

Social Influence and Meat-Eating Behaviour

Subjects: Behavioral Sciences

Contributor: Jiaqi Ge, Andrea Scalco, Tony Craig

Interest in non-meat diets has been growing at an exponential rate in many countries. There is a wide consensus now that increased meat consumption is linked to higher health risks and environmental impact. Yet humans are social animals. Even the very personal decision of whether to eat meat or not is influenced by others around them. Researchers develop an agent-based model to study the effect of social influence on the spread of meat-eating behaviour in the British population.

Keywords: meat-eating behaviour ; vegetarianism ; social influence ; social interaction ; agent-based modelling

1. Background

The number of people who opt for a non-meat diet (including vegetarians and vegans) in the UK has been growing rapidly in recent years. A survey ^[1] shows that during the lockdown of COVID-19 in 2020, one in four people in the UK had reduced their consumption of animal products, and one in five had reduced their meat consumption. It is estimated that the number of vegans in the UK had quadrupled between 2014 and 2019 (Food and You Survey, 2014, Ipsos Mori surveys 2016, 2019). The rapid increase in the demand for meat substitutes has also created a new market with many business opportunities. In 2020 the global market for plant-based meat is estimated at USD 6.67 billion, with the U.S. market alone exceeding USD 1.4 billion.

People's diets have a large impact on both their health and the environment ^[2], which are two of the grand challenges prioritised by the United Nations ^[3] and the UK government's 25 Year Environment Plan ^[4]. Livestock is an important contributor to greenhouse gas (GHG) emissions, which account for 14.5% of all anthropogenic GHG emissions globally ^[5]. Annual emissions from beef production alone accounted for approximately 7% of total GHG emissions, according to the U.N. Food and Agriculture Organization (FAO). In addition, researchers find that foods associated with improved health also have low environmental impacts ^[2]. Increased meat consumption is found to be linked to the growth of degenerative disease (e.g., Alzheimer disease) ^[6], cancer ^{[7][8]}, and stroke ^[9]. A more balanced and sustainable diet therefore will not only improve the quality of life and reduce national health care costs but also significantly lower the environmental impact of food consumption ^{[10][11]}.

However, despite large public health campaigns and educational programmes to promote healthy eating, including more subtle approaches such as nudges, only modest effects have been achieved at best ^{[12][13]}. One reason is that these programmes tend to focus on raising awareness of the nutritional values and environmental impacts for individuals, while the choices of any individual are also influenced by their peers and the social context in which they interact ^{[14][15][16]}. Social factors such as gender, race, ethnicity, location of residence (region and urban vs. non-urban), and social class all appear to affect dietary habits even when controlling for physiological variables such as body weight and age ^[17]. To make public health campaigns and interventions more effective, it is important to go beyond conventional methods of information provision and awareness raising, and give more consideration to the influence of social interactions on these everyday decisions.

Humans are social animals. Apart from individual concerns for health, environmental impacts, and animal rights ^[18], one's eating choices is also greatly influenced by their peers and social groups. A review of 69 experiments published between 1974 and 2014 found strong evidence for the role of social influence in one's dietary choice and eating behaviour ^[19]. People tend to adjust their food choice and intake to affiliate with those around them such as parents, teachers, and peers ^{[20][21]}. Without realising it, people will mimic each other's eating behaviour as a way to affiliate with and ingratiate others ^[22]. They will also unwittingly reduce the level of mimicry if they do not want to bond with the person they are eating with ^[23]. In a real-world setting, based on the combination of a field and a survey experiment in seven German university dining halls, ^[24] analysed the impact of social norms on meat consumption in a single meal choice situation, and found that direct normative influence leads to convergence towards vegetarian meal choices.

