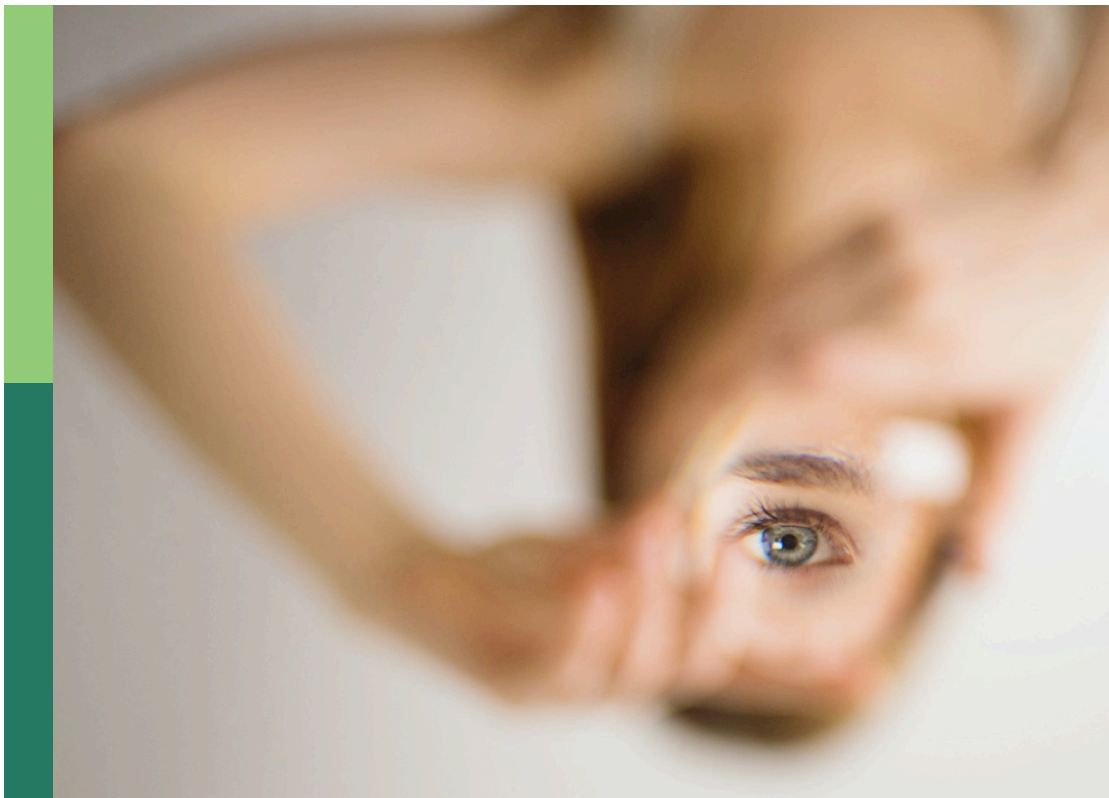
frontiers | Research Topics

Exploration of dietary correlates of conspiratorial thinking

Edited by
Reza Rastmanesh, Neil Dagnall and Guoyan Wang

Published in
Frontiers in Psychology



ISSN 1664-8714
ISBN 978-2-8325-2946-1
DOI 10.3389/978-2-8325-2946-1

About Frontiers

Frontiers is more than just an open access publisher of scholarly articles: it is a pioneering approach to the world of academia, radically improving the way scholarly research is managed. The grand vision of Frontiers is a world where all people have an equal opportunity to seek, share and generate knowledge. Frontiers provides immediate and permanent online open access to all its publications, but this alone is not enough to realize our grand goals.

Frontiers journal series

The Frontiers journal series is a multi-tier and interdisciplinary set of open-access, online journals, promising a paradigm shift from the current review, selection and dissemination processes in academic publishing. All Frontiers journals are driven by researchers for researchers; therefore, they constitute a service to the scholarly community. At the same time, the *Frontiers journal series* operates on a revolutionary invention, the tiered publishing system, initially addressing specific communities of scholars, and gradually climbing up to broader public understanding, thus serving the interests of the lay society, too.

Dedication to quality

Each Frontiers article is a landmark of the highest quality, thanks to genuinely collaborative interactions between authors and review editors, who include some of the world's best academicians. Research must be certified by peers before entering a stream of knowledge that may eventually reach the public - and shape society; therefore, Frontiers only applies the most rigorous and unbiased reviews. Frontiers revolutionizes research publishing by freely delivering the most outstanding research, evaluated with no bias from both the academic and social point of view. By applying the most advanced information technologies, Frontiers is catapulting scholarly publishing into a new generation.

What are Frontiers Research Topics?

Frontiers Research Topics are very popular trademarks of the *Frontiers journals series*: they are collections of at least ten articles, all centered on a particular subject. With their unique mix of varied contributions from Original Research to Review Articles, Frontiers Research Topics unify the most influential researchers, the latest key findings and historical advances in a hot research area.

Find out more on how to host your own Frontiers Research Topic or contribute to one as an author by contacting the Frontiers editorial office: frontiersin.org/about/contact

Exploration of dietary correlates of conspiratorial thinking

Topic editors

Reza Rastmanesh — American Physical Society, United States
Neil Dagnall — Manchester Metropolitan University, United Kingdom
Guoyan Wang — Soochow University, China

Citation

Rastmanesh, R., Dagnall, N., Wang, G., eds. (2023). *Exploration of dietary correlates of conspiratorial thinking*. Lausanne: Frontiers Media SA.
doi: 10.3389/978-2-8325-2946-1

Table of contents

frontiers | Frontiers in Psychology

TYPE Editorial
PUBLISHED 22 June 2023
DOI 10.3389/fpsyg.2023.1205350

OPEN ACCESS

EDITED AND REVIEWED BY
Gerald Matthews,
George Mason University, United States

*CORRESPONDENCE
Reza Rastmanesh
✉ rezar@sbmu.ac.ir

RECEIVED 13 April 2023
ACCEPTED 08 June 2023
PUBLISHED 22 June 2023

CITATION
Rastmanesh R, Dagnall N and Wang G (2023) Editorial: Exploration of dietary correlates of conspiratorial thinking.
Front. Psychol. 14:1205350.
doi: 10.3389/fpsyg.2023.1205350

Editorial: Exploration of dietary correlates of conspiratorial thinking

Reza Rastmanesh[1]*, Neil Dagnall[2] and Guoyan Wang[3]

[1]American Physical Society, College Park, MD, United States, [2]Department of Psychology, Manchester Metropolitan University, Manchester, United Kingdom, [3]School of Communication, Soochow University, Suzhou, China

KEYWORDS

conspiratorial thinking, paranoia, dietary patterns, nutrient deficiencies, conspiracy theories

Editorial on the Research Topic
Exploration of dietary correlates of conspiratorial thinking

While scholarly interest in the origins, purpose, and consequences of conspiratorial thinking and endorsement of concomitant theories has an established tradition in psychological, work assessing the effects of conspiratorial thinking on general and individual diet-related perceptions, attitudes, and behaviors remains limited. Acknowledging this gap in the literature, the editors encouraged authors to highlight relevant developments and contemporary contributions within and around the topic domain. This was necessary since eating healthy foods and consuming drinks in the right proportions and amounts is vital to physical and psychological wellbeing. Accordingly, information that undermines health dietary patterns is potentially harmful to both individuals and society. In this context, conspiracy theories are an important source of inaccurate information that can inappropriately influence diet and detrimentally affect health.

Although there is no single, consensually agreed definition of conspiratorial thinking, commonly used delineations embody canonical themes. These include, but are not restricted to, exploitation of power, collusion, intention, clandestineness, deception, control, manipulation, and premeditation. These themes combine so that conspiratorial thinking reflects the belief that powerful individuals/groups, through exploitation, secretly enact actions to achieve, predetermined nefarious goals. In extreme cases, conspiratorial thinking predominates as a prevailing worldview, where high-order beliefs (e.g., mistrust of authority), askew perception of the world. Although not all conspiracies are false (e.g., Watergate, MKUltra, and Operation Northwoods), theories by definition typically convey false information as truth, or possibility.

In this regard, validation of mis (inaccurate) and/or dis(deliberate incorrect) information can adversely affect healthy life choices and habits. Examples include, theories related to genetically modified foods, sugar consumption, light/low fat products, and relationships between calorie burning and exercise. Despite evidence of a link between conspiratorial thinking and resistance to engage with public health communications, as evidenced during the COVID-19 pandemic, few studies to date have considered the influence of conspiratorial

thinking on diet. Noting this, the present Research Topic asked for contributions addressing this issue and related areas. The outcome was a research collection that comprised research on conspiratorial thinking/theory endorsement, individual differences, and eating/diet/food choices.

With reference to conspiratorial thinking, submitted articles examined the theoretical nature of ideation and its application to diet-related issues. Considering contributions in turn, Franks et al. examined the monological nature of conspiracy acceptance. This is the view that belief in one theory correlates positively with endorsement of others. Franks et al. did this by reconstructing a conspiracy worldview. This approach identified novel features of conspiracy endorsement (e.g., community and personal journey of conversion). Orosz et al. found that rational and ridiculing arguments reduced CT endorsement, and the perceived intelligence and competence of the source of belief-reduction information contributed to the success of the reduction strategy. Prichard and Christman investigated factors associated with a lack of concern about COVID-19 and belief that China was responsible for the virus. Authoritarianism was related with less concern about the virus and Authoritarianism and Conspiracy Beliefs accounted for unique variance in blame on China for the virus. Applied to diet, these article signify that conspiratorial thinking is elaborate and that strategies to increase accurate awareness of health-related matters need to acknowledge this. Particularly, rational arguments that target the connection between the object of belief and its characteristics in a subtle non-confrontational manner, which are presented by credible sources are most likely to reduce conspiratorial thinking.

Articles examining conspiratorial thinking in specific diet-related contexts also produced valuable outcomes. Du et al. found that information exposure was directly connected to attitudes about genetically modified organisms (GMO). Beliefs in conspiracy theories also played a mediating role. Specifically, unofficial information reinforced beliefs in conspiracy theories and stronger beliefs reduced willingness to consume GMO. In contrast, exposure to official information weakened people's beliefs in conspiracy theories and increased their willingness to consume GMO foods. Additionally, knowledge had a moderating role. Objective knowledge reduced conspiracy beliefs, whereas self-assessment enhanced them. Also on GMO, Yang reported that citizen science communicators and scientist science communicators employ different discourse strategies to convey oppositional attitudes to GMOs conspiracy theories. Jedinger found that conspiracy mentality correlated with the perceived threat posed by foreign trade and opposition to international trade. Collectively, these articles illustrate that exposure to conspiracies and contextualization of allied thinking has an important influence on perception of food types and the sourcing of provisions.

