inferiority. Now, because of their illiteracy, economic insolvency, and caste identity, the Robidas are bound to continue working in their associated "traditional occupations". Here, I will explore the social construction of Robidas' identity and livelihood and how they have maintained religious, social, and group boundaries. With this, I will also address other relevant issues such as the lived experience of being a Robidas and how higher caste people (the Brahmin) have kept the Robidas apart for so long in the name of religion.

INTRODUCTION

Caste has been defined as a "system of birth-ascribed stratification, sociocultural pluralism, and hierarchical interaction" (Berreman, 1967, p. 70; Subedi, 2013), and, among anthropologists, caste has largely been imagined to be a (Pan-)Indian phenomenon (e.g., Dumont & Pocock, 1957; Dumont, 1970; Leach, 2008/1967; Mayer, 1960; Marriott, 1976). The caste system as a hierarchical manifestation of religious and/or social status is considered to be a common phenomenon throughout South Asia, exclusively found among those who follow Sanātana Dharma (an endonym for Hinduism). Those at the bottom of society—i.e., the "untouchables", the "Harijans", or, as termed by Ambedkar (1948), the "Dalit"—are stigmatised, ritually and occupationally polluted, and despised (Subedi, 2013). Mahatma Gandhi bestowed them with the euphemistic name, *Harijan*, meaning "children of God" (Asaduzzaman, 2001, p. 3). According to Dumont (1970), it is not possible to explain the nature of the caste system without acknowledging the fundamental antagonism between (religious) purity and pollution that defines many of the principles in Hinduism.

Bangladesh gained independence in 1971, following a nine-month bloody war with Pakistan (van Schendel, 2009). Bangladesh's liberation war was more than just a struggle for independence waged by Bangladeshi nationalists; religion was a major motivator. The Pakistani government longed to convert Bangladeshis into model Muslims by "alienating them from their Hindu roots" (European Foundation for South Asian Studies, 2017, p. 1). According to the 1974 census, Hindus were the dominant non-Muslim group, accounting for 13.5% of the Bangladeshi population, before being reduced to 8.54% in 2011 (Bangladesh Bureau of Statistics, 2022, p. 65). Today, Hindus remain the second largest religious group (~13.1 million), accounting for 7.95% of the total population (ibid.). Dalits (viz. "untouchables"), on the other hand, make up 1% of Bangladesh's total population (Chowdhury, 2009, p. 1). Bangladeshi Hindus are traditionally divided into upper, lower, and scheduled castes, hierarchically ordered as follows: Brahmin (priests and teachers), Kshatriya (warriors and rulers), Vaishya (traders and merchants), and the lowest caste, Shudra. The last of these include traditional serfs, craftsmen, agricultural labourers, and outcasts who perform degradable manual labour (Mohanty, 2004). However, "untouchables" or "Dalits" lie outside this hierarchy, i.e., remaining separate from the *Varna* system. In Bangladesh, "untouchables" are identified mainly with their traditional occupations "such as fishermen, sweepers, barbers, washermen, blacksmiths, goldsmiths, cobblers, oil-pressers, boatmen, weavers, butchers, hunters, sawyers, gardeners, tailors, drum beaters etc" (Islam & Parvez, 2013, p. 12).

The caste hierarchy in Bangladesh operates through the practice of "untouchability" with the main ideologies of impurity and inequality being intergenerationally transferred among descendants. According to the Bangladesh Dalit and Excluded Rights Movement and other organisations (2013, p. 2), around 5.5 million Dalits in Bangladesh faced caste-based discrimination, characterising "untouchables" as deficient and powerless. This rhetoric is often used to justify exploitation and violence against "untouchables" (or "Dalits").

FIELDWORK

This article focuses on the Robidas community in Lalpur village, found in the eastern Bangladeshi district of Brahmanbaria (a Brahmin-dominated district). Specifically, Lalpur is one of the Union Parishad of Ashuganj Upazila under the Brahmanbaria district (Bangladesh Bureau of Statistics, 2013) and the Robidas community is located in the northern part of the Lalpur Bazar on the banks of the river Meghna. Many Robidas are located in the most inhospitable areas on the outskirts of the village. Lalpur village also upholds the Hindu caste system, recognising categories of Brahmins, Vaishyas, Shudras, with the Robidas community being identified as Dalit and often referred to as "Muchi", "Chamar", or "untouchables".

During my research, I used both primary and secondary data collection. I was able to interview 60 Hindu people (aged between 25 and 80)—25 Brahmin, and 35 Robidas—in the Lalpur community between December 2019 and March 2020. I conducted all research in my mother tongue and the dominant language of my interlocutors, *Bangla* [Bengali]. These interviews consisted of both structured and unstructured questions. I find it important to note that when my interlocutors were being questioned, they first turned to one another to construct conjoined and congruent responses. However, I often persisted that individual responses were given to avoid corroboration and other influences on responses. Religion, as a subject matter, was a sensitive topic within the village (and, arguably, Bangladesh more generally). Namely, my interlocutors became visibly awkward and hesitant when discussing issues such as the Hindu caste system and other religious issues, aligning these problems with "the government" or "private organisations". After explaining the reasons and objectives of my research, however, they felt free to communicate. As well as secondary literature (including data collection books, reports, and documents), I engaged with several qualitative studies that focused on Robidas daily life, social interactions with their own community and with Brahmins, perceived social status, and religious undertakings. These studies included 5 focus group discussions with the Robidas; 20 in-depth interviews with 10 Robidas cobblers and 10 Brahmin priests; and 40 key informant interviews with 25 Robidas and 15 Brahmins.

Whilst there are many writings on the caste system in India, there are few ethnographic engagements with the religious dogma of Hindu caste system in Bangladesh. There is even less research on the visible and invisible boundaries between the Robidas and the Brahmin community. Thus, this article aims to understand the lived experiences of "untouchability" among the Robidas community in relation to a religious orthodoxy. I turn to discuss the following areas of social life in which the Robidas are discriminated against by the upper castes: (1) marriage strategies; (2) religious worship; (3) food habits; (4) occupation; and (5) entering the Brahmin house.

MARRIAGE STRATEGIES

Brahmins are imagined as being the highest caste people by all in the village. According to Brahmins, high caste people should not marry people of lower caste; indeed, they could not begin to imagine a marriage between their son/daughter and someone from the Robidas community. Relations were to be kept endogamous (on the marriage between different *jaat* groups, see Asaduzzaman, 2001, pp. 28, 71–98). Thus, Brahmin are to only marry another Brahmin, as inferred by many in their reading of religious texts, including the *Bhagavad Gita* and *Vedas*. Outlining this explicitly, one Brahmin interlocutor stated that:

> Brahmins do not marry between other castes, it is common in our Hindu religion that whichever caste he belongs to, he has to marry within that caste. This is what our religion says. (Personal communication, 2020)

The Robidas also think that they have to get married according to the rules of their religion or their caste. For the Robidas, too, it is not right to marry outside one's caste. However, there are some differences between the Brahmins and Robidas communities in marrying within the same *gotra* [lineage]. Brahmin have 49 *gotras* in their caste, but they do not allow within-*gotra* marriage in their caste (ibid., p. 76). For example, a Brahmin interlocutor opined that:

> Brahmins do not marry within their *gotra* and think *gotra* means blood relatives/relations. And if there is a blood relationship between them, then, they can never get married. So, marriage in the same *gotra* among Brahmins is by no means reasonable. However, among the Brahmins, for those who belong to other *gotras* then the marriage can take place. (Personal communication, 2020)

On the other hand, in the Robidas community, one does not get married unless they belong to the same *gotra*. They can only marry into the same caste and same tribe, considering this to be a religious rule. Thus, the Robidas community is endogamous in its relationship norms, both in caste and *gotra*. On this, one Robidas stated: "In our religion, it is said that we'll have to get married in our *gotra*" (personal communication, 2020).

Though inter-caste marriage occurs in all areas of Bangladesh, only a few of them are socially accepted and violation of caste boundaries via marriage usually results in the village *panchayat* (*council*) arranging punishment for the accused persons (Asaduzzaman, 2001, p. 35). The same situation is found in the Lalpur village. One Robidas interlocutor elucidated that:

> If someone gets married to another caste, people of society criticise and judge them, speak harshly to them, and compel them to lead a miserable life. The influential village members, as well as the chairman, try to solve this problem. Most people prefer to negotiate the matter with the village *panchayat* (with the help of members and chairman) to avoid isolation from their group. (Personal communication, 2020)

In this case, both must neither marry someone from another caste. However, for the Robidas, marrying someone from *another gotra* is a prohibited act, and for Brahmin, *within-gotra* marriage is also considered a religious rule-breaking act.

RELIGIOUS WORSHIP

Participating in social events like *puja* (a worship ritual), Dalits face various forms of discrimination and negligence by traditional Hindus. In some areas, they are not allowed inside the temple, whilst in other regions, "Dalits" may take part in social ceremonies like *puja* where they are tacitly accepted but retain their lower status. According to Naher and Hasan (2016), in some areas of Bangladesh such as Shetabganj and Dinajpur, "untouchables" are not accepted by the influential Hindu group (i.e., Brahmins) and are therefore required to arrange their own worship. This is similar in Lalpur village. The Brahmins of Lalpur village feel that the Robidas community does not conduct their *puja* properly, accusing them of only completing it partially, for example. On the other hand, as a Robidas interlocutor (personal communication, 2020) told me, "the Brahmins do not like us and that is why they do not come to our house to perform religious worship".