Importantly, many seemingly neutral lifestyle choices such as dietary choices are driven by underlying ideology or social status. DellaPosta, Shi ^[15] described the ‘latte-drinking liberals’ and ‘bird-hunting conservatives’ in the U.S., where the nonpartisan lifestyle choices of beverages and leisure activities are strongly associated with a distinctive political and ideological profile. People in the same network tend to become more similar in all aspects of life, not only in areas closely related to their ideological beliefs, thus leading to the clustering of lifestyles and choices ^[25]. According to Weber, a community of individuals with a shared ‘style of life’, agreed upon and expected from all those who belong in the group, marks the beginning of the forming of social status ^[26].

An increasingly important channel of peer influence is social media, which often leads to new lifestyle trends. Social media allows the sharing of information and opinions at a very personal level. For example, in the last few years, top influencers with millions of followers have started to share pictures and videos of their plant-based meals and recipes on various social media. It has been found that food pictures, personal blogs, and vlogs posted on social media are helpful in maintaining a plant-based diet ^[27]. As plant-based diets have become trendy on social media, their popularity has skyrocketed over the last few years, especially among young people ^[28]. As more generations grow up deeply engaged in social media, researchers can expect that peer influence will play an increasingly important role in shaping one’s lifestyle.

Whether in-person or online, peer influence is expected to be stronger if the peers are perceived to be ‘people like us’, which can happen on a variety of parameters (such as gender, race, body type, social class) ^[29]. Research has shown that social influence on eating behaviour is significantly enhanced if people are familiar with their eating companions, or if they perceive similarities with them in terms of gender, weight, or age ^{[19][30][31]}. Cruwys, Platow ^[32] found that when students have high levels of organisational identification with their university, they adjust their food intake to those from the same university, but not from a different one.

In addition, research found that people in different groups may differentiate from each other by abandoning a certain behaviour that is common in the other group ^[33]. For example, university students are found to consume less junk food if eating junk food is associated with an undesirable group ^[34]; minority participants are found to eat less healthily when healthy eating is perceived as the marker of the majority group ^[35].

Agent-based modelling (ABM) is a research method that simulates autonomous and interacting agents in a virtual environment on a computer. An advantage of ABM is that it explicitly represents the dynamic interactions among individuals. ABM has been used to simulate and understand the dynamics of social identity and to test the logical consequences of social theories ^{[36][37][38]}. It has also been applied in the areas of civil conflicts ^{[39][40]}, crowd simulation ^[41], and natural resource management ^{[42][43]}.

2. The Agent-Based Model of Social Influence and Meat-Eating Behaviour

2.1. Agent and Attributes

An agent in the model represents a person. **Table 1** lists the attributes of a Person agent.

Table 1. Main agent attributes.

Attribute	Type/Value	Data Source	Endogenous?	Dynamic?
Serial number	String	BSA	N	N
Age	integer	BSA	N	N
Region	12 region in the UK	BSA	N	N
Gender	[Male, Female]	BSA	N	N
Social Class	[Manual, non-manual]	BSA	N	N
Political Party	[conservative, labour, libdem, ukip, green, other, none, dk]	BSA	N	N
Meat habit	[no meat, less meat, meat]	Initialised with BSA, updated each period	Y	Y
Change tendency *	between 0 and 1	Heterogeneous parameter	N	N
Social accounting *	A list of three numbers between 0 and 1 for the three meat habits	Updated each period	Y	Y

* more details below.

- Change tendency

Change tendency is a heterogeneous personal attribute that measures how likely a person is to change after being exposed to social interactions. Some people may have a lower tendency to change and will stick to their dietary choice despite the social interactions, whereas others may be more open to a change. The parameter 'change tendency' will capture this heterogeneous attribute among the agents. A higher change tendency means the agent is more likely to change after social interactions and vice versa.

The tendency to change will also depend on the current meat-eating behaviour of the agents. Researchers assume that, on average, the change tendency for vegetarians is much lower than that for non-vegetarians. The reason is that in 2014 only approximately 5% of the population were vegetarians, according to the BSA Survey. Being such a small minority means that the vegetarians will inevitably have to be more determined to stick with their current eating behaviour despite being the small minority, or they will soon be converted to the majority after continuous exposure to and interaction with the rest of the population.