In terms of individual differences this Research Topic produced several articles focusing diet and eating. Sariyska et al. investigated how the consumption of animal products was related to dietary habits, primary emotional systems, and dark triad personality traits. Uccula et al. reported that in a potentially threatening situation, there was an association between attachment orientation and preference to use care or food to regulate their negative emotions. Zhang et al. outlines how general and food-specific inhibitory control mechanisms moderate the predictive relationship between automatic attention and food choices. Nettle discusses the notion that individuals of lower socioeconomic position behave and feel as they do because of relative hunger and concludes that hunger is an important mediator between socioeconomic variables and behavioral/psychological outcomes. Cantarero et al. investigated feedback to a dish poorly prepared by a stranger. Outcomes designated that participants were most likely to opt for prosocial lies (i.e., overly positive feedback) when the stranger cared about cooking and was very sensitive to negative feedback.

These papers investigators with a better understanding of how individual differences influence food and nutritional choices. This information is useful to the topic of conspiratorial thinking and diet since it informs possibilities for subsequent research. For instance, future work could assess whether vegans/vegetarians (vs. omnivores) are more susceptible to eating choice based conspiracies and determine whether the observed relationship is influenced by dark triad personality traits. Additionally, studies could examine whether attachment orientation and negative emotions increase the tendency to endorse food, diet, and nutrition based conspiracy theories. There is certainly pertinent extant literature to suggest that areas such as these would produce finding that extend understanding of dietary correlates of conspiratorial thinking.

Within the Research Topic, three articles focused on eating choices and habits. These overlapped with the submissions on individual differences, and similarly suggested useful investigative avenues for ensuing scholarly. Huang et al. found that consumers were susceptible to the influence of targeted marketing strategies for foods with a low-calorie claim. Vestergren and Uysal, following a systematic review of veganism and sustainable diet/lifestyle between 2010 and 2021, identified important themes such as treating all non-meat eaters as a homogeneous group and lack of processes underlying emergence and endurance of veganism, which have limited understanding of veganism and vegan identity. Finally, Moynihan et al. observed that boredom predicted maladaptive and adaptive eating behaviors as a function of the need to distance from the experience of boredom.

The papers in this Research Topic reinforce the need for concerted work in the area of dietary correlates of conspiratorial thinking. Whilst these contributions provide novel conceptual insights and recommend ways to progress the Research Topic, the area despite its social importance, remains relatively under researched. Moreover, within the domain there is a need for greater focus and coherence. Presently, due to breadth, investigation is diffuse and only peripherally connected. Nonetheless, the work in this Research Topic is valuable since in order to develop strategies to counteract the negative effects of conspiratorial thinking on diet, researchers first need to understand allied psychological processes and contextual constraints.

Author contributions

RR wrote the Research Topic and contributed to the draft of editorial. ND wrote the editorial and contributed to the editorship.

GW contributed to editorship. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

frontiers in Psychology

ORIGINAL RESEARCH
published: 01 April 2015
doi: 10.3389/fpsyg.2015.00369

Eaten up by boredom: consuming food to escape awareness of the bored self

Andrew B. Moynihan[1], Wijnand A. P. van Tilburg[2], Eric R. Igou[1], Arnaud Wisman[3], Alan E. Donnelly[4] and Jessie B. Mulcaire[5]*

[1] SOCO-UL Lab, Department of Psychology, Education & Health Sciences Faculty, University of Limerick, Limerick, Ireland, [2] Centre for Research on Self and Identity, School of Psychology, University of Southampton, Southampton, UK, [3] School of Psychology, Keynes College, University of Kent, Canterbury, UK, [4] Centre for Physical Activity and Health Research, Physical Education and Sport Sciences Department, Education & Health Sciences Faculty, University of Limerick, Limerick, Ireland, [5] School of Medicine, University of St. Andrews, Fife, UK

Research indicates that being bored affectively marks an appraised lack of meaning in the present situation and in life. We propose that state boredom increases eating in an attempt to distract from this experience, especially among people high in objective self-awareness. Three studies were conducted to investigate boredom's effects on eating, both naturally occurring in a diary study and manipulated in two experiments. In Study 1, a week-long diary study showed that state boredom positively predicted calorie, fat, carbohydrate, and protein consumption. In Study 2, a high (vs. low) boredom task increased the desire to snack as opposed to eating something healthy, especially amongst those participants high in objective self-awareness. In addition, Study 3 demonstrated that among people high in objective self-awareness, high (vs. low) boredom increased the consumption of less healthy foods *and* the consumption of more exciting, healthy foods. However, this did not extend to unexciting, healthy food. Collectively, these novel findings signify the role of boredom in predicting maladaptive and adaptive eating behaviors as a function of the need to distant from the experience of boredom. Further, our results suggest that more exciting, healthy food serves as alternative to maladaptive consumption following boredom.

Keywords: boredom, self-awareness, individual differences, sensation-seeking, unhealthy eating, meaning

OPEN ACCESS

Edited by:
Marcel Zentner, University of Innsbruck, Austria

Reviewed by:
Katy Tapper, City University London, UK
Mark Hallahan, College of the Holy Cross, USA

****Correspondence:***
Andrew B. Moynihan, SOCO-UL Lab, Department of Psychology, Education & Health Sciences Faculty, Main Building, University of Limerick, Castletroy, Limerick, Ireland
andrew.moynihan@ul.ie

Specialty section:
This article was submitted to Personality and Social Psychology, a section of the journal Frontiers in Psychology

Received: *18 November 2014*
Accepted: *16 March 2015*
Published: *01 April 2015*

Citation:
Moynihan AB, van Tilburg WAP, Igou ER, Wisman A, Donnelly AE and Mulcaire JB (2015) Eaten up by boredom: consuming food to escape awareness of the bored self. Front. Psychol. 6:369. doi: 10.3389/fpsyg.2015.00369

Introduction

Recent studies have highlighted that general measures of negative affect may not be strongly associated with eating behaviors (Evers et al., 2010; Adriaanse et al., 2011; Haedt-Matt and Keel, 2011). However, specific types of negative affect seem to play a more important role in understanding some food consumption (Goldenberg et al., 2005). One likely, less researched affective predictor of eating behavior is boredom (Koball et al., 2012). Boredom has been implicated in the current obesity epidemic and eating behavior (World Health Organization-Europe, 2007). Eating when bored follows a psychological process that is distinct from those prompted by other negative states in the sense that boredom has been found to predict eating behaviors independently of other negative emotions. Specifically, boredom continues to be an important predictor of eating behaviors after controlling for other affective states (Koball et al., 2012). This suggests that boredom can help to explain some eating behavior (Cleobury and Tapper, 2014). Recent theories suggest that eating in

response to boredom may be a meaning-regulation response (Wisman, 2006), unlike what happens regarding some other negative emotions (Van Tilburg and Igou, 2011). However, the literature on boredom and eating has not yet established a causal relationship between state boredom, a relatively recent psychologically examined construct, and eating.

Boredom is a discrete emotion that associates with feeling dissatisfied, restless, and unchallenged when one interprets actions and situations at the present time as purposeless (e.g., Leary et al., 1986; Mikulas and Vodanovich, 1993; Barbalet, 1999; Fahlman et al., 2009; Van Tilburg and Igou, 2011, 2012). When one is bored, situations receive low attention due to lack of interest or stimulation coming from one's immediate environment (Sansone et al., 1992). Essentially, the emotional experience of boredom signals that a current situation is devoid of purpose (Barbalet, 1999; Van Tilburg and Igou, 2012). Following meaning threats, people are motivated to re-establish a sense of purpose in their engagement or turn to behaviors that they deem more meaningful. Indeed, boredom is a meaning threat (Barbalet, 1999; Van Tilburg and Igou, 2012) and triggers responses aimed at reinstating a sense of purpose. For example, Van Tilburg and Igou (2011) found that boredom increased people's valuations of their in-groups and devaluation of out-groups, key sources of meaning (Heine et al., 2006). Similarly, people sometimes engage in nostalgic reverie to counteract the lack of meaning signaled by boredom (Van Tilburg et al., 2013). Specifically, boredom serves the self-regulatory function of redirecting people's cognitions and behaviors toward mitigating the lack of meaning at hand (Van Tilburg and Igou, 2012).

In the context of a compromised sense of meaningfulness, as signaled by boredom, different types of responses, relevant to health behaviors, have been implicated (Goldenberg and Arndt, 2008; Arndt and Goldenberg, 2010). When people face a challenge to perceived meaning, they may attempt to escape from their sense of self-awareness and hence are *distracted* from such threats completely. Therefore, the conflict between the desired sense of meaningfulness and the acute lack of it is removed by losing one's sense of self-awareness. This is a common, though short-term reaction to lacking perceived meaning. Examples of means to avoid this aversive self-awareness include engaging in unhealthy behaviors that are ultimately harmful. For example, food helps to escape a sense of aversive self-awareness (Wisman, 2006) and may hence be used to cope with boredom. The excitement or stimulation certain foods offer may help to distract people's attention from the bored self. Indeed, obesity is more prevalent among those who regularly experience boredom, compared with other negative states (Abramson and Stinson, 1977). Consistently, boredom has been correlated with various eating disorders (Ganley, 1989).

Similarly, objective self-awareness theory (e.g., Duval and Wicklund, 1972; Gollwitzer and Wicklund, 1985) suggests that people become more aware of discrepancies between the present and ideal self when the self is the focus of attention. This is a different phenomenon than mindfulness, which involves changing how one becomes aware of one's thoughts and experiences that are seen as less real, personal, vivid, and compelling, and perceiving them as transient events (Papies et al., 2015). Bored people note the lack of purpose in their current state and how this contrasts from their ideal of engaging in purposeful activities (Van Tilburg and Igou, 2012). This inconsistency is aversive, motivating action to reduce the discrepancy. If people are unable to do so by doing something that gives them a sense of meaning (e.g., bolstering cultural worldviews and ideologies), they become likely to focus on reducing or avoiding the self-focus. Again, one way of avoiding aversive self-related thoughts is by 'escaping from self-awareness,' for example, by eating or other behaviors that involve a loss of self-awareness such as affiliation (Heatherton and Baumeister, 1991; Wisman and Koole, 2003; Wisman, 2006). These behaviors shift focus from the self-regulatory challenge to acute sensations.