According to Mayer (1960), the communal hierarchy is based on the theory that pollution is transmitted through indirect contact with less pure individuals, even through "polluted" objects via touch or even by mere presence (also see Asaduzzaman, 2001, pp. 40–41). In the case of sacrificing animals in Kali *puja*, we can see differences between the two castes. One of the Brahmin interlocutors informed me:

> Anyone can give the sacrifice but we can't give it. Brahmins never sacrifice. The Brahmins do all the worship and rules before the sacrifice but the sacrifice is done by the Chamars [Robidas] or someone else. (Personal communication, 2020)

However, a 58-year-old Robidas interlocutor claimed that:

> When it comes to sacrificing something on the behalf of worship or devotion, Brahmins think that we [Robidas] sacrifice animals only to feed ourselves. Otherwise, we do not follow the rules of worship properly. But that's not right. We sacrifice animals because we have these rules in our religion. (Personal communication, 2020)

On the other hand, when it comes to wearing *janeu* [the sacred thread], the Brahmin and Robidas communities have two perspectives. According to Kancha I. Shepherd (2019), "the spiritual symbols for the top three *varnas* such as the "*janeu* (sacred thread) can't be worn by all Hindus", especially untouchables. In Lalpur, Brahmins think that as a result of the so-called "virtue of one hundred births", they are solely entitled to theological practices, such as *puja*. It is for this reason that they imagine themselves as being the only appropriate worshipers in the temple. On this point, a Robidas interlocutor stated that:

> Only Brahmins can wear *janeu*. They are Brahmins by birth, they do all the

puja, and we are people of other castes; we are not Brahmins by birth so we cannot wear *janeu*. In our area, the priests perform *puja*, for this reason only Brahmins can wear *janeu*. (Personal communication, 2020)

In this case, we can see that the power one Brahmin holds in this life is believed to be destined by religious deity, for the virtue of their previous birth. According to Brahmin informants, this also serves to justify their view that the Robidas are born in a much lower caste due to their previous life's "heinous deeds". Such preconceived notions of the Robidas result in the Brahmin's discrimination toward the Robidas, looking down on them and attempting to disqualify the Robidas from engaging in religious practices. It is clear, however, that both communities understand their own and each other's practices differently, with various consequences.

FOOD HABITS

According to Rina Nayar (1976), there were 5 "Hindu Food Taboos":

1. The Cooking Taboo – which lays down rules regarding who may cook the food a man eats.
2. The Commensal Taboo – which lays down rules regarding in whose company a man may eat.
3. The Food Taboo – which lays down rules regarding from whom a man may accept different categories of food.
4. The Eating Taboo – which lays down rules regarding observance of proper rituals at a meal.
5. The Smoking Taboo – which lays down rules regarding in whose company a man may smoke. (1976, p. 57)

Nayar continues to explain that "[those] who are more particular about maintaining these taboos and thus their purity are said to rank higher than those who are less so" (ibid.). In this regard, Brahmin always consider themselves superior especially as they see the Robidas as low, abstaining from eating religious foods and instead eating everything that is forbidden, particularly those listed in Hindu religious books (e.g., dead cows and pigs). Brahmins thus render the Robidas as unclean. Whilst I discussed the topic with a Brahmin priest, he drew a vertical ladder to rank the four castes. He put his Brahmin caste at the top and the Robidas community at the lowest, "untouchable" level. On this, one Brahmin priest on separate occasions stated:

> We don't eat pork but they eat both pork and dead cows, and they don't obey our Hindu religious rules and regulations properly … They don't care what they eat, they eat cows and pigs, they eat everything alive and dead. In our religion, eating pork and cow is forbidden. They are also eating it, so it is unclean. (Personal communication, 2020)

According to Robidas interlocutors, pigs are such an essential feature of their marriage ceremonies that it is said no marriage can take place without the pig. In addition to this, pigs are generally perceived by Brahmins as disgusting and unclean. Whilst some Brahmins think that the Robidas eat dead cows, a Robidas interlocutor (aged 34) retorted:

> We eat pigs because our religion has rules for eating pigs. But we do not eat dead cows. Since we work with leather, Brahmins think that we also eat cows. This is their complete misconception about us. (Personal communication, 2020)

Another Robidas interlocutor replied: "We aren't Chamar [a term used by Brahmin to describe the Robidas], we don't know why they consider us unclean Chamar. We are cleaner than they are" (personal communication, 2020).

According to Ambedkar (1948, pp. 86–89), there was a time when the Brahmins and non-Brahmins both ate "flesh" and "beef". However, Brahmins were said to abandon beef-eating, starting "cow worship" instead. For the "untouchables", on the other hand, the dead cow's skin, bones, flesh, etc. remained economic resources, and thus they continued the practice of beef-eating against the will of Brahmins (ibid.). Indeed, the strange food superstitions of the aristocracy have been the hallmark of Hindu practices around the world for many centuries. In this way, the perceived purity ratio of food often matches the perceived status of the caste.

OCCUPATION

A caste system is also a division of society based on occupation and family lineage. Edmund Leach (2008/1967, pp. 10–12) was perhaps strongest on the point of "traditional occupation" being the defining feature of caste classification. According to Joshi (2017), the Hindu caste system (*Varna*) recognises four distinct classes and applies a strict code of conduct to each class. More than this, so-called traditional occupations are ascribed to each caste. These can also be found in documents from the Vedic period where they are elaborated within ancient legal texts such as the *Manu Smriti* (ibid.). As previously mentioned, these are the Brahmin (priests and teachers), Kshatriya (warriors and rulers), Vaishya (traders and merchants), Shudras (the lowest who cannot study the *Vedas* or even listen to sacred mantras and are to serve the other three castes), and finally the Chandalas/Dalits ("untouchables").

It can be said that certain occupations are associated with certain castes because only members of these castes were allowed to practise them and a person's caste status is ultimately determined by their birth situation (unless expelled from their caste for religious offences). Similar views of intrinsic impurity of occupation with similar enactments of—as Moffatt (2017/1979) terms it in his study of "untouchables" in Endavur, South India—the "right" and "duty" of castes are evident in Lalpur village. According to the Brahmins, only they can be associated with the priestly profession, whilst the Robidas community are to be associated with the profession of shoemaking (a long-held tradition, no less). Moreover, their association with dead animals—particularly the cow—has sanctioned their permanently polluted and polluting condition. Take the following statement by an interlocutor from the Robidas community:

> We do shoe work because our ancestors did it and we respect this work. But they think sewing shoes is the smallest kind of work and that's why they neglect us. (Personal communication, 2020)

A Robidas' occupation and workplace, as well as their general lifestyle, were to be understood as—and expected to be—silent aspects of their identity. Whilst they may live close to their kinfolk (from their own caste group), the Robidas nonetheless remains socially isolated with their physical environment (especially ghettos), being generally very dirty and muddy due to a lack of proper drainage, insufficient living space, pig lavatories, and so on. Take the following statement from a Brahmin priest:

> I've seen them as unclean since I was a child; now that I'm 40 or 45, I still see them as unclean … It can be said that uncleanliness has been practised from generation to generation. Even their parents and grandparents were raised in this manner; they picked up the habit from their surroundings or from within. Their living quarters and clothes were and still are filthy. So, I think uncleanness has come down to them physically, environmentally, and hereditarily. (Personal communication, 2020)

However, according to Naher and Hasan (2016), the main reason for constructing the "Dalit" as "untouchable" is the "unclean" and "dirty" work they do and their association to the "unclean" animals they raise. By creating and naturalising these prejudices against the Robidas, social exclusion is often "justified as 'natural' and therefore, the real causes of their vulnerability remain unexplained and unquestioned" (ibid., p. 19).

ENTERING THE BRAHMIN HOUSE

During my fieldwork, it became clear that Brahmins were indeed imagined as belonging to the upper class or upper caste whilst the Robidas community were imagined to belong to the lowest caste or "untouchable" group. Normally, members of Brahmin society would not enter the Robidas locality. Accordingly, outside the Robidas' locality and specifically because of their surroundings, the Robidas encounter a social environment in which their participation or admission is limited. In Lalpur village, the Robidas cannot participate in nor are they ever

invited to any ceremonies in Brahmin houses. In contrast, a member of the Robidas community may invite a Brahmin; although, the Brahmin is very unlikely to accept the invitation and ever enter the Robidas' house. As one Brahmin recounted: "the Robidas are very unclean; they are unclean by nature; they eat cows and pigs, so we do not like to eat at their place" (personal communication, 2020).

As Rina Nayar elucidates, the Brahmins "have the greatest number of prescriptive and proscriptive rules governing their communal behaviour": for example, since there is no higher caste than them and food from lower castes belong to a "ritually prohibited category", they may only accept "*jhutha*" [touched] food from their own caste (Nayar, 1976, p. 59; see also Nadel, 1954, p. 16, as cited in Asaduzzaman, 2001, p. 127). She goes on to explain that "[the] superior position of the Brahmins is further strengthened by the fact that any kind of food, even *jhutha* food if offered by them, will be accepted by members of all other castes" (ibid., p. 60). Again, the Robidas are not welcomed into Brahmin houses. One Robidas informed me: "If I wish, I can go to the Brahmins' courtyard, but they will not allow me to enter their room or house" (personal communication, 2020). On this point, one Brahmin priest replied:

> Entering the house depends on how clean you are. … If you enter someone's house covered in dirt, it feels bad to you, and we have temples in our house, so we are very clean … We have religious rules to stay clean, so we like to stay clean. (Personal communication, 2020)

Another Brahmin informant added:

> We do not allow them [Robidas] to come into our house because they are unclean … because they are really dirty, their work is dirty, and whatever they do is dirty, so we don't let them into our house. (Personal communication, 2020)

Brahmins do not accept food and water from the Robidas either. Thus, as discussed, members of the Brahmin caste avoid direct and even indirect contact with them because Brahmins think that the Robidas are "untouchable", thus rendering them an unclean Dalit group. One Brahmin informant said:

> I have never personally eaten at their house. Because they are unclean and eat dead cows and pork, they are not similar to us. That's why I've never eaten at their house. (Personal communication, 2020)

With these particular eating habits, and cognisant of what Brahmins think of them, the Robidas often are reluctant to invite a Brahmin to dine with them or to any of their religious or family functions. Indeed, there is no Brahmin among the Robidas, nor is there any particular person or group that replicates the role of the Brahmin (e.g., priesthood) and hence identifies themselves as a group of religious specialists. The Robidas often mentioned that "they can perform their *puja*, and they do not require any Brahmin to perform their *puja*" (anonymous interlocutor, personal communication).

Here, a Brahmin priest reminded:

> The Robidas do not perform any religious *puja* properly; I have doubts about whether they perform all religious worship or not … For example, a few days ago, Lakshmi *puja* ended, but I did not see them doing Lakshmi *puja*. (Personal communication, 2020)

On the occasions of feasts, however, Nayar (1976, p. 71) explains that whilst "untouchables" may never be formally invited, they nonetheless attend—although, they are sure to avoid sitting near high castes "for fear of pollution and in accordance with the commensal rules."