- Social accounting

Each agent keeps a representation of what is referred to here as 'social accounting' (illustrated in **Figure 1**) of the level of social appeal associated with adopting one of the eating behaviours: to eat no meat (represented by colour green), less meat (pink), and meat (red). The agent will adopt the meat-eating behaviour that has the highest score or level of appeal. In the model, the initial levels of social accounting will be consistent with the agent's current behaviour. **Figure 1** is an example that illustrates an agent's social accounting for different eating behaviour. In **Figure 1**, the behaviour with the highest score in the social accounting is to eat meat. As a result, the agent will choose to eat meat. The values for each behaviour in the social accounting will be updated in each period as the agents engage in different types of social interactions with each other, which will be detailed in the next section, 'Section 2.2. Process: Four Types of Interactions'.



Figure 1. An agent's social accounting for different meat consumption behaviour.

2.2. Process: Four Types of Peer Influence

2.2.1. In-Group Reinforcement: Same Group, Same Behaviour

The first type of social interaction, *in-group reinforcement*, occurs when two agents in the same group with the same eating behaviour meet. As demonstrated in **Figure 2**, both agent 1 and 2 belong to the same social group (group A) and have the same dietary behaviour (no-meat eater). Because the two agents are identified as in the same group and they have the same behaviour, their social accounting for their current behaviour (no-meat eater) will both increase. Hence their current meat-eating behaviour will be reinforced after the interaction.

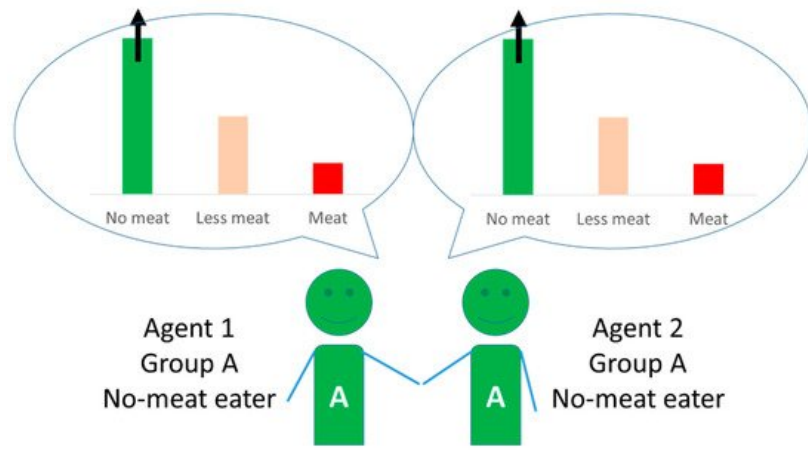


Figure 2. Social accounting for **in-group reinforcement**: Same group, same behaviour.

2.2.2. In-Group Influence: Same Group, Different Behaviour

The second type of social interaction, **in-group influence**, occurs when two agents are in the same social identity group but have different eating behaviours. Because the agents identify each other as being in the same group, they will exert a positive influence on one another. As demonstrated in **Figure 3**, agent 1 is a meat eater and agent 2 is a no-meat eater, and both are in the social group A. Since both agents 1 and 2 are in the same social group, agent 1's social accounting for no-meat eaters will increase after meeting agent 2; so will agent 2's social accounting for meat-eaters after meeting agent 1. In-group influence will increase the social accounting score for different behaviour, making it slightly more appealing to the agent, although the change may not be enough to reach the behaviour-changing threshold.