Thus, we suggest that the state of aversive self-awareness when bored can motivate people to escape the self. If boredom leads to eating, then this effect may in part be understood as an attempt to reduce self-awareness as a means to escape the self-regulatory discrepancy. Further, we reason that people high in dispositional self-awareness, that is, people who gravitate to introspection easily, would be particularly vulnerable to the aversive self-discrepancies. Since eating distracts people from unpleasant self-awareness associated with lacking meaning (Gerrard et al., 2008), people especially high in self-awareness should engage in eating when they experience boredom.

Our current research is designed to go beyond previous research, analyzing food choices people make in relation to state boredom. These predictions were examined in a series of three studies. Study 1 used a diary procedure examining state boredom and food intake. State boredom was manipulated in Studies 2 and 3 and consumption intentions and behavior were measured whilst examining self-awareness as critical moderator. Further, in Study 3, we investigated whether boredom can promote eating more exciting, healthier foods, as more adaptive eating behavior than indulging in less healthy foods. Boredom encourages people to seek sensation (e.g., Van Tilburg and Igou, 2012), therefore, we argue that more 'exciting' food serves as a potent distraction of self-regulatory challenges for example by providing an intense appearance or taste (McGregor et al., 2012). Consequently, the current research tested if the negative effects of boredom on eating behaviors would be counteracted by offering more exciting, yet healthy foods. We expected that bored people would eat certain foods as a function of escaping from aversive self-awareness associated with the meaning threat. Indeed, self-awareness is necessary to perceive that one is experiencing meaning threats (Wisman, 2006).

Our three studies adopted different methodological approaches (diary study, experimental) in which eating was assessed differently (self-reported, behavioral). By examining the link between boredom and eating from these different angles, limitations associated with one particular approach were addressed with another methodology. For example, the diary study offered a window in real-life settings which were complemented by test of causal relations available through lab experimentation. All studies were approved by the University of Limerick's education and health sciences research ethics committee.

Study 1: A Behavioral Diary Study: Boredom Increases Unhealthy Eating

In this study, we used a 1-week long diary procedure to examine the relationship between state boredom and food intake. We predicted that boredom was positively associated with increased intake of food as indicated by increases in energy, fats, carbohydrates, and proteins.

Method

Participants and Design

Thirty-three people from Limerick city, Ireland ($M_{age} = 50.30$, SD = 10.81; 30 women, 3 men; $M_{BMI} = 24.96$, SD = 5.37, range: 17.07–43.40) took part in a diary study across 7 days. Participants were recruited from the general population by distributing advertisements in the local area.

Materials and Procedure

Participants received a folder with the paper-and-pencil materials of the diary study sorted by day. On the first day and after giving informed consent, participants reported demographic information as well as height and weight. Further, they were instructed how and when to complete the diaries each day. Participants then completed a shortened version of the 'boredom proneness scale' (Gordon et al., 1997). This scale assessed individual differences in the proclivity to experience boredom (12 items, e.g., "It is easy for me to concentrate on my activities"; 1 = *not at all*, 7 = *very much*; $\alpha = 0.66$). Trait boredom proneness is psychologically different from state boredom (Van Tilburg and Igou, 2012). This scale was included to verify that state boredom prompted increased eating of certain food groups above and beyond any influence of trait boredom.

This was followed by the 'Positive and Negative Affect Scale' short-form (PANAS; Watson et al., 1988), which probed negative and positive affect with five items for each construct (e.g., upset; 1 = *very slightly* or *not at all*, 5 = *extremely*; $\alpha_{positive} = 0.70$, $\alpha_{negative} = 0.71$). Participants were asked to answer this scale based on how they felt in general.

On each evening, participants first responded to three separate items developed by the research team assessing state boredom, stress, and enjoyment experienced during that day (e.g., "How boring was your day?," "Did you have a stressful day?," "Did you have an enjoyable day?"; 1 = *not at all*, 7 = *a lot*). These items were taken from existing reliable and valid measures to fit the current diary study context (Van Tilburg and Igou, 2011, 2012). Next, participants kept track of their food and drink intake using the 7-days EPIC-Norfolk diary (Bingham et al., 2001). This diary consists of a booklet with separate sections for each day. Participants were requested to be as detailed as possible in their records and the booklets contained color pictures of various food types and amounts to aid the assessment of portions. Studies assessing the amount and types of different food groups and products consumed attest to the validity and reliability of this measure based on correlations with potassium, nitrogen, and sodium in urine secretion content and weighed records (Bingham et al., 1997; McKeown et al., 2001). Listed consumptions were decoded into daily amounts of energy (kilocalories), fat, carbohydrate, fiber, and protein (grams) using the aids to calculation of food composition provided by McGuire and Beerman (2007).

Results

Considering the multilevel structure of the data (i.e., multiple days nested 'within' participants), data was first disaggregated. Conducting this technique resulted in 231 part-dependent observations (i.e., seven observations for each of the 33 participants). With the exception of the food content variables, all variables were standardized. When using regression-based analyses (multiple regression analysis, simple slope analysis, some multilevel analysis), it is important to standardize variables. This prevents multicollinearity when using interaction terms (Tabachnick and Fidell, 2008). Further, the strength of the covariates correlations with each other and with boredom ranged from small to medium strength (Maximum: 0.65, Minimum: −0.60). Therefore, there was no problematic multicollinearity. Subsequent analysis consisted of restricted maximum likelihood random-intercept multilevel analyses in which participants were specified as a grouping variable, hence accounting for dependency of observations. To examine the impact of state boredom on dietary choices, participants' daily level of boredom was specified as predictor of the various food contents, with covariates added to more complex models.

Variables were entered into the model based on their relevance or interest to the current study. Specifically, state boredom, the central variable of interest, was entered as the predictor in the first models, and then the other predictors were added in the subsequent models.

Energy

Energy consumption was operationalized as kilocalorie content. As reflected in **Table 1** (Model 1), state boredom was significantly positively associated with energy consumption, $\lambda = 98.69$, $S_e = 35.90$, $t(215.55) = 2.76$, $p < 0.01$. This indicated that when participants' level of boredom rose by its standard deviation, 1.585, the equivalent energy content of one additional scrambled egg or banana, approximately an extra 100 calories, was consumed.

The association with daily boredom remained after additionally controlling for the other variables, dispositional boredom, positive affect, negative affect, stress and body mass index, $\lambda = 123.78$, $S_e = 39.77$, $t(179.19) = 3.11$, $p < 0.01$ (Model 2).

Fats

In **Table 1** (Model 1), it can be seen that state boredom was significantly positively associated with the consumption of fats, $\lambda = 5.25$, $S_e = 1.69$, $t(215.50) = 3.11$, $p < 0.01$. This result indicated that, on average, with every standard deviation increase in boredom, approximately five additional grams of fat were consumed, equivalent to the fat content of one biscuit. This relationship was also found after controlling for the other variables, $\lambda = 6.15$, $S_e = 1.88$, $t(177.19) = 3.28$, $p < 0.01$ (Model 2).

Carbohydrates

As shown in **Table 1** (Model 1), state boredom was significantly, positively associated with carbohydrate intake, $\lambda = 9.81$,

TABLE 1 | Daily consumption of food types as a function of state boredom (Study 1).

	State boredom		State enjoyment		State stress		Boredom proneness		Positive affect		Negative affect		BMI	
Energy	λ	S_e	λ	S_e	λ	S_e	λ	S_e	λ	S_e	λ	S_e	λ	S_e
Model 1	98.64**	35.69												
Model 2	123.78**	39.77	135.87**	44.68	−1.15	43.94	−33.68	90.77	−16.53	87.18	−56.77	85.20	−24.78	77.59
Fat														
Model 1	5.25**	1.69												
Model 2	6.15**	1.88	4.67*	2.12	1.17	2.08	1.06	4.62	−3.30	4.44	−4.22	4.34	−3.36	3.96
Carbohydrate														
Model 1	9.81*	4.64												
Model 2	11.10*	5.20	12.32*	5.83	−3.61	5.74	−1.19	11.30	1.73	10.85	−2.01	10.61	−3.22	9.65
Protein														
Model 1	3.52*	1.78												
Model 2	4.89*	1.99	5.68*	2.23	0.99	2.20	−2.81	4.49	0.56	4.31	−3.16	4.21	1.05	3.83
Fiber														
Model 1	−0.23	0.59												
Model 2	−0.09	0.66	−0.21	0.52	−0.31	0.44	−0.04	1.66	1.22	1.60	0.52	1.56	−0.93	1.42

*$p < 0.05$; **$p < 0.01$.

$S_e = 4.64$, $t(215.92) = 2.12$, $p = 0.04$. This result indicated that, on average, with every standard deviation increase in boredom, approximately ten additional grams of carbohydrates were consumed, equivalent to the carbohydrate content of a packet of sweets. This association remained after controlling for the other variables, $\lambda = 11.10$, $S_e = 5.20$, $t(180.28) = 2.13$, $p = 0.03$ (Model 2).

Proteins

In **Table 1** (Model 1), it is shown that state boredom was significantly positively associated with the amount of protein consumed, $\lambda = 3.52$, $S_e = 1.78$, $t(215.96) = 2.00$, $p = 0.05$. This result indicated that, on average, with every standard deviation increase in boredom, approximately three-and-a-half additional grams of protein were consumed, equivalent to the protein content of a cup of mushrooms. Again, the results remained much the same when controlling for the other variables, $\lambda = 4.89$, $S_e = 1.99$, $t(179.47) = 2.46$, $p = 0.02$ (Model 2).

Fibers

In contrast to the other content indexes, state boredom was not significantly associated with the consumption of fiber, $\lambda = -0.23$, $S_e = 0.59$, $t(214.04) = 0.39$, $p = 0.70$, as shown in **Table 1** (Model 1), a relation that remained non-significant when controlling for the other variables, $\lambda = -0.09$, $S_e = 0.66$, $t(176.84) = 0.13$, $p = 0.89$ (Model 2).

Discussion

Consistent with our predictions, state boredom was associated with a greater energy intake, as well as the consumption of higher quantities of fats, carbohydrates, and proteins. Each of these associations remained significant after controlling for stress, enjoyment, and individual differences in boredom proneness, positive affect, negative affect, and body mass index. Also, the impact of these individual differences was not significant.

These findings demonstrate that state boredom indeed relates to higher levels of consumption including fats and carbohydrates, energy-dense food groups most relevant to the obesity epidemic (World Health Organization-Europe, 2007). From our review of the literature, we suspect that this is the first study which has demonstrated overconsumption of particular food groups in response to state boredom.