When the Brahmins were asked whether they supported this caste system or not, they answered that, as Hindus, they must support this caste system. According to them, what is given in Hindu religious texts is the greatest of all. Since the Hindu religion says that Brahmins will be at the top and the Robidas will be at the bottom, everyone should accept that. One of the Robidas informants, on the other hand, replied:

> Everyone from the upper castes has kept us below. No social event or other social activity invites us that much. They discriminate against us; they neglect us because we work as shoemakers, so how can we support the caste system? (Personal communication, 2020)

"Dalits" and "untouchables", as we have seen in the case of the Robidas in Lalpur village, are constructed as "others" in general. This "otherness" acquires isolated meaning and significance in the socio-political and economic landscape of Bangladesh and has arguably led to various weaknesses, exclusions, and injustices (Islam & Parvez, 2013). In this context, it is easy to see why the Brahmin society usually maintains a rigid boundary against the Robidas, confirming their social construction of the Robidas as "untouchable" or being rooted in the lowest rank of the village. Beyond physical appearances, the Robidas community is perceived as being symbolically "filthy" due to the physical conditions in which they live, their pork and dead cow eating habits, their traditional occupation, and so on. While the higher caste (the Brahmins) believes that the caste system is destined to be such by God and ought to be respected by all, the Robidas community believes that the caste system is merely a means of being exploited.

CONCLUSION

Caste, as succinctly put by Waughray (2013), is "distinguished from other forms of social stratification based on the inherited status by its religious underpinnings in orthodox Hinduism and by the concept of 'untouchability'" (p. 1). Moreover, some are "considered intrinsically, permanently, and irredeemably polluted" (ibid.), too. The caste system separates the Hindus by making boundaries "touchable" and "untouchable". As with the ethnography I have provided, the Robidas community is regarded as "untouchable", and they are restricted in many facets of their social lives. Since social exclusion and one's inferiority or superiority is understood to be "naturally" inherited, so-called "untouchables" were (and still are) met with a kind of racial prejudice which, in turn and cyclically, is further judged on consequent illiteracy, economic insecurity, and caste identity. Due to their powerlessness and the prevailing caste system, these deprived communities are subjected to a particular imagination and active discrimination. Overall, I have hoped to engage and better understand the social construction of the Robidas community's identity and livelihoods whilst paying close attention to how they have maintained their religious, social, and group boundaries.

ETHICAL STATEMENT

The ethnographic fieldwork conducted in this study in Lalpur village, Bangladesh, was first presented and approved to an ethics board in the Department of Anthropology, Jagannath University, Dhaka, Bangladesh (Prof. Dr. Shanzida Farhana, Chairman).

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Interdisciplinary Commentary

BIOLOGICAL ANTHROPOLOGY

An evolutionary perspective on intracommunity religious discrimination

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Das shows that "untouchability" continues to reproduce hierarchical caste systems in parts of South Asia, such as for the Robidas community in Lalpur, Bangladesh. This phenomenon, a fundamentally hierarchical, religious form of discrimination within a community, may not be recent but may instead have deep evolutionary roots. Here, I argue that intracommunity religious discrimination likely first appeared 110–50 kya in large, hierarchical forager communities following the emergence of religious behaviour and shamanism. Such an evolutionary perspective highlights not just the universality of intracommunity religious discrimination, but also invites considerations about the ways that this behaviour emerges and functions in different contexts, leading to a more nuanced understanding of its specific instances.

Introduction

The Hindu caste system is intrinsically linked to the concept of "untouchability" whereby the lowest caste (the Dalits) is excluded from the religious community due to the inherited status of its members as "impure", in polar opposition to the "pure" status of the highest caste (the Brahmins). Indeed, Dumont (1970) argues that this pure/impure dichotomy is integral to the caste system's operation. As the author demonstrates, this is still the case in some parts of South Asia, such as for the Robidas community in Lalpur, Bangladesh. Importantly, Das shows that the discrimination faced by the Robidas community is justified on religious grounds, a product of Vedic scripture interpretation.

Similar forms of intracommunity religious discrimination have been observed across all the major religions of the Indian subcontinent (Jodhka & Shah, 2010) and their roots have been traced to at least as far back as the transition to agricultural societies in South Asia (Klass, 1980), although likely emerged even earlier. Here, I consider the behaviour from an evolutionary perspective by drawing on archaeological, fossil, and ethnographic records to argue that intracommunity religious discrimination originated at least 50 kya in hierarchical forager societies following the emergence of religious behaviour and shamanism. Recognising the evolutionary roots of such behaviour complements studies on its manifestation in contemporary communities by highlighting its nuanced history and allowing for a deeper recognition of how it manifests itself in specific historical and contemporary cases.

Inequality and discrimination in human evolution

A common model used to explain social organisation during human evolution is the nomadic-egalitarian model which assumes that humans evolved as members of small, nomadic foraging societies organised along egalitarian lines (e.g., Boehm, 1999). According to this model, it was with the advent of agriculture that complex societies and inequality emerged in marked contrast to the largely egalitarian lifeways that characterised hominin behaviour throughout the Pleistocene (see recently Fry et al., 2020).

However, far from all non-agricultural societies were egalitarian, small, or mobile. The Natufian complex existed prior to the agricultural transition in the Levant and largely subsisted by foraging, yet the presence of special buildings and bodily decorations for only a fraction of known burials (8%) indicate differences in the status of individuals within the society (see Price & Bar-Yosef, 2010). Archaeologist Brian Hayden (2012) has furthermore argued that a range of material evidence from Neanderthal sites indicates an incipient social hierarchy further back in the Pleistocene. This includes the existence of prestige items; the limited amount of burials, which may suggest that only some members of groups were deemed worthy of such veneration; head deformation in some buried individuals as a further marker of elite status; the occupation of hard-to-reach sites such as Galérie Schoepflin, which could not have supported a full band as a domestic site and would therefore have had another—possibly ritual—function (for a critical engagement on this, see Spikins et al., 2017); and the low frequency of evidence for elderly care. The latter is based on the relative lack—not complete absence—of fossils from old individuals, which could be taken to suggest that those that do show up in the fossil record were cared for exceptionally even after becoming infirm, unlike the majority of Neanderthals. Indeed, the ethnographic and archaeological records are full of examples of hierarchical non-agrarian societies throughout the Holocene and into the Pleistocene, as recently demonstrated by Singh and Glowacki (2022). Thus, the nomadic-egalitarian model is inconsistent with the evidence and needs to be revised.

In an attempt to move beyond the simple nomadic-egalitarian model, Singh and Glowacki (ibid.) argued that inequality tends to occur when foragers inhabit resource-dense areas. Such areas often have easy access to marine resources for subsistence and produce large and (semi-) sedentary societies based on resource control and social hierarchy (Smith & Codding, 2021). The earliest systematic exploitation of these environments happened at least 110 kya in South Africa (Marean, 2014), although marine-based subsistence began at least 164 kya and perhaps even earlier (Marean et al., 2007). To account for these patterns in human evolution, Singh and Glowacki (2022) proposed a "diverse histories model" of human socio-political evolution, which posits that egalitarianism was not the rule during the Pleistocene but one of several possible political strategies that were adopted by foraging societies to meet changing environmental circumstances.

Indeed, hierarchical societies are the norm amongst our close ape relatives (Boehm, 1999; Gruber & Clay, 2016; de Waal, 2007). The most parsimonious explanation proposed by anthropologists for this contrast in social systems between foragers and our closest living relatives is that the egalitarian behaviour amongst foragers evolved independently (Boehm, 1999). However, if the "diverse histories model" is true, hierarchical social structuring would have persisted alongside egalitarianism as a legitimate political strategy throughout human evolution.

Origins of religious behaviour

The earliest archaeological evidence of ritual behaviour might be up to 700 kya (Goren-Inbar, 1986), but there is no conclusive evidence of decidedly religious behaviour until the emergence of the Neolithic (Pettitt, 2011). However, Dunbar (2003) has argued that the fossil record can be used to determine the earliest possible emergence of religion in hominins by working from the assumption that there is a direct relation between the size of the frontal lobe in hominins and their achieved level of theory of mind (ToM: the ability to attribute different states of mind to external actors at increasing reflexivity, i.e., level 1: I believe; level 2: I believe that you think; etc.). According to Dunbar (2022), religion in its modern form requires level 5 ToM as well as linguistic capacity for expressing this level of intentionality. The first time that hominins with a frontal lobe big enough to support Dunbar's criteria for level 5 ToM appear in the fossil record is with the emergence of anatomically modern humans ~200 kya. Hence the capacity for religion would be a phenomenon unique to our species.

This conclusion can be elaborated further by looking at the findings

from a study by Peoples and colleagues (2016) which quantified the evolutionary history of religious behaviour from the ethnographic record. Based on seven traits and phylogenetic reconstruction of character states, the study showed that animism likely emerged early in the hominin lineage, followed by the belief in an afterlife and shamanism, which were present as modern humans dispersed out of Africa 50–60 kya (Bergström et al., 2021). Shamans are important religious leaders in some modern forager societies using their exclusive, supernatural knowledge to benefit followers as well as control community members through fear (Garfield et al., 2020). Based on the similarity of the underlying mental and social capacities of contemporary and early modern humans as well as the assumption that forager societies are representative of the archaeological record, it may be inferred that shamans could have filled the same role in the Upper Palaeolithic that they do today.

These different lines of evidence provide a workable hypothesis which suggests that religious behaviour evolved 200–50 kya with shamans emerging as important new leaders in human societies. Considering that hierarchical societies were likely present at least 110 kya, it is conceivable that some Pleistocene societies may have emerged with shamans at the top as religious leaders whose position of power was sustained by the juxtaposition of a lower group kept at the bottom. This could well have been justified on religious grounds, similar to the way that the author shows that Bangladeshi Dalits are kept subordinate by the Brahmin class.

The issue remains to conclusively identify such behaviour archaeologically. However, by combining archaeological, fossil, and ethnographic evidence, it is possible to propose a scenario by which intragroup religious discrimination could have emerged during at least the Upper Pleistocene and possibly earlier, suggesting that such behaviour has deep evolutionary roots intrinsically linked to our species. (For methodological considerations on studying religion anthropologically, see Chidichimo, 2022.)

Conclusion

As the author discusses, discrimination against Hindu Dalits is still a pertinent issue in several parts of Asia, including for the Robidas community in Lalpur, Bangladesh. This form of discrimination against community members on religious grounds has been observed across South Asia and traced to the Neolithic transition, but here I suggest that the human behaviours needed to sustain such a practice may have evolved by at least 50 kya. Consequently, intragroup religious discrimination may not have first emerged during the Neolithic, but likely has deep, evolutionary roots. This opens up considerations about the different ways that such behaviour emerged and functioned in specific cases in the recent and deep past, which may constructively contribute to a deeper understanding of its current practice in Hindu societies and beyond.