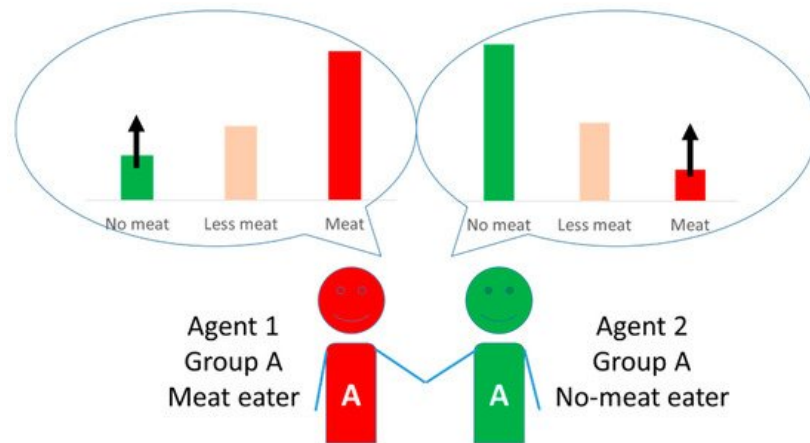


Figure 3. Social accounting for **in-group influence**: Same identity, different behaviour.

2.2.3. Out-Group Reinforcement: Different Group, Different Behaviour

The third type of social interaction, **out-group reinforcement**, describes the process where two people in different social groups with different behaviours meet. As shown in **Figure 4**, agent 1 is a meat-eater who belongs to social group A, whereas agent 2 is a no-meat eater who belongs to social group B. Because they belong to different social groups, when agents 1 and 2 meet, both will lower the social accounting score for the behaviour of the other party after the interaction. Hence, agent 1's score for no-meat eaters will decrease, and so will agent 2's score for meat-eaters. This represents a process of 'negative stereotyping', i.e., that a behaviour performed by an out-group member makes it less appealing, which is documented in the literature as discussed previously ^{[34][35]}. Out-group reinforcement effect will reinforce the agent's current behaviour by reducing the appeal of a different behaviour performed by an out-group member.

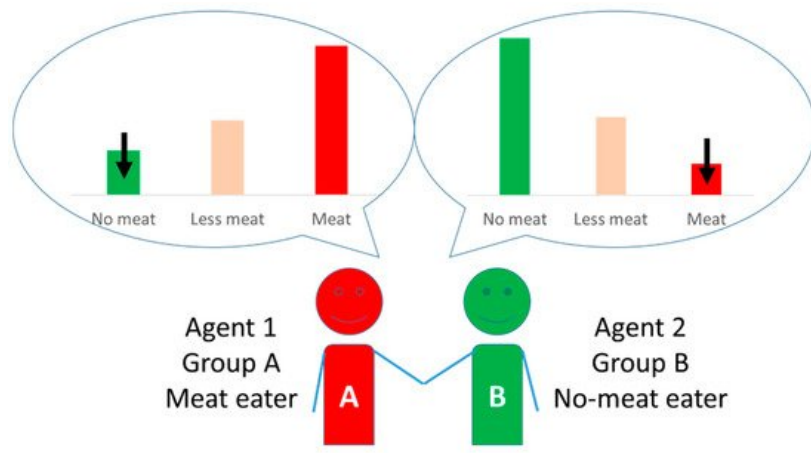


Figure 4. Social accounting for **out-group reinforcement**: Different identity, different behaviour.

2.2.4. Out-Group Influence: Unknown Identity, Different Behaviour

Lastly, not all social interactions are driven by social groups or identities. In some social settings, the social group of the other person cannot be known or observed, in which case there will be **out-group influence with unknown social groups**. As shown in **Figure 5**, agents 1 and 2 do not know each other's social groups. Agent 1 is a meat eater and agent 2 is a no-meat eater. After meeting agent 2, agent 1's social accounting for no-meat eaters will increase, and vice versa. Under out-group influence with unknown social groups, a person's social accounting for a certain behaviour increases after observing the behaviour of others, according to descriptive norms theory ^[44]. Researchers also assume that out-group influence only happens among agents living in the same region, when they are more likely to mingle and observe each other's eating behaviours.