Study 2: The Role of Self-Awareness in Boredom and Snacking Desire

A major benefit of Study 1 was that it examined boredom's relationship with eating behaviors in 'real-life' settings. However, the diary method limited testing the causal structure of this relationship. Therefore, our next study tested the causal relationship between boredom and eating behavior in a more controlled context. We designed Study 2 to manipulate boredom and to test the proposed effect of boredom on food preferences at different levels of objective self-awareness. Our hypothesis was that unhealthy eating would function as an escape from aversive self-awareness associated with boredom (Wisman, 2006). Earlier research has suggested that self-awareness required for self-regulation after meaning threats may be compromised as it highlights deficiencies in the self (Twenge et al., 2003; Baumeister et al., 2005). Further, objective self-awareness is an individual difference (Baumeister, 1991). Accordingly, we expected that especially among those participants high on trait levels of objective self-awareness, high levels of boredom would facilitate temptations to snack on less healthy foods compared to those low in self-awareness and those in the low boredom condition.

Self-report measures were used to assess these food choices. By using short self-report measures (rather than elaborate diaries or actual eating behavior), Study 2's hypothesis was tested in a larger sample, not hindered by more demanding methodological

requirements, to control demand characteristics and item redundancy.

Method

Participants and Design

Seventy-nine students (M_{age} = 19.68, SD = 2.32; 33 women, 46 men) of the University of Limerick, Ireland participated in Study 2 in return for partial course credits or €3. They were assigned to one of two conditions of a between subjects design (boredom: high vs. low). This study's population was changed from Study 1. We did this to generalize findings to other populations (Larson and Richards, 1991).

Pilot Study

Importantly, whereas prior studies have manipulated boredom by varying the duration of involvement in a dull activity (e.g., Van Tilburg and Igou, 2011; Van Tilburg et al., 2013), we attempted to keep the task duration comparable across the two studies. For this purpose, a novel boredom induction task was used, based on a pilot study. This task consisted of a simple puzzle in which participants had to connect different objects while adhering to basic rules. In the low boredom condition, several depicted cows and chickens needed to be connected, by drawing a line, to a trough or coop, respectively. Drawn 'paths' were not to cross, there was a limit to the amount of animals connected to each trough or coop, and several dotted lines called 'canals' could not be crossed. In the high boredom condition, the puzzle was identical except that the cows, chickens, troughs, and coops were replaced with circles, rectangles, triangles, and squares, respectively. Based on past research, we anticipated the latter variation to be less engaging, and therefore to solicit boredom (Csikszentmihalyi, 1975/2000; Van Tilburg and Igou, 2012).

Fifteen students from the University of Limerick worked on both puzzles and evaluated task boredom ("How boring is this task?"; 1 = *not at all*, 7 = *very much*, Van Tilburg and Igou, 2012). The high boredom version was considered more boring (M = 5.33, SD = 1.18) than the low boredom version (M = 3.80, SD = 1.97), $t(14) = 3.44$, $p < 0.01$, $d = 0.94$.

Materials and Procedure

After giving informed consent and providing demographic details, participants completed the eight-item objective self-awareness measure from the self-consciousness scale (Fenigstein et al., 1975; e.g., "I generally pay attention to my inner feelings"; 1 = *not at all*, 7 = *very much*; α = 0.74). This measure was followed by the boredom induction task.

Previous research shows that snacking is associated with less nutritious food (Adriaanse et al., 2011). In addition, people generally try to abide by a societal norm to act healthily, which may be hampered by snacking (Goldenberg et al., 2005). Therefore, as a measurement of unhealthy consumption, participants indicated their desire to snack after the puzzle ("Do you feel like snacking right now?"; 1 = *not at all*, 7 = *very much*) as well as their wish to eat healthy ("Do you feel like eating something healthy right now?," 1 = *not at all*, 7 = *very much*). These two items were developed by the research team. Afterward, participants were thanked and debriefed.

Results and Discussion

After standardizing the aggregated objective self-awareness scores and effect coding the boredom induction (−1 = *low*, 1 = *high*), these variables and their interaction were entered as predictors of participants' reported snacking desires in an ordinary least squares regression analysis. The results of this analysis evidenced the predicted significant interaction between the boredom induction and objective self-awareness, $B = 0.48$, $S_e = 0.24$, $t(75) = 2.00$, $p = 0.05$, as well as a significant partial effect of self-awareness, $B = 0.62$, $S_e = 0.24$, $t(75) = 2.59$, $p = 0.01$, and a non-significant partial effect of the boredom induction, $B = 0.22$, $S_e = 0.23$, $t(75) = 0.96$, $p = 0.34$.

As illustrated in **Figure 1**, these results indicate that the amplification of snacking desire under high boredom is more pronounced among those high in objective self-awareness relative to those low in objective self-awareness. When probing the interaction (Hayes, 2012, Model 1), no significant association between objective self-awareness and snacking desire was found among those in the low boredom condition, $B = 0.14$, $S_e = 0.29$, $t(75) = 0.49$, $p = 0.62$. However, there was a significant positive relationship between these two constructs in the high boredom condition, $B = 1.10$, $S_e = 0.38$, $t(75) = 2.88$, $p < 0.01$. These results indicate that boredom fosters the desire to snack, especially among those high in objective self-awareness.

The results of the healthy eating analysis evidenced no significant interaction between the boredom induction and objective self-awareness, $B = -0.12$, $S_e = 0.20$, $t(75) = 0.61$, $p = 0.55$, no significant partial effect of self-awareness, $B = 0.07$, $S_e = 0.20$, $t(75) = 0.34$, $p = 0.74$, and also no significant partial effect of the boredom induction, $B = 0.19$, $S_e = 0.19$, $t(75) = 1.02$, $p = 0.31$.

Overall, Study 2 demonstrated that state boredom promotes a desire to snack, typically less healthy foods (Adriaanse et al., 2011). The maladaptive eating tendency was especially present among those participants high on objective self-awareness. This finding is consistent with the hypothesis that boredom—which emotionally signals a lack of meaning (Van Tilburg and Igou,

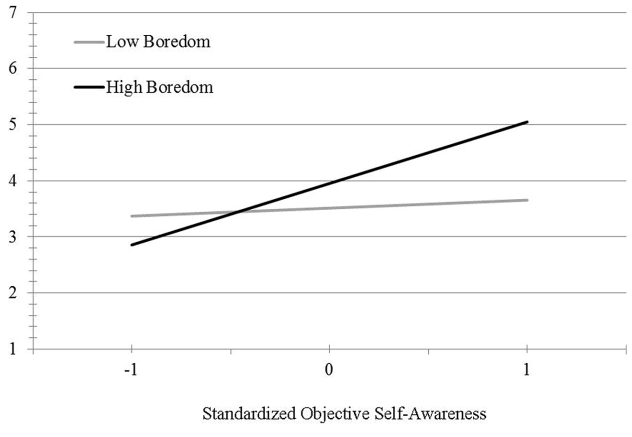


FIGURE 1 | Snacking desire by boredom and objective self-awareness (Study 2).

2011, 2012; Van Tilburg et al., 2013)—increases the desire to eat unhealthily, especially among people with high objective self-awareness. Moreover, no effects were observed for the desire to eat healthier foods, suggesting that boredom does not simply increase any consumption, but it promotes more unhealthy consumption in particular.

Study 3: Boredom Specificity and the Choice of Eating Healthy Foods

In Study 3, we extended the previous studies' findings by offering participants actual food choices. Further, offering food choices helped to clarify if self-awareness moderates actually acting upon the desire for snacking rather than mere awareness of a desire for snacking. Moreover, boredom specificity was tested against another negative experience, sadness, to rule out that the effects on eating behavior were based on general negative affect repair motivations. Indeed, boredom and sadness have been found to have distinct relationships with eating in previous research (Koball et al., 2012).

We gave participants the choice not only between a healthy vs. less healthy food option, but also a more 'exciting' healthy alternative. This was done because seeking stimulation is a distinctive aspect of boredom (Van Tilburg and Igou, 2012). The reason why unhealthy eating is used by bored people to escape from self-awareness may stem from the fact that particularly unhealthy food tends to be more exciting and stimulating. In contrast, healthier food is typically more boring (Craeynest et al., 2008). Importantly, if this excitement factor indeed provides unhealthy food its ego-escape utility, then also relatively exciting alternatives that are nonetheless *healthy* should appeal to those who are bored.

We predicted that among those high in objective self-awareness, boredom would solicit preferences for the less healthy snack. In addition, we expected that the more exciting, healthy alternative would similarly be preferred among bored participants high in objective self-awareness.

Method

Participants and Design

Forty-four students (M_{age} = 20.48, SD = 3.12; 31 women, 13 men) of the University of Limerick, Ireland were assigned to one of the two conditions of a between subjects design (boredom vs. sadness) in exchange for €4.

Pilot Study

In a pilot test, fourteen students from the University of Limerick indicated the excitement of the foods using one item (e.g., "These [crackers] are exciting"; 1 = *not at all*, 7 = *very much*). Both the unhealthy sweets (M = 5.07, SD = 1.90) and the relatively healthy cherry tomatoes (M = 4.07, SD = 1.98) were considered to be more exciting food compared to the relatively healthy crackers (M = 2.36, SD = 1.34), $t(13) = 5.59$, $p < 0.001$, $d = 1.65$, and $t(13) = 2.43$, $p = 0.03$, $d = 1.01$, respectively. The tomatoes and sweets did not significantly differ in perceived levels of their excitement, $t(13) = 1.36$, $p = 0.20$, $d = 0.52$. Although this latter effect size was not trivial, it was much smaller than the difference in excitement judgments between crackers and sweets or tomatoes ($d = 1.65$, $d = 1.01$, respectively). Further, previous literature suggests that tomatoes and sweets have more exciting properties than crackers (Craeynest et al., 2008). Previous research also suggests that tomatoes and crackers are perceived as healthier than sweets (Verhoeven et al., 2012). Thus, participants in the main study had a choice of foods that varied in their healthiness as well as how exciting they were considered to be.

Materials and Procedure

After giving informed consent and providing demographic details, participants were seated in a research laboratory and worked on a computer-based study. They first completed the objective self-awareness scale (Fenigstein et al., 1975) as in Study 2 (α = 0.72). Next, participants watched a 15 min movie extract. In the high boredom condition, this movie consisted of an instruction how to set up a successful 'fish farming' enterprise, covering themes ranging from selecting suitable species and cages, to water quality and existing aqua culturists' entrepreneurial insights. The sadness condition also covered water life, but focused on the topic of dolphin abuse specifically. Prior to watching the movie clip, participants were instructed that they could eat as many or as few of the food provided as wanted during the course of the movie. Each participant received three bowls containing 10 cherry tomatoes, sweets, and crackers, respectively. None of the participants indicated to have allergies to any of these products or their content when prompted. All food consumption in Study 3 was measured by counting the remaining snacks following the experiment to assess the amount consumed for each food type.