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ENVIRONMENTAL SCIENCE

Water Contamination by Estrogenic Compounds: Review, Policy Gaps, and Recommendations for US Federal Regulation

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E1, E2, E3, and EE2 are types of estrogens that need to be federally regulated in waterbodies in the United States. Absence of regulation has led to untreated releases from wastewater treatment plants of estrogen from natural human excretion and releases from animal feeding operations (AFOs) eluding proper waste management. Estrogens have been detected in drinking water, which has caused concerns over human health as there is little research evaluating the health risks. Due to there being no evidence supporting negative impacts on human health, there is no justification for regulation under current Safe Drinking Water Act provisions. However, as guided by the precautionary principle, current laws could be amended to utilize preventative measures since there is no certainty that exposure to estrogenic drinking water is harmless. Exposure also proves to be an issue for aquatic life and potentially other species. Thus, I argue that E1, E2, E3, and EE2 must be listed as pollutants under the Clean Water Act and increased regulations on AFOs must be implemented.

INTRODUCTION

Pollutants and contaminants released into waterbodies can dramatically impact the health of humans and aquatic wildlife (Bhandari et al., 2015; Wu & Janssen, 2011). These can include hormones such as estrogens and testosterones (Lopez, 2010). This has raised concern for human health when such hormones are present in drinking water (Wu & Janssen, 2011). Hormone releases into water have generally never been regulated which has caused problems for aquatic wildlife that are regularly exposed, such as changes in physical development and mating behavior (ibid.; Wright-Walters & Volz, 2009).

Endocrine-disrupting compounds (EDC) have been found in water supplies all over the world, where they bind to hormone receptors and/or alter expression of genes, thus interfering with several bodily processes like hormone synthesis and metabolism (Bhandari et al., 2015). Estrogens are EDCs that have increasingly become contaminants of concern due to their effects on aquatic wildlife and their lack of regulation.

The most common estrogens found in the environment are estrone (E1), estradiol (E2), estriol (E3), and 17α-ethynylestradiol (EE2; Gonsioroski et al., 2020). E1, E2, and E3 are naturally produced by humans and other animals, but can also be prescribed, while EE2 is synthetic and found in contraceptives (Caldwell et al., 2010). E2 is the most predominant estrogen in the human body (MohanKumar et al., 2018).

Since humans naturally produce these compounds, they are excreted in urine and enter wastewater treatment plants (WWTP) where conventional treatment processes are unable to completely remove them (Adeel et al., 2017; Caldwell et al., 2010; Gonsioroski et al., 2020; Kidd et al., 2007; McCullough et al., 2018; Rodriguez-Mozaz & Weinberg, 2010). Animal feeding operations (AFOs) are also a source of these estrogens as animal wastes contain estrogens, but are not treated before they reach surface waters (Adeel et al., 2017; Rodriguez-Mozaz & Weinberg, 2010).

There are concerns about the impacts of estrogenic water on humans, as exposure to xenoestrogens have been linked with altered reproduction, breast cancer, testicular cancer, and disruption of the endocrine system (Wright-Walters & Volz, 2009; Gonsioroski et al., 2020). Exposure to these exogenous estrogens is also considered to be responsible for intersex characteristics, alterations in mating behavior, and prevention of gonadal maturation in aquatic wildlife, which could destabilize populations due to lower reproductive fitness (Kidd et al., 2007; Wright-Walters & Volz, 2009). Despite the evidence that exogenous estrogens from WWTPs and AFOs are linked to negative effects on aquatic life and the concerns over human health, there are currently no standards set by the United States Environmental Protection Agency (shortened to EPA hereafter)[1] to measure or monitor these estrogens in water (McCullough et al., 2018).

Due to their potential impacts on human health and endangerment to aquatic populations, E1, E2, E3, and EE2 must be federally regulated. This paper will review the available information about estrogenic water pollution and its effects on humans and aquatic life and its sources. The central purpose is to propose policies to reduce the presence of the estrogens in the environment.

SOURCES

Estrogens that find their way into surface waters come from two main sources: wastewater treatment plants (WWTPs) and animal feeding operations (AFOs; Adeel et al., 2017). Neither of these sources are regulated for estrogen contamination in waterbodies by the EPA (2021; Wright-Walters & Volz, 2009). Thus, understanding where these estrogens originate will help contextualize impacts and provide the basis for possible regulation. Pathways of exposure are illustrated in **Figure 1** and information about each estrogen including source, structure, use, predicted no-effect concentration (PNEC) for fish, and acceptable daily intake for humans is summarized in **Table 1**.

GLOSSARY OF ABBREVIATIONS

AFOs	Animal feeding operations
AST	Activated sludge treatment
BPA	Bisphenol A
CAFOs	Concentrated Animal Feeding Operations
CCL	Contaminant Candidate List
CWA	Clean Water Act
EU	European Union
E1	Estrone
E2	Estradiol
E3	Estriol
EDC	Endocrine-disrupting compounds
EE2	17α-ethynylestradiol
EPA	(United States) Environmental Protection Agency
FDA	(United States) Food and Drug Administration
GAO	(United States) Government Accountability Office
NMP	Nutrient management plan
NPDES	National Pollutant Discharge Elimination System
NRDC	Natural Resources Defense Council
NWR	National wildlife refuge
PNEC	Predicted no-effect concentration
SDWA	Safe Drinking Water Act
TBEL	Technology-based effluent limitation
USDA	United States Department of Agriculture
WWTP	Wastewater treatment plants

WWTPs are inefficient in removing estrogens that are naturally produced in human wastes. As mentioned, humans naturally produce and can be prescribed E1, E2, and E3, while EE2 is entirely synthetic and is prescribed in contraceptives (Caldwell et al., 2010). These estrogens are excreted in urine and thus enter WWTPs where they are unable to be fully removed (Adeel et al., 2017; Bolong et al., 2009; Caldwell et al., 2010; Gonsioroski et al., 2020; Kidd et al., 2007; McCullough et al., 2018; Rodriguez-Mozaz & Weinberg, 2010). EE2, for example, has increasingly been detectable in sewage effluent in the last 20 years, ranging in concentration from <1 to 831 ng/L in effluents and surface waters (Roggio et al., 2014).

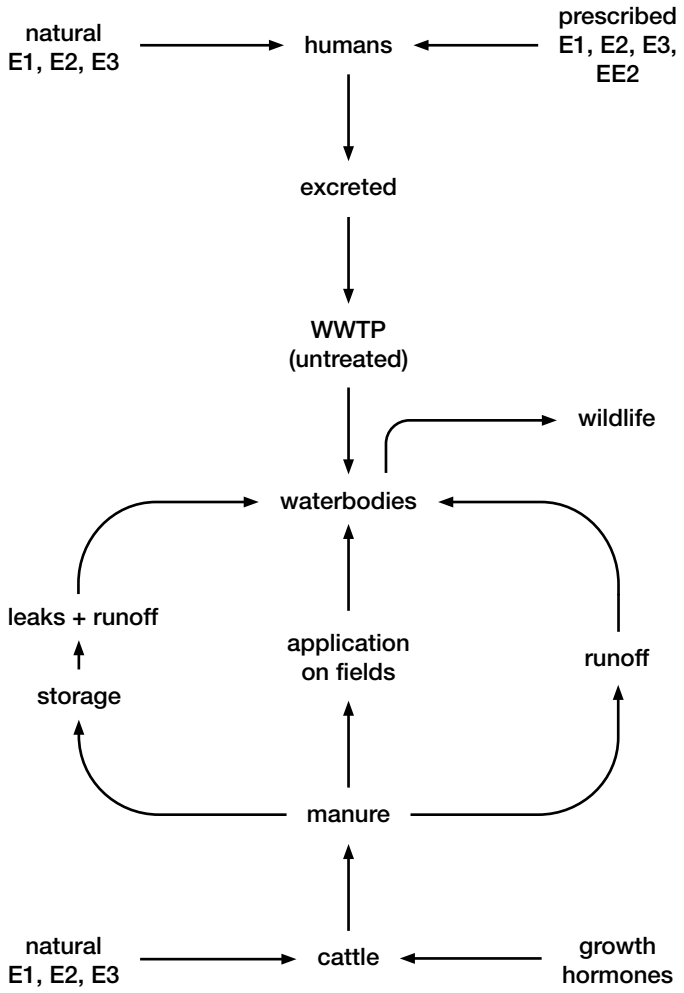
Estrogens have been detected in several studies of wastewater influents and effluents and have been found to be in waters at polluting levels close to WWTPs globally (Adeel et al., 2017; Caldwell et al., 2010). Atkinson and colleagues (2003) found that bodies of water had higher concentrations of E1 the closer they were located to sewage effluent. Kostich and colleagues (2013) modeled average influent concentrations to be 173 ng/L for E1, 92 ng/L for E2, 1491 ng/L for E3, and 6 ng/L for EE2, with removal rates varying and the potential for concentrations to exceed PNECs. Michelle E. Jarvie (2007) calculated that influent concentrations average 50.9 ng/L for E1 and 14.6 ng/L for E2, with an average removal rate of >75.1% and >79.9%, respectively. Effluent concentrations average <12.7 ng/L of E1 and <2.94 ng/L E2, which are above the PNEC (ibid.).

Even though effluent from WTTPs is a major source of estrogen release into waterbodies that have negative impacts on aquatic wildlife, there is no regulations or standardized way of measuring concentrations and removal (Wright-Walters & Volz, 2009; Rodriguez-Mozaz & Weinberg, 2010; Jarvie, 2007). In some cities, where effluent is concentrated due to population density, 50% of river flow can be discharged effluent and up to 90% of effluent in the winter (Wright-Walters & Volz, 2009). Cities can also experience overflows which forces plants to release untreated sewage into surface and drinking water (ibid.). This can lead to high concentrations of estrogens in nearby waterbodies.

However, the primary avenue for estrogens to enter aquatic environments is manure runoff from AFOs, mostly from cattle (Adeel et al., 2017; Caldwell et al., 2010; Gonsioroski et al., 2020). The US Food and Drug Administration (FDA) has stated that a number of synthetic hormones are approved to be used in cows raised for meat to improve growth rate and efficiency (FDA, 2018). These include synthetic E1, E3 and predominantly Zeranol which mimics E2 which is administered through an implant in the ear (ibid.; EPA, 2013). Estrogen administration is not approved in dairy cows, veal calves, pigs or poultry, but they still release natural estrogens in their feces (FDA, 2018).