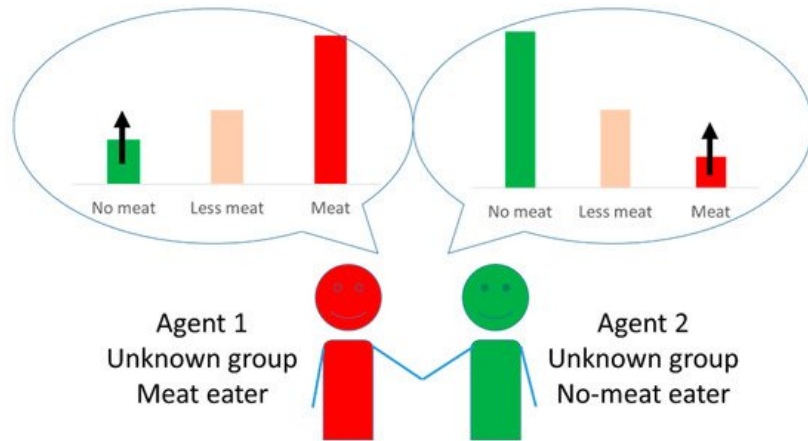


Figure 5. Social accounting for **out-group influence**: Unknown identity, different behaviour.

Figure 6 summarises the four types of social interactions by meat-eating behaviour and social groups. When two people with the same behaviour and in the same group meet, they engage in in-group reinforcement (type I) and they are more rooted in their current behaviour after the interaction. When two people in the same social group with different eating behaviour meet, they exert in-group influence on each other, and they are more likely to change their current behaviour (type II). When two people in different social groups with different social behaviour meet, they exert (negative) reinforcement effect on each other, and become less likely to convert to the other's behaviour (type III). Finally, when two people with different eating behaviours meet and do not know each other's social groups, they exert a positive social influence on each other (type IV), although the level of influence is less than if they belonged to the same social group. Additionally, when two people in different social groups and with the same eating behaviour meet, their social accounting does not change after the interaction. In summary, both in-group and out-group influence promote changes in behaviour, while both in-group and out-group reinforcement promote the status quo.

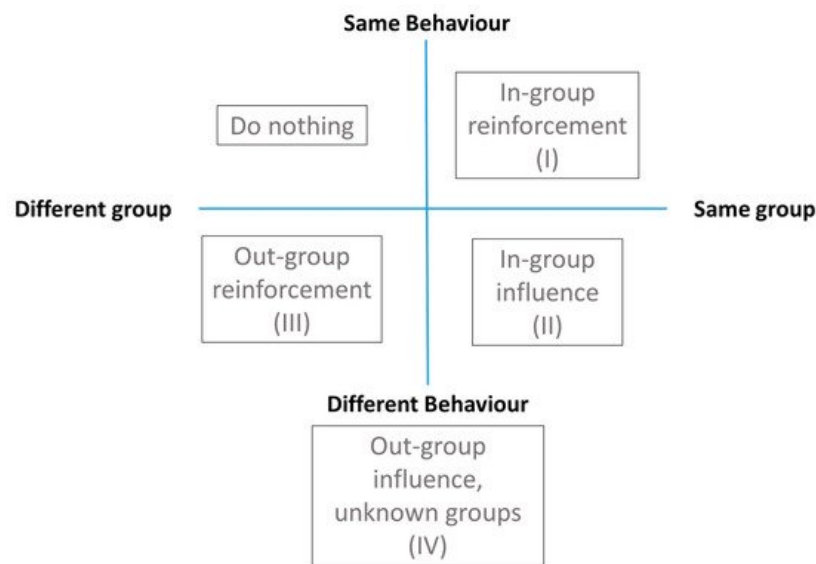


Figure 6. Four types of social interactions: in-group reinforcement (I), in-group influence (II), out-group reinforcement (III), and out-group influence with unknown identity (IV).

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