When the movie clip ended, participants subsequently rated how boring and sad the movie was (e.g., "How boring was this movie?"; 1 = *not at all*, 7 = *very much*), and how bored and sad they felt (e.g., "How bored do you feel?" 1 = *not at all*, 7 = *very much,* Van Tilburg and Igou, 2012). Afterward, participants reported demographics and were thanked, debriefed, and rewarded.

Results and Discussion

Relative to participants who watched a sad movie, those who watched the boring video clip considered the movie itself as more boring (M = 5.00, SD = 1.95, vs. M = 1.57, SD = 1.04), $F(1,42) = 54.58$, $p < 0.001$, $\eta^2 = 0.57$, and also felt more bored (M = 5.10, SD = 1.84 vs. M = 1.65, SD = 0.94), $F(1,42) = 62.80$, $p < 0.001$, $\eta^2 = 0.60$.

Unhealthy Food: Sweets

After standardizing the aggregated objective self-awareness scores and effect coding the movie manipulation (−1 = sad, 1 = boring), these variables and their interaction were entered as predictors of participants' consumption of the unhealthy sweets in an ordinary least squares regression analysis. The results of this analysis evidenced the predicted significant interaction between the boredom induction and objective self-awareness, $B = 0.27$, $S_e = 0.11$, $t(40) = 2.50$, $p = 0.02$, as well as a significant partial effect of self-awareness, $B = 0.39$, $S_e = 0.11$, $t(40) = 3.52$,

$p < 0.01$, and a non-significant partial effect of the boredom induction, $B = 0.22$, $S_e = 0.23$, $t(75) = 0.96$, $p = 0.34$. Probing the interaction (Hayes, 2012, Model 1) revealed that objective self-awareness was associated with more consumed sweets among those who were exposed to the boring movie clip, $B = 0.66$, $S_e = 0.18$, $t(40) = 3.67$, $p < 0.001$. No significant association was present among those who watched the sad movie, $B = 0.11$, $S_e = 0.13$, $t(40) = 0.89$, $p = 0.38$, (**Figure 2A**). Thus, the engagement in a highly boring activity promoted the consumption of relatively unhealthy sweets, among those participants high in self-awareness.

Healthy Food: Crackers

An analysis similar to the above for the consumption of crackers, the healthy yet unexciting food revealed no significant interaction between the boredom induction and objective self-awareness, $B = 0.08$, $S_e = 0.27$, $t(40) = 0.31$, $p = 0.76$, no significant partial effect of self-awareness, $B = 0.08$, $S_e = 0.27$, $t(40) = 0.29$, $p = 0.77$, and a non-significant partial effect of the boredom induction, $B = 0.02$, $S_e = 0.25$, $t(40) = 0.08$, $p = 0.94$. Thus, boredom did not promote consumption of the unexciting, healthy food as was the case for those who watched the sad movie, $B = -0.00$, $Se = 0.31$, $t(40) = 0.02$, $p = 0.99$.

Healthy Food: Cherry tomatoes

A similar analysis was conducted on the consumed cherry tomatoes, a healthy and comparatively more 'exciting' food. Intriguingly, a significant interaction between the boredom induction and objective self-awareness emerged, $B = 0.52$, $S_e = 0.22$, $t(40) = 2.36$, $p = 0.02$, as well as a significant partial effect of self-awareness, $B = 0.49$, $S_e = 0.22$, $t(40) = 2.20$, $p = 0.03$, and a non-significant partial effect of the boredom induction $B = -0.08$, $S_e = 0.21$, $t(40) = 0.39$, $p = 0.70$ (**Figure 2B**). Probing the interaction (Hayes, 2012, Model 1) revealed that, objective self-awareness was associated with increased consumption of cherry tomatoes among those who were exposed to the boring movie clip, $B = 1.01$, $Se = 0.36$, $t(40) = 2.78$, $p < 0.01$. No significant association was present among those who watched the sad movie, $B = -0.03$, $S_e = 0.25$, $t(40) = 0.13$, $p = 0.89$.

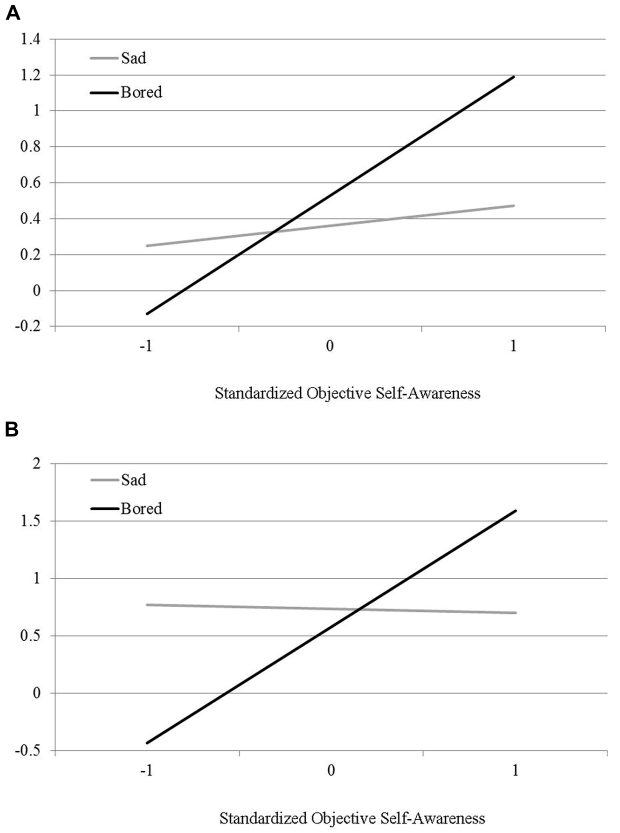


FIGURE 2 | (A) Sweets consumption by boredom and objective self-awareness (Study 3). **(B)** Tomato consumption by boredom and objective self-awareness (Study 3).

Discussion

Study 3 indicated that boredom promotes preferences for less healthy foods, consistent with the previous studies. As in Study 2, this effect was more pronounced among participants high in self-awareness. Importantly, however, boredom did not just evoke unhealthy eating. Indeed, healthy, yet more exciting foods were also consumed more among high objectively self-aware participants. To our knowledge, these findings have not been identified in any previous research. We acknowledge that watching a movie in a lab with accompanying food probably made participants aware that food consumption was being investigated. However, participants did not know that we related this to boredom (they were unaware of the existence of two conditions) and we assessed emotional experiences after the consumption behavior, essentially ruling out any demand characteristics. Thus, it could be argued that while some participants may have realized that the studies investigated consumption behavior, they are unlikely to have linked this to boredom in particular. These results support the hypothesis that food choices based on boredom are a function of peoples' efforts to escape from self-awareness.

General Discussion

Study 1 showed significant, positive relations between state boredom and calorie, fat, carbohydrate, and protein consumption. These relations remained after controlling for stress, enjoyment, and individual differences (e.g., boredom proneness, positive and negative affect, body mass index).

In Study 2, we employed an experimental design and consolidated Study 1 by examining choices between desires to snack on healthy and less healthy food when bored. A boredom manipulation increased the desire to snack, especially amongst those high in objective self-awareness. No such role of objective self-awareness emerged for eating healthily.

Study 3 further extended the findings by investigating boredom's effects on healthy and more exciting eating choices. In addition, one of boredom's unique consequences, desire for

sensation-seeking, was investigated (Van Tilburg and Igou, 2012). The boredom manipulation increased snacking on sweets and on healthy, more exciting foods (cherry tomatoes), especially among participants high in objective self-awareness. No such interaction emerged for eating healthy, yet unexciting foods. Further, analyses revealed that significant effects were attributed to boredom and no results emerged from sadness (Van Tilburg and Igou, 2011, 2012). Therefore, Study 3 demonstrates that boredom specifically encourages consumption of sensational foods (see also Sommers and Vodanovich, 2000), healthy or unhealthy.

Overall, the empirical findings were derived across a variety of methods and measures, providing convergent support for our hypothesis. For example, the major benefit of using single-item self-report measures in Study 2 comes with the limitation of short self-report measures as main dependent variable. This limitation, however, is in turn addressed by Studies 1 and 3. Collectively, the studies indicate that boredom increases eating, specifically unhealthy and exciting foods which can serve as means to escape the bored self.

Our research supports and extends Wisman's (2006) theory of eating to escape aversive self-awareness to the domain of boredom. This is particularly relevant for those with high levels of self-awareness. By eating, bored people may regulate their self-awareness to avoid threatening existential issues. Attention is narrowed to the current and immediate stimulus environment (Heatherton et al., 1991; O'Connor et al., 2008). This consumption reduces self-awareness in which the meaning-threat posed by boredom resides.

The key role of escape from self-awareness following boredom (a meaning threat) is what we believe distinguishes this process from solely self-regulatory failure (Vohs and Faber, 2007) and escape-control strategies formulated in earlier research (often trait-like phenomena, relevant to general stress research; Folkman et al., 1986). Previous research has suggested that the capacity for self-control remains largely intact after experiencing meaning-threats (Baumeister et al., 2005). However, an effort to escape from aversive self-awareness and further impulsiveness associated with boredom (Dahlen et al., 2004) are likely to reduce self-regulatory efforts. Thus, the process between boredom and eating behaviors does not seem to be primarily due to a breakdown in self-regulation but a voluntary, active escape from aversive self-awareness.

It could be proposed that escape from self-awareness by unhealthy eating is actually an attempt at hedonic mood repair (Haedt-Matt and Keel, 2011; Loxton et al., 2011). Yet, research strongly suggests that escape from self-awareness is a distinct process. For example, the meaning-regulation strategies employed following boredom are independent of negative affect (Van Tilburg and Igou, 2011, 2012, 2013). Indeed, the predicted effects were obtained by controlling for negative affect (see Studies 1 and 3). Thus, it is unlikely that unhealthy eating as a function of boredom is solely driven by hedonic affect regulation.