Figure 1

Sources of E1, E2, E3, and EE2 to Waterbodies From Human Excretion and Manure Runoff From Cattle



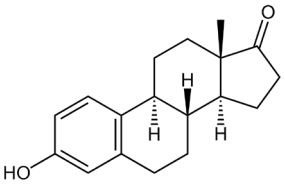
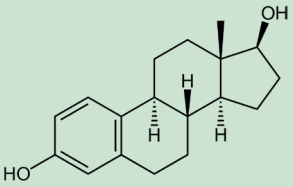
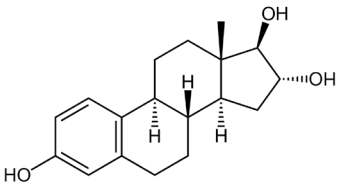
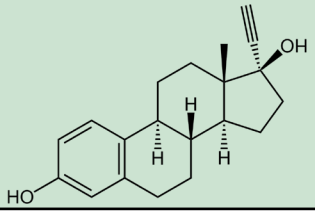
AFOs result in 2 trillion pounds of waste in the United States (Wu et al., 2009, p. 32). In 2002, farm animals produced 49 tons of natural and synthetic estrogen in their waste (Adeel et al., 2017). McCullough and colleagues (2018) have claimed that animal manure accounts for 90% of estrogens in the environment, and that if 1% of estrogens in their manure reached waterways, it would contribute to 15% of the estrogen released. The majority of estrogen is excreted by cattle, totaling 99,208 pounds of estrogen, which accounts for 92.7% of estrogen released by livestock (EPA, 2013).

The manure can reach waterbodies through runoff from pasture and rangeland, runoff from cropland fertilized with manure, leaks/overflows, and equipment failures from storage lagoons (Adeel et al., 2017; EPA, 2013). The EPA (2013), in their literature review, agrees that the estrogens cause endocrine disruption in fish. There are no sewage treatment requirements for animal manure (Miller et al., 2019). There are few studies examining the effects of estrogen in manure from AFOs on aquatic wildlife, and it is difficult to obtain at what concentrations they are being released at since there is no monitoring system in place (EPA, 2013).

Research shows that hormones are present in low but active levels in surface waters near AFOs (EPA, 2013). A study by Chen and colleagues (2010) showed that concentrations of E1, E2, and E3 of a river receiving discharge from livestock farms in Taiwan were significantly higher upstream (where discharge occurs) than those downstreams, especially in the winter where dilution and microbial activity was low. The site closest

Table 1

Summary of Common Estrogens Found in Waterbodies Including their Chemical Name, Short-Hand Name, Uses, Sources into the Environment, PNEC in Fish, and Acceptable Daily Intake in Humans

Full name	Short name	Structure	Uses	Source	PNEC (fish)	Acceptable daily intake (humans)
Estrone	E1		Excreted by all humans Pharmaceutcals Excreted naturally by livestock Supplemented in meat cattle for faster growth	WWTPs AFOs	6 ng/L	0.052 µg/person/day
Estradiol	E2		Excreted by all humans Pharmaceutcals Excreted naturally by livestock Supplemented in meat cattle for faster growth	WWTPs AFOs	2 ng/L	3 µg/person/day
Estriol	E3		Excreted by all humans Pharmaceutcals Excreted naturally by livestock Supplemented in meat cattle for faster growth	WWTPs AFOs	60 ng/L	0.084 µg/person/day
17α-ethynylestradiol	EE2		Pharmaceuticals (contraceptives)	WWTPs	0.1 ng/L	0.026 µg/person/day

to the livestock operation had a mean concentration of 398 ± 451 ng/L of E1, 84.3 ± 117 ng/L of E2, and 82.5 ± 69.6 ng/L of E3 (ibid.). The site furthest from the AFO had 46.4 ± 53.8 ng/L of E1, 9.6 ± 6.4 ng/L of E2, and 13.2 ± 12.5 ng/L of E3, whilst the reference site which did not receive any runoff averaged only 1.7± 4.1 ng/L for E2 (ibid.).

In general, EE2 is considered to be the most potent, but contributes less to water estrogenicity than other estrogens due to it only being excreted in urine by those who are prescribed it (Gonsioroski et al., 2020; Kostich et al., 2013; Thorpe et al., 2003). E1 has been shown to be generally more potent than E2 (although at times it can be equipotent) and is the most abundant estrogen in surface waters due to the fact it is excreted at higher levels by cycling women and can result from the breakdown of E2 (Jarvie, 2007; Thorpe et al., 2003). E3 is considered the least potent as it is 300 times less active than E2 and is not considered as responsible for estrogenicity as much as the other estrogens (ibid.).

There are two primary federal laws that protect water quality by regulating pollutant and contaminant discharges: the Clean Water Act (CWA) and the Safe Drinking Water Act (SDWA; EPA, 2004/2019; EPA, 2022 "Summary"). These laws protect waterbodies by limiting the amount of substances released into water bodies from particular sources, including WWTPs and certain AFOs (ibid.). E1, E2, E3, and EE2 discharges are not currently limited by either of these laws, but this paper will discuss them and the possibility for regulation (EPA, 2021; Wright-Walters & Volz, 2009).

HUMAN IMPACTS

Estrogens have been detected in drinking water and its presence has caused concern over human health (Caldwell et al., 2010; Rodriguez-Mozaz & Weinberg, 2010). In general, environmental exposure to EDCs during both development and adulthood can be a risk factor for diseases such as endocrine and reproductive cancers, diabetes, hypertension, and heart disease (Bhandari et al., 2015). Estrogen toxicity has increasingly gained attention from the scientific community, regulatory bodies, and the public as there has been a dramatic increase of endocrine and metabolic diseases since the 1970s by 2- to 3-fold (ibid.; MohanKumar et al., 2018).

Several studies show that an excess of estrogen is detrimental to human health. High levels of E2 have been associated with many disorders including several cancers, breast cysts, gallbladder disease, and thyroid disorders. It has also been associated with heavy menstruation, nervousness, irritability, mood swings, headaches, and sleep disturbances (Delgado & Lopez-Ojeda, 2022; Kumar et al., 2018; Watson et al., 2010). One study demonstrated that men, in particular, can experience infertility and swollen breast tissue, and postmenopausal women who were being treated with hormone replacement therapy with chronic exposure to estrogen demonstrated increased risk for dementia and cardiovascular disease (Delgado & Lopez-Ojeda, 2022). A review of several laboratory experiments in mice and rats by MohanKumar and colleagues (2018) suggests that chronic E2 exposure has an array of neurological, cardiovascular, and behavioral effects in addition to reproductive ones, including anxiety, ovulatory failure, mammary and pituitary tumors, and increase in blood pressure. However, these studies focus on effects from certain medications, controlled doses, and overproduction in the body, not from drinking water pollution.

Estrogens at polluting levels have been linked with cancer, such as breast and prostate, and reduced fertility (Adeel et al., 2017; Gonsioroski et al., 2020). But admittedly there are not many studies or much literature on estrogen toxicity in humans, and there is even less about estrogenic drinking water (Delgado & Lopez-Ojeda, 2022). Most exposures to estrogens occur at low, persistent levels, and effects of these chronic

exposures have not been well studied in humans (MohanKumar et al., 2018).

Humans have no specific biomarkers of exposure to estrogenic EDCs and they do not follow linear-dose responses, making their impacts on humans harder to identify and predict (Bhandari et al., 2015; Jarvie, 2007). Some studies have claimed that current data supports that human exposure is low compared to effect levels and that there is little data supporting negative effects on humans (Caldwell et al., 2010; Kostich et al., 2013; Rodriguez-Mozaz & Weinberg, 2010). To the author's knowledge, there has been no specific study conducted that examined the specific correlation between estrogenic drinking water and health effects.

A study by Caldwell and colleagues (2010) suggests that people are exposed to E1, E2, and E3 in their diet, from products such as soy, dairy, and a wide variety of other foods, more than in drinking water. They found that total exposure in drinking water is at least 82 times lower than dietary exposure and 28 times less than acceptable daily intakes for sensitive individuals (ibid.). This suggests that regular dietary intake is the primary pathway of exposure to estrogens (apart from those naturally produced by our bodies and those that are prescribed) and that drinking water exposures are expected to have no adverse effects—at least according to current literature and relative to dietary exposure.

Therefore, while excess estrogens have the ability to negatively impact humans, there is no current evidence that suggests drinking water contains estrogens at polluting levels or that chronic exposures at current low levels is harmful. Because these human impacts are unknown and unsupported, the EPA does not view E1, E2, E3, and EE2 as a risk to humans under the SDWA (EPA, 2013). Nevertheless, humans are exposed to xenoestrogens from a variety of sources, including food, pharmaceuticals, and consumer products, hence a controlled study is needed to find relationships from estrogenic drinking water and human health (Kumar et al., 2018).

EFFECTS ON AQUATIC LIFE AND OTHER SPECIES

The unregulated release of estrogens by WWTPs and AFOs exposes aquatic life to additional doses of the hormone, causing an array of physiological, hormonal, biochemical, reproductive, and behavioral alterations. These health impacts, particularly on reproductive fitness, can lead to negative consequences for population stability. The majority of existing literature seems to focus on fish, while fewer studies focus on other species such as amphibians and invertebrates.

There is a wide consensus among the scientific community that estrogens in aquatic environments have the ability to feminize and alter fish physiology, notably of male fish (Adeel et al., 2017; Baynes et al., 2012; Bhandari et al., 2015; Bolong et al., 2009; EPA, 2013; Gonsioroski et al., 2020; Iwanowicz et al., 2016; Jarvie, 2007; Kidd et al., 2007; McCullough et al., 2018; Roggio et al., 2014; Orlando et al., 2004; Sumpter & Jobling, 1995; Thorpe et al., 2003; Wright-Walters & Volz, 2019). Every study that was examined in this review that mentioned E1, E2, E3, and/or EE2 supported their negative impacts on aquatic life.

Exposure to exogenous estrogens in fish has been observed to result in intersex individuals, reduced reproductive fitness, abnormal spawning behavior, altered oogenesis, skewed sex ratios, kidney damage, liver damage, and compromised immune systems (EPA, 2013). While there is no consensus on which estrogen is most responsible for these impacts, E1, E2, E3 and EE2 are of concern as they can impact stability of fish populations (Atkinson et al., 2003).