Furthermore, it has been reported that people experiencing existential threats become temporarily numb to emotional pain (DeWall and Baumeister, 2006; Twenge et al., 2007) and their cognitive processes can constrict to focus narrowly on unthreatening issues through the avoidance of self-focused attention (Baumeister et al., 2005). Apparently, the immediate response too many meaning-threatening experiences is a defensive, emotional shutdown, which is why emotional distress fails to mediate these behavioral consequences (Twenge et al., 2003). Further, it has been argued that negative affect may later run parallel to these experiences instead of mediating them (De Wall et al., 2010). In sum, recent research findings on consequences of meaning threats are consistent in the conclusion that negative affect does not explain the increase in escape from self-awareness.

A limitation of Study 1's diary design was its short time period. It would be valuable to measure boredom and eating behaviors over a longer period, accounting for how detailed daily assessment may influence participants' normal eating habits (O'Connor et al., 2008). Future replications may wish to obtain physiological data for concurrent validity. This would also facilitate the study of some possible moderators such as hunger. In addition, Study 1's methodology to assess food intake would benefit from using methods that do not entirely rely on self-report (e.g., observational studies). This would provide a better understanding of exactly how many more calories are consumed in response to boredom. Finally, Study 1's sample mainly consisted of female participants. Yet, there was better gender balance in the following studies suggesting that the phenomenon is generalizable. Nevertheless, we acknowledge that a number of health-related variables could moderate these findings, as discussed later (e.g., dieting status; Goldenberg et al., 2005).

It could be suggested that Study 1's findings could be interpreted alternatively. That is, participants were primed of Study 1's purpose and adjusted their eating behaviors accordingly. Likewise, bored people may have better memories for what they consumed during as they were involved in less engaging activities. However, we believe that sufficient empirical evidence exists in Studies 2 and 3 to indicate that the causal direction is likely from experience of boredom to the consumption of foods high in carbohydrates, fats, and sugars and not vice versa. Further, these studies did not rely on recalled behaviors. Numerous experimental studies demonstrate that meaning threats are associated with unpleasant self-awareness and engaging in hedonic behaviors that avoid this focus (e.g., Arndt et al., 1998). Physiological data from other studies lends convergent validity to these claims (e.g., Newman et al., 2007). Further, diary studies have often been shown to be reliable and valid measures of eating behaviors (Bingham et al., 1995, 1997; O'Connor et al., 2008).

There are also several lines of research supporting the association between negative affective states and food intake (Adriaanse et al., 2011). In addition, recall biases generally effects trait measures of eating behaviors rather than state measures, as investigated in this research. Ready et al. (2007) further note that it has been shown that people can report recent affect with moderate accuracy. A literature review also failed to identify any research that suggests a plausible psychological or biological mechanism that indicates that food consumption recall influences emotional perceptions of one's day (O'Connor et al., 2008).

The findings from our studies provide and interesting foundation for future research in this field. Escaping the self through unhealthy eating may only occur in specific circumstances such as when one is highly self-aware. Future research could further

investigate how people low in objective self-awareness deal with the problems associated with boredom. Some health-facilitating experiences may also be threat-avoidance responses (e.g., flow; Csikszentmihalyi, 1975/2000). Additionally, coping variables, more common in certain genders, may moderate health decisions (Arndt et al., 2006). Indeed, longitudinal replications will help to verify under what circumstances bored people may choose different strategies to escape from the self.

In addition, it is possible that different strategies are chosen when different means of meaning-regulation are available simultaneously. Wisman (2006) postulates that those with stronger, coherent worldviews or leanings may attempt to manage meaning-threats with worldview defense (Dechesne et al., 2003; Van Tilburg and Igou, 2011). Those with weaker, less coherent worldviews or those that feel incompetent to live up the standards set by certain cultural norms may be left without adequate resources to regulate meaning symbolically. Therefore, the latter groups (e.g., individuals with low self-esteem) may be more likely to attempt avoiding self-awareness through eating. Thus, unhealthy eating or more generally unhealthy behaviors in response to boredom may occur particularly when individuals experience that symbolic resources are unavailable or insufficient (Wisman, 2006).

Conclusion

The current findings support our hypothesis about how and why eating may emerge from common experiences like boredom (Koball et al., 2012). This hypothesis can be further examined by future studies that address some of the points raised in our Discussion. Unhealthy behavior may draw attention away from the threatening, self-focused, existential experience that boredom entails. Our results further demonstrated that boredom can promote eating healthy, more exciting foods by endorsing bored people's need for sensation-seeking. This fascinating finding has great potential in dietary intervention designs (World Health Organization-Europe, 2007; Adriaanse et al., 2009).

References

Abramson, E. E., and Stinson, S. G. (1977). Boredom and eating in obese and non-obese individuals. *Addict. Behav.* 2, 181–185. doi: 10.1016/0306-4603(77)90015-6

Adriaanse, M. A., de Ridder, D. T. D., and de Wit, J. B. F. (2009). Finding the critical cue: Implementation intentions to change one's diet work best when tailored to personally relevant reasons for unhealthy eating. *Pers. Soc. Psychol. Bull.* 35, 60–71. doi: 10.1177/0146167208325612

Adriaanse, M. A., de Ridder, D. D., and Evers, C. (2011). Eating when emotional or emotional about eating? *Psychol. Health* 26, 23–39. doi: 10.1080/08870440903207627

Arndt, J., and Goldenberg, J. L. (2010). "When self-enhancement drives health-decisions," in *Handbook of Self-Enhancement and Self-Protection*, eds M.D. Alicke and C. Sedikides (New York, NY: Guilford Press), 380–398. doi: 10.1080/14768320500537662

Arndt, J., Greenberg, J., Simon, L., Pyszczynski, T., and Solomon, S. (1998). Terror management and self-awareness: evidence that mortality salience provokes avoidance of the self-focused state. *Pers. Soc. Psychol. Bull.* 24, 1216–1227. doi: 10.1037/0022-3514.83.1.26

Arndt, J., Routledge, C., and Goldenberg, J. L. (2006). Predicting proximal health responses to reminders of death: the influence of coping style and health optimism. *Psychol. Health* 21, 593–614. doi: 10.1080/14768320500537662

Barbalet, J. M. (1999). Boredom and social meaning. *Br. J. Sociol.* 50, 631–646. doi: 10.1111/j.1468-4446.1999.00631.x

Baumeister, R. F. (1991). Binge eating as escape from self-awareness. *Psychol. Bull.* 110, 86–108. doi: 10.1037/0033-2909.110.1.86

Baumeister, R. F., DeWall, C. N., Ciarocco, N. J., and Twenge, J. M. (2005). Social exclusion impairs self-regulation. *J. Pers. Soc. Psychol.* 88, 589–604. doi: 10.1037/0022-3514.88.4.589

Bingham, S. A., Cassidy, A., Cole, T. J., Welch, A., Runswick, S. A., Black, A. E., et al. (1995). Validation of weighed records and other methods of dietary assessment using the 24 h urine nitrogen technique and other biological markers. *Br. J. Nutr.* 73, 531–550. doi: 10.1079/BJN19950057

Bingham, S. A., Gill, C., Welch, A., Cassidy, A., Runswick, S. A., Oakes, S., et al. (1997). Validation of dietary assessment methods in the UK arm of EPIC using weighed records, and 24-hour urinary nitrogen and potassium and serum vitamin C and carotenoids as biomarkers. *Int. J. Epidemiol.* 26, S137. doi: 10.1093/ije/26.suppl_1.S137

Bingham, S. A., Welch, A. A., McTaggart, A., Mulligan, A. A., Runswick, S. A., Luben, R., et al. (2001). Nutritional methods in the European prospective investigation of cancer in Norfolk. *Public Health Nutr.* 4, 847–858. doi: 10.1079/PHN2000102

Cleobury, L., and Tapper, K. (2014). Reasons for eating 'unhealthy' snacks in overweight and obese males and females. *J. Hum. Nutr. Diet.* 27, 333–341. doi: 10.1111/jhn.12169

Craeynest, M., Crombez, G., Koster, H. W. E., Haerens, L., and De Bourdeaudhuij. (2008). Cognitive-motivational determinants of fat food consumption in overweight and obese youngsters: the implicit association between fat food and arousal. *J. Behav. Ther. Exp. Psychiatry* 39, 354–368. doi: 10.1016/j.jbtep.2007.09.002

Csikszentmihalyi, M. (1975/2000). *Beyond Boredom and Anxiety: Experiencing Flow in Work and Play*. San Fransisco: Jossey-Bass.

Dahlen, E. R., Martin, R. C., Ragan, K., and Kuhlman, M. M. (2004). Boredom proneness in anger and aggression: effects of impulsiveness and sensation seeking. *Pers. Individ. Dif.* 37, 1615–1627. doi: 10.1016/j.paid.2004.02.016

Dechesne, M., Pyszczynski, T., Arndt, J., Ransom, S., Sheldon, K. M., van Knippenberg, A., et al. (2003). Literal and symbolic immortality: the effect of evidence of literal immortality on self-esteem striving in response to mortality salience. *J. Pers. Soc. Psychol.* 84, 722–737. doi: 10.1037/0022-3514.84.4.722

DeWall, C. N., and Baumeister, R. F. (2006). Alone but feeling no pain: effects of social exclusion on physical pain tolerance and pain threshold, affective forecasting, and interpersonal empathy. *J. Pers. Soc. Psychol.* 91, 1–15. doi: 10.1037/0022-3514.91.1.1

De Wall, C. N., Twenge, J. M., Bushman, C., Im, C., and Williams, K. (2010). A little acceptance goes a long way: applying social impact theory to the rejection-aggression link. *Soc. Psychol. Personal. Sci.* 1, 168–174. doi: 10.1177/1948550610361387

Duval, S., and Wicklund, R. A. (1972). *A Theory of Objective Self-Awareness*. New York, NY: Academic Press.