A commonly used biomarker of exogenous estrogen exposure is elevated levels of vitellogenin—an egg yolk precursor protein induced by estrogen found in adult females and intersex fish (Gonsioroski et al., 2020; Jarvie, 2007; Kidd et al., 2007; Sumpter & Jobling, 1995). Even low concentrations of estrogens in aquatic habitats can stimulate the production of vitellogenin, with some papers citing the no-effect concentration for fish to generally be 1 ng/L across the four estrogens (Baynes et al., 2012; Iwanowicz et al., 2016; Sumpter & Jobling, 1995). The presence of vitellogenin in males is associated with loss of secondary sex characteristics, such as reduced testicular size, and feminization, while elevated levels in females can lead to reduced ovary size and egg production (EPA, 2013; Gonsioroski et al., 2020; Jarvie, 2007). In a seven-year experimental lake study, investigators documented elevated vitellogenin levels and reproductive abnormalities post-exposure in fathead minnows, even resulting in the collapse of the experimental population prior to the completion of the study (Kidd et al., 2007).

The above impacts are not only seen in experimental contexts but are also prevalent in natural environments. A study by Iwanowicz and colleagues (2016) examining sites in national wildlife refuges (NWRs) in the northeast of the US recorded that intersex smallmouth bass males were present in all 12 sites across 7 NWRs with a composite of 85%. Out of 23 sites, intersex largemouth bass males were observed in 20 sites from 13 NWRs with a composite of 27%. The study also tested water samples at 45 sites across 19 NWR and observed that estrogenic activity was above the quantitation limit in 21 of these sites (ibid.).

Some studies have different PNECs: Caldwell and colleagues (2012) claim in their study that they are 6 ng/L E1, 2 ng/L E2, 60 ng/L E3, and 0.1 ng/L EE2, with Sumpter and Jobling (1995) agreeing with the PNEC for EE2, and Iwanowicz and colleagues (2016) reporting E2 PNEC ranges from 1–10 ng/L. It is important to note that some species of fish are more sensitive to estrogens than others, and there is no available composite study with PNEC for multiple species of fish (Iwanowicz et al., 2016).

Most studies examining the effects of estrogens on aquatic life focus on fish with less being known about other species (Bhandari et al., 2015). The lack of knowledge is exacerbated by the lack of quantification studies in aquatic environments (Atkinson et al., 2003). To take one brief example of the limited studies conducted on other species, in amphibians, exposure may distort sex ratios in favor of females and alter mating behavior (Bhandari et al., 2015). Several studies in different species of frogs demonstrate that exposure to EE2 during the developmental stage resulted in sex ratio imbalance, complete or partial feminization, male to female sex reversals, reduced fertility in males, and gonad alterations (ibid.). Exposure in male African clawed frogs of varying concentrations of EE2 reduced mating calls, sexual arousal, and the number of females willing to mate with them (ibid.).

CURRENT REGULATIONS

The Safe Drinking Water Act (SDWA) and the Clean Water Act (CWA) are the two primary federal laws that protect waterbodies in the United States. While no state water quality standards for estrogens and other hormones were found, some state governments, including New Jersey, Minnesota, and California, have conducted monitoring studies on emerging contaminants and EDCs whose reports included E1, E2, E3 and EE2 (Ferrey, 2011; Fischer et al., 2018; de Vlaming et al., 2007). However, this paper mainly concerns federal regulation. This section will discuss the basic components of the acts, the policy gaps in the regulations, and the potential for regulation of estrogen.

Safe Water Drinking Act

The SDWA passed in 1974, was amended 1986 and 1996, and aims to protect the public's health by regulating the drinking water supply, including rivers, lakes, reservoirs, springs, and groundwater wells. It enables the EPA to set health-based standards for natural and man-made contaminants (EPA, 2004/2019).

Every five years, the SWDA requires the EPA to publish a Contaminant Candidate List (CCL), which is a priority list of contaminants that are currently not regulated by the SDWA but are known or anticipated to occur in public water systems (EPA, 2014). Formal decisions, called regulatory determinations, are then made to determine whether the EPA should initiate the process to develop regulations for certain contaminants (ibid.). The SDWA requires the EPA to make regulatory determinations for at least five contaminants from the most recent CCL within five years of the previous round of determinations (ibid.). The EPA is also able to make regulations for contaminants currently not on the CCL if research shows that it poses a public health risk.

E1, E2 (specifically 17β-estradiol), E3, and EE2 were all listed on CCL 3 in 2009, but were not chosen to be regulated (EPA, 2009). They were also published in CCL 4 in 2016, but once again were not listed as regulated contaminants under the SDWA (EPA, 2021, 2022b). The EPA (2022c) published CCL 5 in November 2022 and none of the estrogens

were listed as a candidate contaminant. This is likely due to the absence of research that supports the fact that estrogens are harmful to human health in drinking water.

The lack of regulations for estrogens in drinking water is unsurprising, but justified, as there is not enough research to quantify and prove adverse health effects of estrogenic drinking water. However, estrogenic compounds have received the most concern out of any other EDCs (Houtman, 2010). This not only includes the ones in this paper, but other human-made xenoestrogens that make their way into drinking water that are not regulated, such as bisphenol A (BPA; Kumar et al., 2018). The lack of research may not provide evidence of harm, but it also results in the lack of evidence of no-risk. Without proper toxicology and risk-assessment, there is no assurance that chronic exposure to E1, E2, E3, and EE2 in drinking water has no effect on humans. This uncertainty causes concern among the public. This may result in the need to use the precautionary principle to guide water quality policies to proactively protect human health not only from chronic exposure of the aforementioned estrogens, but other unregulated xenoestrogens as well.

The SDWA and the precautionary principle

The precautionary principle has been an increasingly compelling method for drinking water regulations (Crawford-Brown & Crawford-Brown, 2011). However, due to the current nature of the SDWA which requires a certain amount of proof, creating drinking water standards for E1, E2, E3, and EE2 becomes difficult and would require major changes to the law on a legislative level.

The precautionary principle exists as a method to proactively prevent negative consequences by avoiding an action entirely even in the face of uncertainty (Crawford-Brown & Crawford-Brown, 2011; Houtman, 2010). Despite evidence being far from definitive, the precautionary principle can be preferable when it comes to protecting drinking water from emerging contaminants (Houtman, 2010).

The European Union (EU) can serve as an example as to how to utilize precaution in drinking water. The EU has the precautionary principle written into its primary law in the 1992 Maastricht Treaty, which defines environmental policy in the EU in order to provide the highest level of protection (Dolan et al., 2013). The Drinking Water Directive, the EU's drinking water policy, uses the principle to justify a low maximum allowable concentration of 0.1 µg/L for most active pesticides substances, which the US either has higher allowable values for or no set standard at all (ibid.). A similar universal standard to regulate E1, E2, E3, and EE2 could be utilized in the United States.

When making the decision to regulate a contaminant in drinking water, the SDWA specifically states that it must meet three criteria (EPA, 2014): (1) the contaminant may have an adverse effect on the health of persons; (2) the contaminant is known to occur or there is substantial likelihood the contaminant will occur in public water systems with a frequency and at levels of public health concern; and (3) regulation of the contaminant presents a meaningful opportunity for health risk reductions for persons served by public water systems. In short, there must be strong evidence that the contaminant occurs in public drinking water and that it has the ability to harm human health.

If E1, E2, E3, and EE2 were to be regulated in drinking water under justification of the precautionary principle, the SDWA would have to be amended in Congress to allow for preventable measures. This would mean either amending the existing criteria or adding separate criteria for emerging contaminants. Not only would this allow the possibility of regulation of E1, E2, E3, and EE2 as a proactive measure to protect human health, but other xenoestrogens such as BPA and phthalates. (Kumar et al., 2018).

However, passing these amendments would be difficult as the precautionary principle is still poorly defined both in practice and in law, in the U.S. and internationally (Crawford-Brown & Crawford-Brown, 2011). Despite being written into EU law, it is not defined in the Maastricht treaty and relies on the European Commission for guidance (Dolan et al., 2013). Moreover, the use of the precautionary principle in the EU's drinking water does not seem to apply to EDCs as there are few standards and virtually none for xenoestrogens (Houtman, 2010). This could possibly indicate lack of application of the principle due to the absence of a concrete legal definition and general shortcoming in practice as it is still considered an underdeveloped concept. Without a solid legal definition and the sheer difficulty of creating environmental legislation in Congress, drinking water standards for estrogens seems unlikely for now.

Until more research emerges on estrogenic drinking water, there is no true justification for regulation under current SDWA laws. But while there are no specific recommended policies, we advocate for US laws to adopt the precautionary principle in the future to protect drinking water quality.

Clean Water Act

The CWA, enacted in 1948 and amended in 1972, provides the basic protection for surface waters by regulating pollution discharges and water quality (EPA, 2022a). It makes it illegal for point sources to discharge pollutants into navigable waterways without obtaining a National Pollutant Discharge Elimination System (NPDES) permit (ibid.).

Estrogens are not listed under the CWA as pollutants nor are they monitored for removal (General Provisions, 1974). The CWA's purpose is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" with one of the goals being "protection and propagation of fish, shellfish and recreation in and on the water, wherever attainable" (Federal Water Pollution Control Act, 2002). Therefore, it is the federal government's duty to protect wildlife negatively impacted by water pollutants, including EDCs. Due to the widely-agreed upon evidence that E1, E2, E3, and EE2 impact aquatic wildlife, it is recommended that they be listed as pollutants under the CWA. This would require point sources that release estrogens into navigable waterways to obtain NPDES permits, be subject to technology-based effluent limitations (TBELs), and require compliance monitoring for the four estrogens (EPA, 2022a).

Municipal WWTP are considered point sources as they directly discharge into surface waters and thus are covered by the CWA and NPDES permitting (Jarvie, 2007; EPA, 2022a). WWTPs often fail to remove estrogens below PNEC for aquatic wildlife. The listing of E1, E2, E3, and EE2 as pollutants would force WWTPs to obtain NPDES permits for them, thus requiring their monitoring and removal in treated water before being released. It would require WWTPs to adhere to TBELs, hence the systems treating the water would need to be updated. Available technologies that show promise will be discussed later.

The lack of regulations: Concentrated animal feeding operations (AFOs)

Regulating estrogen from AFOs becomes complex since there are no treatment requirements for animal wastes and CWA laws only apply to certain operations (Miller et al., 2019). The AFOs that are regulated also tend to easily avoid any current requirements due to insufficient enforcement by the EPA. Therefore, even if estrogens were to be listed under the CWA, gaps in current regulations would prevent meaningful reduction of estrogens in the environment as AFOs are the primary source for contamination.