Evers, C., de Ridder, D. D., and Adriaanse, M. A. (2010). Adequately predicting emotional eating with self-reports: not as easy as pie. *Health Psychol.* 29, 344–345. doi: 10.1037/a0020228

Fahlman, S. A., Mercer, K. B., Gaskovski, P., Eastwood, A. E., and Eastwood, J. D. (2009). Does a lack of life meaning cause boredom? Results from psychometric, longitudinal, and experimental analyses. *J. Soc. Clin. Psychol.* 28, 307–340. doi: 10.1521/jscp.2009.28.3.307

Fenigstein, A., Scheier, M. F., and Buss, A. H. (1975). Public and private self-consciousness: Assessment and theory. *J. Consult. Clin. Psychol.* 43, 522–527. doi: 10.1037/h0076760

Folkman, S., Lazarus, R. S., Dunkel-Schetter, C., De Longis, A., and Gruen, R. J. (1986). Dynamics of a stressful encounter: cognitive appraisal, coping, and encounter outcomes. *J. Pers. Soc. Psychol.* 50, 992–1003. doi: 10.1037/0022-3514.50.5.992

Ganley, R. M. (1989). Emotion and eating in obesity: a review of the literature. *Int. J. Eat. Disord.* 8, 343–361. doi: 10.1002/1098-108X(198905)8:3<343::AID-EAT2260080310>3.0.CO;2-C

Gerrard, M., Gibbons, F. X., Houlihan, A. E., Stock, M. L., and Pomery, E. A. (2008). A dual-process approach to health risk decision making: the prototype willingness model. *Dev. Rev.* 28, 29–61. doi: 10.1016/j.dr.2007.10.001

Goldenberg, J. L., and Arndt, J. (2008). The implications of death for health: a terror management health model for behavioral health promotion. *Psychol. Rev.* 115, 1032–1053. doi: 10.1037/a0013326

Goldenberg, J. L., Arndt, J., Hart, J., and Brown, M. (2005). Dying to be thin: The effects of mortality salience and body mass index on restricted eating among women. *Psychol. Health* 31, 1400–1412. doi: 10.1177/0146167205277207

Gollwitzer, P. M., and Wicklund, R. A. (1985). Self-symbolizing and the neglect of others' perspectives. *J. Pers. Soc. Psychol.* 48, 702–715. doi: 10.1037/0022-3514.48.3.702

Gordon, A., Wilkinson, R., McGrown, A., and Jovanoska, S. (1997). The psychometric properties of the boredom proneness scale: an examination of its validity. *Psychol. Exp.* 42, 85–97.

Haedt-Matt, A. A., and Keel, P. K. (2011). Revisiting the affect regulation model of binge eating: a meta-analysis of studies using ecological momentary assessment. *Psychol. Bull.* 137, 660–681. doi: 10.1037/a0023660

Hayes, A. F. (2012). *PROCESS: A Versatile Computational Tool for Observed Variable Mediation, Moderation, and Conditional Process Modeling* [*White paper*]. Available at: http://www.afhayes.com

Heatherton, T. F., and Baumeister, R. F. (1991). Binge eating as escape from self-awareness. *Psychol. Bull.* 110, 86–108. doi: 10.1037/0033-2909.110.1.86

Heatherton, T. F., Herman, C. P., and Polivy, J. (1991). Effects of physical threat and ego threat on eating behavior. *J. Pers. Soc. Psychol.* 60, 138–143. doi: 10.1037/0022-3514.60.1.138

Heine, S. J., Proulx, T., and Vohs, K. D. (2006). The meaning maintenance model: on the coherence of social motivations. *Pers. Soc. Psychol. Rev.* 10, 88–110. doi: 10.1207/s15327957pspr1002_1

Koball, A. M., Meers, M. R., Storfer-Isser, A., Domoff, S. E., and Musher-Eizenman, D. R. (2012). Eating when bored: revision of the emotional eating scale with a focus on boredom. *Health Psychol.* 31, 521–524. doi: 10.1037/a0025893

Larson, R. W., and Richards, M. H. (1991). Boredom in the middle school years: blaming schools versus blaming students. *Am. J. Educ.* 99, 418–443. doi: 10.1086/443992

Leary, M. R., Rogers, P. A., Canfield, R. W., and Coe, C. (1986). Boredom and interpersonal encounters: antecedents and social implications. *J. Pers. Soc. Psychol.* 51, 968–975. doi: 10.1037/0022-3514.51.5.968

Loxton, N. J., Dawe, S., and Cahill, A. (2011). Does negative mood drive the urge to eat? The contribution of negative mood, exposure to food cues and eating style. *Appetite* 56, 368–374. doi: 10.1016/j.appet.2011.01.011

McGregor, I., Nash, K. A., Prentice, M., Hirsh, J., and Inzlicht, M. (2012). *Raw Data*. Toronto, ON: York University.

McGuire, M., and Beerman, K. A. (2007). *Nutritional Sciences: From Fundamentals to Food*. Belmont, CA: Thompson Wadsworth Publishers.

McKeown, N. M., Day, N. E., Welch, A. A., Runswick, S. A., Luben, R. N., Mulligan, A. A., et al. (2001). Use of biological markers to validate self-reported dietary intake in a random sample of the European Prospective Investigation into Cancer United Kingdom Norfolk cohort. *Am. J. Clin. Nutr.* 74, 188–196.

Mikulas, W., and Vodanovich, S. (1993). The essence of boredom. *Psychol. Rec.* 43, 3–12.

Newman, E., O'Connor, D. B., and Conner, M. (2007). Daily hassles and eating behavior: the role of cortisol reactivity. *Psychoneuroendocrinology* 32, 125–132. doi: 10.1016/j.psyneuen.2006.11.006

O'Connor, D. B., Jones, F., Conner, M., McMillan, B., and Ferguson, E. (2008). Effects of daily hassles and eating style on eating behavior. *Health Psychol.* 27, S20–S31. doi: 10.1037/0278-6133.27.1.S20

Papies, E. K., Pronk, T. M., Keesman, M., and Barsalou, L. W. (2015). The benefits of simply observing: mindful attention modulates the link between motivation and behavior. *J. Pers. Soc. Psychol.* 108, 148–170. doi: 10.1037/a0038032

Ready, R. E., Weinberger, M. I., and Jones, K. M. (2007). How happy have you felt lately? Two diary studies of emotion recall in older and younger adults. *Cogn. Emot.* 21, 728–757. doi: 10.1080/02699930600948269

Sansone, C., Weir, C., Harpster, L., and Morgan, C. (1992). Once a boring task always a boring task? Interest as a self-regulatory strategy. *J. Pers. Soc. Psychol.* 63, 379–390. doi: 10.1037/0022-3514.63.3.379

Sommers, J., and Vodanovich, S. J. (2000). Boredom proneness: its relationship to psychological- and physical-health symptoms. *J. Clin. Psychol.* 56, 149–155. doi: 10.1002/(SICI)1097-4679(200001)56:1<149::AID-JCLP14>3.0.CO;2-Y

Tabachnick, B. G., and Fidell, L. S. (2008). *Using Multivariate Statistics*, 5th Edn. Boston, MA: Allyn & Bacon.

Twenge, J. M., Baumeister, R. F., De Wall, N. C., Ciarocco, N. J., and Bartels, J. M. (2007). Social exclusion decreases prosocial behavior. *J. Pers. Soc. Psychol.* 92, 56–66. doi: 10.1037/0022-3514.92.1.56

Twenge, J. M., Catanese, K. R., and Baumeister, R. F. (2003). Social exclusion and the deconstructed state: time perception, meaninglessness, lethargy, lack of emotion, and self-awareness. *J. Pers. Soc. Psychol.* 85, 409–423. doi: 10.1037/0022-3514.85.3.409

Van Tilburg, W. A. P., and Igou, E. R. (2011). On boredom and social identity: A pragmatic meaning-regulation approach. *Pers. Soc. Psychol. Bull.* 37, 1679–1691. doi: 10.1177/0146167211418530

Van Tilburg, W. A. P., and Igou, E. R. (2012). On boredom: lack of challenge and meaning as distinct boredom experiences. *Motiv. Emot.* 36, 181–194. doi: 10.1007/s11031-011-9234-9

Van Tilburg, W. A. P., and Igou, E. R. (2013). On the meaningfulness of behavior: an expectancy x value approach. *Motiv. Emot.* 37, 373–388. doi: 10.1007/s11031-012-9316-3

Van Tilburg, W. A. P., Igou, E. R., and Sedikides, C. (2013). In search of meaningfulness: using nostalgia as an antidote to boredom. *Emotion* 13, 450–461. doi: 10.1037/a0030442

Verhoeven, A. A. C., Adriaanse, M. A., Evers, C., and De Ridder, D. T. D. (2012). The power of habits: unhealthy snacking behavior is primarily predicted by habit strength. *Br. J. Health Psychol.* 17, 758–770. doi: 10.1111/j.2044-8287.2012.02070.x

Vohs, K. D., and Faber, R. J. (2007). Spent resources: self-regulatory resource availability affects impulse buying. *J. Consum. Res.* 33, 537–547. doi: 10.1086/510228

Watson, D., Clark, L. A., and Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *J. Pers. Soc. Psychol.* 54, 1063–1070. doi: 10.1037/0022-3514.54.6.1063

Wisman, A. (2006). Digging in terror management theory: to 'use' or 'lose' the symbolic self? *Psychol. Inq.* 17, 319–327. doi: 10.1080/10478400701369468

Wisman, A., and Koole, S. L. (2003). Hiding in the crowd: can mortality salience promote affiliation with others who oppose one's worldviews? *J. Pers. Soc. Psychol.* 84, 511–526. doi: 10.1037/0022-3514.84.3.511

World Health Organization-Europe (WHO). (2007). *The Challenge of Obesity in the WHO European Region and the Strategies for Response*. Available at: http://www.euro.who.int/__data/assets/pdf_file/0010/74746/E90711.pdf

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 13 October 2016
doi: 10.3389/fpsyg.2016.01525

Changing Conspiracy Beliefs through Rationality and Ridiculing

Gábor Orosz[1,2]*, *Péter Krekó*[1,3], *Benedek Paskuj*[4], *István Tóth-Király*[1,5], *Beáta Bőthe*[1,5] *and Christine Roland-Lévy*[6]

[1] Department of Social Psychology, Institute of Psychology, Eötvös Loránd University, Budapest, Hungary, [2] Research Centre for Natural Sciences, Institute of Cognitive Neuroscience and Psychology, Hungarian Academy of Sciences, Budapest, Hungary, [3] Central Eurasian Studies Department, Indiana University, Bloomington, IN, USA, [4] Department of Psychology, University College London, London, UK, [5] Doctoral School of Psychology, Eötvös Loránd University, Budapest, Hungary, [6] C2S, Department of Psychology, University of Reims Champagne-Ardenne, Rheims, France

Conspiracy theory (CT) beliefs can be harmful. How is it possible to reduce them effectively? Three reduction strategies were tested in an online experiment using general and well-known CT beliefs on a comprehensive randomly assigned Hungarian sample ($N = 813$): exposing rational counter CT arguments, ridiculing those who hold CT beliefs, and empathizing with the targets of CT beliefs. Several relevant individual differences were measured. Rational and ridiculing arguments were effective in reducing CT, whereas empathizing with the targets of CTs had no effect. Individual differences played no role in CT reduction, but the perceived intelligence and competence of the individual who conveyed the CT belief-reduction information contributed to the success of the CT belief reduction. Rational arguments targeting the link between the object of belief and its characteristics appear to be an effective tool in fighting conspiracy theory beliefs.