Most agricultural activity is not regulated by the CWA as they are classified as nonpoint sources, including AFOs (Copeland, 2010). However, a subset of AFOs, Concentrated Animal Feeding Operations (CAFOs), are explicitly a point source and thus regulated under the CWA (ibid.; Copeland, 2016). AFOs are considered CAFOs if they have more than 1000 animals and either discharge pollutants through a man-made ditch or similar man-made device, or discharge pollutants directly that "originate outside of and pass over, across, or through the facility, or otherwise come into direct contact with the confined animals" (Copeland, 2010, p. 3). "[AFOs] with 300–999 animals may be CAFOs depending on discharge characteristics; and those with fewer than 300 may be CAFOs in some cases" (ibid.). Only 5% of AFOs are CAFOs; however, they account for 40% of the livestock in the US raised in a confined facility (ibid.). AFOs not considered CAFOs are not subject to any standards as they are nonpoint sources (Copeland, 2016).

Since CAFOs are subject to CWA regulations, they require NPDES permits, but only if they discharge pollutants into waters of the United States (Copeland, 2010). CAFOs that do not discharge or propose to

discharge do not need permits, therefore all CAFOs are not currently obligated to obtain NPDES permits (Copeland, 2016). Unplanned and accidental discharges from unpermitted CAFOs are illegal under the CWA (ibid.). NPDES requirements are mostly under a voluntary basis as a CAFO's "no discharge" certification is not reviewed by permitters or available for public comment (ibid.). A 2003 rule required that all CAFOs had a "duty to apply" for NPDES permits unless they proved they did not discharge (ibid.). This was then changed to the current rule in 2008 when the U.S. Court of Appeals for the Second Circuit vacated the rule in 2005 in *Waterkeeper Alliance et al.. v. EPA*, because the CWA only covers actual discharges rather than potential ones (ibid., p. 10; EPA, n.d.).

Many CAFOs remain unregulated and operate without a permit (Food & Water Watch et al., 2017; Miller et al., 2019). Even though 75% of CAFOs discharge into waters, only 40% have obtained the necessary NPDES permits to do so (Food & Water Watch et al., 2017). Most CAFOs remain unpermitted because the burden remains on the EPA to prove they are discharging (Kenyon, 2017). There is no collective database of CAFO size, location, and operations by any federal agency and states vary in enforcement and additional permit requirements with little guidance from the EPA (Food & Water Watch et al., 2017; Miller et al., 2019).

More than this, "agricultural stormwater discharge" (runoff as a result of precipitation events) are exempted from regulation as long as the manure has been applied in accordance to "site-specific nutrient management practices" (Copeland, 2016, p. 13; Food & Water Watch et al., 2017; Miller et al., 2019).

Here, nutrient management plans (NMPs)—which address the amount, source, timing, and placement of nutrients—can assist in preventing nutrient leaching and poor nutrient applications and practices. Such malpractices may lead to overapplication and runoff, for example. The US Department of Agriculture (USDA) recommends that NMPs should include measures to not apply nutrients to soils that are frozen, covered in snow, saturated (top two inches), on areas of concentrated flow, and/or steep slopes (USDA, 2019). It also encourages setback distances and consideration of weather, climate, soil characteristics, and amount of nutrients needed to be applied. While NMPs are required to be submitted with NPDES applications, the items are not enforceable and there is no federal oversight that ensures wastes are applied properly (Copeland, 2011; Food & Water Watch et al., 2017). Due to the lack of regulation, CAFOs are incentivized to over-apply wastes against NMP guidelines, which result in large amounts of runoff (Brotzman, 2015; EPA, 2013; Food & Water Watch et al., 2017).

Often, the amount of manure that is produced exceeds what can be applied to croplands, so manure is often overapplied and applied on saturated or frozen soils where nutrients can not penetrate the soil and be absorbed because it the cheapest method of disposal (Brotzman, 2015; EPA, 2013; Food & Water Watch et al., 2017; Miller et al., 2019). In 2014, *ALT v. EPA* made other discharges eligible under the current agricultural stormwater exemption definition, namely those associated from a "production area" defined as "the animal confinement area, the manure storage area, the raw materials storage area, and the waste containment areas" (CAFO Rule, 2003, 7266, cited in Kenyon, 2017, pp. 1199–1200) This made other aspects of AFOs other than land application become unregulated (Food & Water Watch et al., 2017; Kenyon, 2017).

If estrogens were listed as a pollutant under the CWA, the lack of regulation of AFOs, lack of permitting and enforcement for CAFOs, and the agricultural stormwater would render the law useless for estrogen pollution. As a result, additional policies would need to be put in place to reduce the amount of animal waste from reaching surface waters.

RECOMMENDED ADDITIONAL POLICIES UNDER CWA FOR CAFOs

Based on the current insufficient standards for manure from CAFOs under the CWA and NPDES permit system, additional policies must be put in place to protect aquatic wildlife from hormonal, physical, biochemical, and reproductive harm. While WWTPs are no doubt a source of estrogens that can affect aquatic life, due to the fact estrogen pollution is primarily from unregulated animal feeding operations, increased regulations should be focused in this area (Adeel et al., 2017; Caldwell et al., 2010; Gonsioroski et al., 2020). Therefore, it is essential that additional policies be implemented which close regulatory gaps, including adjustment to the definition of a CAFO and agricultural stormwater exemption, baseline manure management practices, NPDES and NMP enforcement, and creation of a comprehensive and accessible database.

The desire for increased regulations to limit discharges from CAFOs is nothing new. Wastes from CAFOs have been known to affect water quality as they contribute large amounts of phosphorus and nitrogen that cause increased algae blooms and fish kills, pathogens that can spread diseases among human populations, salts, trace elements, antibiotics, pesticides, and other hormones (Copeland, 2016; EPA, 2013; Miller et al., 2019). Therefore, implementing new rules on CAFOs in the frame of the multitude of these problems with water quality would reduce the amount of estrogen being discharged into surface waters.

Environmental organizations have advocated for increased regulations and new rules: they argue that current measures are too voluntary and fail to require improved technology rather than mandating strict compliance (Copeland, 2010). To date, few researchers have deeply explored this area of proposed policy changes. Suggested changes to CAFO regulation under the CWA in the last twenty years were searched for—six relevant works were found. It is important to note that while many environmental advocates and groups advocate for increased CAFO oversight, few relevant reports citing specific changes were found. Authors of recommendations include advocacy groups, law students, and government researchers.

The United States Government Accountability Office (GAO, hereafter) is an independent, nonpartisan agency that provides recommendations to Congress to improve its efficiency. They released two reports (GAO, 2003, 2008) on improvements in CAFO oversight to protect environmental quality: one in 2003 prepared on request from former Senator Tom Harkin over concerns on water quality and another in 2008 over similar concerns. Two papers were drafted by law students who acted as independent advocates to strengthen AFO and CAFO regulations (Brotzman, 2015; Kenyon, 2017). A large coalition of environmental groups submitted a petition to the EPA asking for several standards for CAFOs to be altered (Food & Water Watch et al., 2015). The Natural Resources Defense Council (NRDC) released a report (see Miller et al., 2019) detailing the negative impacts of CAFO manure on humans and the environment with a proposed permit system to increase transparency of farm practices.

The proposed rule changes proposed by the six authors were analyzed to find commonalities and aggregated into workable recommendations for new rules in this article. Concerns that need to be addressed include enforcement of NMPs, limiting the agricultural stormwater exemption, and enforcement of NPDES permits. **Table 2** summarizes what was proposed by each author and compares them to what this paper suggests. Proposed rules that would contradict court rulings or meet substantial and avoidable backlash from the farming industry are not included in the recommendations. For example, a petition item by Brotzman—proposing limiting the number of animals per acreage of sprayfields and NRDC—recommended that almost all CAFOs be required to have NPDES permits. These types of rules would likely cause backlash from farmers for being too restrictive and troublesome. Recommendations were limited to measures that seemed reasonable and achievable.

NMPs were frequently discussed, specifically enforcing their implementation or enforcing recommended practices associated with them (Brotzman, 2015; Food & Water Watch et al., 2017; Kenyon, 2017). It is crucial to reduce the amount of runoff of manure from fields, therefore it is recommended that these measures become enforceable, baseline requirements for all AFOs (not just permitted ones; ibid.). These should be universal standards for how much manure can be applied per acre to prevent over-application and runoff. NMPs should be increasingly scrutinized during the NPDES process and approved before the permit is issued. Violators of manure application standards and NMPs should be prosecuted and issued high monetary penalties. These measures would effectively limit the agricultural stormwater exemption by specifically banning certain practices and force farmers to comply with NMPs for

Table 2

Summary and Comparison of Recommended Policies by Various Groups, Including Advocacy Groups, Law Students, Government Researchers, and This Paper

Review authors	US GAO (2003)[1]	US GAO (2008)[2]	Brotzman, E. (2015)[3]	Food & Water Watch et al. (2017)[4]	Kenyon, E. (2017)[5]	NRDC (2020)[6]	Shrivastava (2023)[7]
Redefine CAFO definitions			x	x		x	x
Allow newly regulated CAFOs to apply for general permits			x				
Strengthening/enforcing NMP standards			x	x	x		x
Regulate waste management practices			x		x		x
Placing a cap on the number of animals per acre of sprayfield			x				
Establish more effective engagement with the public			x				x
Increase transparency in information reporting and encourage citizen enforcement			x			x	x
Institute monitory requirements to improve accountability				x	x		
Nationwide database of CAFO size, location, NPDES permit status, and operations		x				x	x
Limit/revise agricultural stormwater exemptions				x	x		x
Presume certain CAFOs will discharge thus requiring NPDES permits rather than CAFOs proposing or potentially discharging				x			
Apply Large CFO effluent limitations guidelines to all CAFOs				x			
Require all but the smallest CAFOs to obtain NPDES permits						x	
EPA and states develop and implement their own plans that identify how they intend to carry out their increase permitting, inspection and enforcement responsibilities within specified time frames	x						
Universal standard for manure application per acre							x

Note. [1,2] Government agency — Research and recommendation by nonpartisan government agency [Report]
[3] Independent environmental advocate [Petition]
[4] Coalition of environmental organizations [Petition]
[5] Law review [Journal article]
[6] NRDC — Environmental advocacy group [Online report]
[7] Environmental researcher [Journal review article]

"proper application" of wastes to their field.

The EPA must redefine and clarify the agricultural stormwater exemption to exclude the unregulated discharge from production areas that contribute to negative impacts on water quality (Food & Water Watch et al., 2017, Kenyon, 2017). Emily Kenyon (2017) suggested that the agricultural stormwater exemption be redefined so that it is limited to land application for crops that will be harvested. This recommendation should be followed so that all other discharges from other aspects of production are excluded from the exemption to protect surface waters from unregulated, unmonitored discharges.

Smaller AFOs that do not qualify as CAFO are not required to obtain NPDES permits, but still contribute heavily to water impairment (Brotzman, 2015). Out of 238,000 AFOs, only 20,000 are subject to regulations based on discharge characteristics (ibid.). Erika Brotzman (ibid.) has recommended that the number of animals on a farm to be considered a CAFO be lowered so that more farms are subject to NPDES

permits. This adjustment would thus make more AFOs subject to CWA regulations for discharging, monitoring, and NMPs.

Many CAFOs remain unregulated despite their discharging of wastes into waterways. Action needs to be taken to enforce NPDES permits, which starts with increased monitoring of CAFOs themselves. While CAFOs that are permitted need to monitor, record-keep, and report discharges of CWA pollutants, unpermitted CAFOs do not. The NRDC has created a proposed permit system that would collect and distribute CAFO operations and data to the EPA, state, and public (Miller et al., 2019). However, this exact permit system is unlikely to be implemented due to the already present NPDES permit system. The GAO (2008) had proposed a nation-wide inventory in order to collect data on permitted CAFO to ensure compliance and protect water quality. This was implemented at a state level, but states vary in consistency and level of scrutiny in gathering data from permitted, unpermitted, and illegally unpermitted CAFOs and enforcing required permits (Food & Water Watch et al., 2017). It is recommended that a combination of the NRDC permit system and GAO recommendation be used to create a national database by the EPA for all AFOs, including size, location, animal type and number, NPDES permit status, NMP information, manure analysis, and other waste management practices. States should be required to gather the information of all AFOs and report it to the EPA to form a nation-wide CAFO database.

Tracking accurate information can be difficult for many states where CAFOs may slip under the radar and/or where states do not scrutinize their data-collection. Transparency to the public is crucial to maintain trust and keep citizens informed about the quality of their water. The NRDC found that most states have low transparency of CAFO data and operations. Brotzman (2015) has advocated for increased engagement with the public, and joined the NRDC in encouraging more transparency (see also Miller et al., 2019). The national database for CAFOs should be available online on a single website for the public to access.

The EPA generally has issues with enforcement of the CWA due to an insufficient budget (Feller, 1983). But the CWA allows for citizen enforcement measures by allowing individuals and organizations to sue violators of effluent standards or federal agencies for failing to enforce standards which helps fill the enforcement gap (ibid.). Under the CWA, citizens must provide the alleged violator with a 60-day notice of the intent to file suit (Federal Water Pollution Control Act, 2002; Ohio Environmental Council, n.d.). The suit may only be filed if during these 60 days the violator does not come into compliance or if another federal agency is taking action already (ibid.). The suit must be filed within the judicial district in which the violation occurred and a copy must be sent to the US EPA Administrator and the U.S. Attorney General (ibid.). Violators can be fined up to $25,000 per violation per day and the regulatory agency has the authority to order the violator to cease its operations, and revoke or refuse to renew the permit (Ohio Environmental Council, n.d.). If estrogens were listed as a pollutant, under current laws, citizens and organizations would be able to bring lawsuits against CAFOs who violate the effluent standards.

We recommend the EPA then take this one step further by allowing legal action against CAFOs for failing to follow reporting, permit, and farm practice requirements within the program for national database, such as reporting false information, failing to obtain NPDES permits when necessary, failing to follow baseline manure requirements, and failing to follow NMPs. These types of suits could follow the same requirements outlined by the CWA regarding a 60-day notice and $25,000 per violation per day fine to keep things standardized and simple. If citizens are unable to file suit due to financial or time commitment reasons, the online national database should have a form to report any violations either self-identified or anonymously. Citizens and independent organizations should also be allowed to submit supplementary information, such as AFOs that are in operation but there is no data on. The EPA would then be able investigate, collect information, and issue penalties as necessary. This method of citizen enforcement would not only help educate the public about CAFO operations in their proximity, but help supplement gaps and enforcement of CWA regulations, NPDES permits, and baseline farming practices, as well as lower costs associated with increased federal agency enforcement (Brotzman, 2015).

Due to the fact that CAFOs are the primary source for E1, E2, E3, and EE2 in the environment which threatens the health of aquatic wildlife, supplementary policies under the CWA, in summary, include: scrutinizing NMPs and making then enforceable by law; requiring standard manure management practices; limiting the agricultural stormwater exemptions to only land application of manure; lowering the numerical definition of CAFOs so that more farms require NPDES permits; and the creation of a comprehensive database of all CAFOs and their operations accessible by the public for citizen enforcement of NPDES permits.

METHODS FOR TREATMENT

WWTPs

With the addition of estrogens as a pollutant under the CWA, current WWTPs will need to be updated because current technology is not sufficient enough for estrogen removal to protect wildlife (Baynes et al., 2012). Many promising technologies have been explored for removal, but more research is needed to understand their use and improve efficiency before implementation.

Granular activated charcoal (carbon) adsorption has shown promise in studies for removing estrogens and preventing intersex induction in studies; however, disposal and high expenses may make this treatment method difficult to implement (Baynes et al., 2012; Bolong et al., 2009; Jarvie, 2007; Koh et al., 2008). Reverse osmosis has also been shown to be effective in experiments, but also may be too expensive (ibid.).

The effectiveness of sand filtration is up for debate: Jarvie (2007) claimed that it was effective whilst Baynes and colleagues (2012) demonstrated that the treatment method effectively prevented feminization in a controlled study. More research is needed, but it may prove to be a low-cost treatment method. Disinfection with sodium hypochlorite and ozonation have been shown to have the ability to remove up to 100% of estrogens, but more research is needed (EPA, 2013). Phytoremediation also has potential as sandbar willow, *Arabidopsis*, and curly leaf pondweed have demonstrated the ability to remove estrogens in controlled studies (Adeel et al., 2017; Trueman & Erber, 2013).

Bioremediation strategies have been explored, using selective microbes that can convert estrogens into different forms, degrade, or metabolize them (Adeel et al., 2017; Koh et al., 2008; Yu et al., 2013) Sources of bacteria include soils, activated sludge, dental plaque, and human intestines (Yu et al., 2013). Current knowledge of the chemical pathways are limited and 99% of potential bacteria are unculturable in a lab (ibid.). More research is needed to understand how the bacteria function to degrade, metabolize, or transform estrogens, and how to maximize their potential in treatment facilities (ibid.).

The most promising treatment method may be improvements in secondary activated sludge treatment (AST) that utilizes natural microorganisms that exist in the wastewater (Jarvie, 2007; Bolong et al., 2009; Koh et al., 2008). AST is the most common secondary treatment in WWTPs and it is where most estrogens are degraded, but not completely removed (ibid.). Longer sludge retention times and/or hydraulic retention times have been suggested to work as the longer times and increased aeration allow the bacteria to grow more and allow more contact time (ibid.).

Nitrifying AST tanks may also be an effective treatment option as it can remove more than 95% of estrogenic activity (Bolong et al., 2009; Koh et al., 2008). Effectiveness depends on sludge volume, pH, oxygen, and temperate conditions (Bolong et al., 2009). A study by Hicks and colleagues (2017) found that when the Kitchener WTTP in southern Ontario was upgraded to nitrifying AST with higher sludge retention times and aeration to better treat ammonia, there was a reduction in the incidence and severity of intersex male rainbow darter downstream from previous years. One site saw a decrease of 100% intersex incidence in fall 2012 (pre-upgrade) to 14% incidence in fall 2015, three years post-upgrade (ibid.).

CAFOs

Technologies have been explored and developed to treat manure as well, but expenses may be too high to implement them cost-efficiently (EPA, 2013). Proper storage of excess manure needs to be emphasized with

structures like enclosures, piles, lagoons, and ponds should be updated to increase capacity and prevent leaks and spills (ibid.). Composting may be an effective method for reducing hormone concentration with one study finding that composting decreased E2 concentrations by 84% in chicken manure (ibid.), but more research is needed.

CONCLUSION

Waterbodies contaminated with estrogens as a result of WWTPs and AFOs have led to feminization of male fish, intersex males, reduced reproductive fitness, and damage to bodily systems which put stability of populations at risk. Research also suggests estrogens have an array of negative effects on other wildlife. Due to these impacts, E1, E2, E3, and EE2 should be regulated under CWA, particularly enforcing responsible practices on CAFOs. Recommended regulations include lowering the number of animals in the definition of a CAFO so that the operation is subject to NPDES permits, making NMP plans enforceable, requiring baseline manure management practices, limiting the agricultural stormwater exemption, creating a comprehensive database of CAFOs and their discharges, and allowing citizen enforcement. Limited research does not support impacts on human health, therefore there is no justification for any regulation under the SDWA. However, the precautionary principle remains as a possible future tool if lawmakers are willing to amend the SDWA or enact new legislation. This review was able to cover general impacts of estrogen contamination on fish from studies such as smallmouth and largemouth bass. However, we recommend more research be done on different PNEC levels on different species, as some species may be more sensitive to different concentrations of estrogens than other species. There also needs to be more research done for the effects on amphibians, reptiles, and other invertebrate life that may regularly be exposed to contaminated waters. Moreover, more studies are needed to quantify concentrations in different aquatic environments.

The link between the regular consumption of estrogenic water and human health needs to be further studied as no current research exists on the topic. Research should include the effects on young developing children as they may be more susceptible to lower concentrations. More research is also needed on estrogenic treatment methods for WWTPs and CAFOs, including the effectiveness of technologies like sand filtration and metabolic pathways of bacteria that can metabolize, degrade, or transform estrogens.

This review and policy recommendation will hopefully kickstart the discussion on comprehensive monitoring of not only estrogens, but other hormones, such as testosterone, in waterbodies. Many environmental organizations have advocated for increased regulations on AFOs, especially CAFOs, hence this paper can serve as one of the starting points for regulating CAFOs for the wide range of pollutants they discharge into waterbodies.

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NOTES

1. EPA is abbreviated both in-text and citations for "United States Environmental Protection Agency".

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