Keywords: conspiracy theory, belief, rationality, ridiculing, empathy

OPEN ACCESS

Edited by:
Igor Grossmann,
University of Waterloo, Canada

Reviewed by:
Paul Conway,
Florida State University, USA
Ulrich Von Hecker,
Cardiff University, UK

***Correspondence:**
Gábor Orosz
gaborosz@gmail.com;
orosz.gabor@ttk.mta.hu;
orosz.gabor@ppk.elte.hu

Specialty section:
This article was submitted to Personality and Social Psychology, a section of the journal Frontiers in Psychology

Received: *27 June 2016*
Accepted: *20 September 2016*
Published: *13 October 2016*

Citation:
Orosz G, Krekó P, Paskuj B, Tóth-Király I, Bőthe B and Roland-Lévy C (2016) Changing Conspiracy Beliefs through Rationality and Ridiculing. Front. Psychol. 7:1525. doi: 10.3389/fpsyg.2016.01525

INTRODUCTION

The level of beliefs in conspiracy narratives differs among people. Conspiracy narratives claim that powerful people or organizations cooperate in secret, to achieve sullen objectives by deceiving the public (Abalakina-Paap and Stephan, 1999; Wood et al., 2012; Wood and Douglas, 2013). According to 160 million Americans, there was a conspiracy behind JFK's murder; today, 110 million people believe that global warming is a hoax; 18 million believe that Bin Laden is still alive; and 12 and a half million believe that non-human beings, the so called Lizard people (they are the reptilian elite controlling the world since ancient times) control politics (Williams, 2013). Conspiracy theories are relevant for social interaction and democracy as they can induce anger, lead to low political participation, and to learned helplessness. While some studies have shown that inducing conspiracy theories is easy (Butler et al., 1995), to date, only a few researchers have attempted to examine the possibility of reducing beliefs in conspiracy theories (Banas and Miller, 2013); there is no accumulated knowledge about effective methods of CT reduction. The present study intends to fill this gap.

Despite theoretical diversity (see Krekó, 2015, for an overview), a few characteristics of CTs appear to be consensual. First, CTs are associated with a mechanistic worldview covering the beliefs that (a) nothing happens by chance; (b) nothing is what it seems; (c) everything interconnects with everything (Barkun, 2003). Second, CTs are organically connected to each other and are likely to be integrated in a lay conspiracy meta-theory of society (Goertzel, 1994). Although CTs are organically

connected, they can be categorized on the basis of their scope: (a) they can explain concrete events (e.g., JFK); (b) systematic CTs cover a group's attempt for hegemony; (c) super CTs refer to a complex conspiracy worldview, including several seemingly independent theories (Barkun, 2003). Third, CT's are characterized by a bipolar, black, and white logic, which divides society into good and evil (Moscovici, 1987; Berlet, 2009). Fourth, CTs resist rational arguments, because only the pieces of information, which are consistent with them, are processed, the incompatible ones being rejected (Bartlett and Miller, 2010). The present study intends to challenge this latter characteristic of CTs with an experimental study.

According to previous studies, individual differences appear regarding beliefs in CTs. These individual differences can be categorized into personality and attitudinal dimensions. Among personality variables, belief in CTs is negatively related to self-esteem (Abalakina-Paap and Stephan, 1999; Swami et al., 2011), to agreeableness (Swami et al., 2011; Bruder et al., 2013), and to conscientiousness among Big Five traits (Brotherton et al., 2013). Based on attitudinal variables, beliefs in CTs are positively related to feelings of powerlessness (Abalakina-Paap and Stephan, 1999; Bruder et al., 2013), to perceived lack of control (Hamsher et al., 1968; Whitson and Galinsky, 2008), to mistrust of other people (Goertzel, 1994; Abalakina-Paap and Stephan, 1999; Brotherton et al., 2013), and authorities (Swami et al., 2010), anomie (Goertzel, 1994; Abalakina-Paap and Stephan, 1999; Brotherton et al., 2013; Bruder et al., 2013), and authoritarianism (Goertzel, 1994; Abalakina-Paap and Stephan, 1999; Swami et al., 2011; Bruder et al., 2013). The only demographic variable positively related to beliefs in CTs was minority status (Goertzel, 1994; Crocker et al., 1999). Nevertheless, these individual differences were only weakly related to beliefs in CTs.

If conspiracy theories are associated with malevolent effects, the question arises: How is it possible to change conspiracy beliefs? According to Fishbein and Ajzen (1975), beliefs can be defined as one's subjective probability judgments related to a given aspect of the perceived world. Beliefs contribute to the understanding of oneself and depend on the person's environment. CTs are mainly inferential beliefs because they go beyond the observable events and are derived from external sources. These sources provide certain pieces of information; thus they can be interpreted as informational beliefs. CTs, as other beliefs, have an object (Jews, European Union, global financial system, or bankers, etc.), which is related to a given attribute (exploitative, hidden, and manipulative, etc.). The link between the object and the attribute exists on a certain level, based on subjective probability judgment.

Based on Fishbein and Ajzen's conceptualization (Fishbein and Ajzen, 1975), belief change refers to the modification of subjective probability judgments. Based on the theory of planned behavior[1] (Ajzen, 1985, 1991), we assume that it is possible to change these probability judgments in three ways. First, it is possible to (a) change the link between the object and the attribute. Second, it is possible to (b) increase the distance between the self and those who hold a relationship between the object and the attribute. Third, it is possible to (c) manipulate the level of identification between the object and the person who holds a certain level of conspiracy belief toward the object. All three of these strategies can be anchored to pre-existing attitude change theoretical frameworks: the functional attitude theories (Katz, 1960), the elaboration likelihood model with its central and peripheral routes (Petty and Cacioppo, 1986), and the consistency theories (e.g., Abelson, 1968).

(a) In order to change the link between the object and the attribute, further logical pieces of information or logical steps can be provided, thus allowing us to elaborate on the logical structure which can result in a more complex link. For example, the object of the belief can be the banks, and the attribute can be exploitative. A low level of elaboration lacks arguments as to why this link exists, whereas a high level of elaboration includes many logically compatible and underpinned arguments. We hypothesize that pointing out the logical flaws of this link, providing an elaborated explanation without logical flaws could make one deconstruct the preexisting link and construct a new one between the object and the attribute. This should lead to belief changes. In the previous example, if we provide detailed information about how much money banks get from taxpayers' money, which is four times less than what they pay to the state in many different special taxes in any given period of time, the link becomes more elaborate in terms of complexity and coherence. We assume that this can lead, to some extent, to belief change. From the perspective of functional attitude theories (Katz, 1960), rational arguments affect the knowledge function by providing detailed information about the link between the object and the attribute of the belief. This strategy can provide a deeper sense of understanding and control over the particular conspiracy-related part of the external world. From the perspective of the elaboration likelihood model (Petty and Cacioppo, 1986), the rational strategy is related to the central route of persuasion in which an individual holding CT beliefs evaluates the pros and cons of the rational arguments and estimates the fit of these detailed arguments to the pre-existing value system. From the perspective of inconsistency theories (Abelson, 1968), belief rationalization in the three arguments present different forms of inconsistency. Regarding those who hold CT beliefs, showing data through rational arguments can create inconsistencies between the informational content of the previous beliefs and the new information regarding events or people related to the conspiracies. This inconsistency can be reduced by challenging the original conspiracy beliefs.

(b) The second possibility of conspiracy belief change involves increasing the distance between the self and those who hold a certain link between the object and the attribute. To achieve this, one can demonstrate that those people who hold such beliefs are characterized by negative traits or they are targeted as being ridiculous. As practically no one wants to be ridiculed by others, the ridiculing argument can be fueled by the ego-protective function (Katz, 1960). For example, if one shows that people who

[1] According to the theory of planned behavior, a behavior occurs more probably if (a) the individual has a positive attitude toward, (b) has a sense of being able to control the given behavior, and (c) the subjective norms support this particular behavior. This combination of attitudes, beliefs, and subjective norms leads to increased behavioral intention, which in turn results in higher probability of the actual performance.

believe that Osama Bin Laden is still alive, while also believing that he was already dead before the US troops found him (see Wood et al., 2012), they cannot be taken seriously. Nevertheless, this is a part of CT beliefs and suggests that CT believers have difficulties with logical thinking. In this case, an individual may choose to increase the distance between the self and those who hold a certain link between the object (mass media/Osama Bin Laden) and the attribute (misleading/dead). If one considers the elaboration likelihood model (Petty and Cacioppo, 1986), the ridiculing method belongs to the peripheral routes. It is affected by less deliberate processes either through building more positive emotional bonds to the object of the beliefs or by increasing the gap between the self and those who hold such beliefs as a result of ridiculing arguments. Furthermore, we assume that those individuals who have had prior conspiracy beliefs will experience a certain level of cognitive dissonance (Festinger, 1962; Aronson, 1969). The source of dissonance is the opposition between being a logical person and the irrationality of CT believers. Ridiculing arguments can create inconsistency as a result of social identity issues, that is, that the individual does not want to belong to a ridiculous group (Abelson, 1968). This dissonance can be reduced through changing the CT beliefs; however, it also needs to question (a) the assumption that CT believers are irrational, as well as (b) the source of this information. As far as we know, this self-distancing aspect of belief change has been relatively poorly investigated in social psychology. However, there are some successful belief change examples from recent history. One of these is the reduction of the popularity of the Ku-Klux-Klan (KKK): in the 1940's Stetson Kennedy exposed many of the KKK's secret rituals (handshakes, passwords, and other ludicrous behaviors) in a ridiculous manner. The consequences were immediate, after 2 weeks, the recruitment of KKK plummeted to zero. People did not want to join an organization because the formerly terrifying shadow organization of white pride was now regarded as laughable. Therefore, we presume that, in this case, the belief change occurred as a result of distancing one's self from KKK members because of their pathetic and ridiculous practices.

(c) We suppose that the third form of conspiracy belief change relates to the identification with the object of the belief. Therefore, in this case, the primary goal is not to change the link between the object and the attribute, but to focus on the reduction of the distance between the self and the object of the CT. For example, CTs concerning objects (e.g., Jews) generally include negative attributes (e.g., secretly manipulative). If, as a result of a message (e.g., claiming that Christians faced similar conspiracy theories beforehand), people put ourselves in the position of Jews, they can empathize more easily with them, which can lead to more positive attitudes toward them. These empathizing arguments can be related to value expressive functions in terms of presenting an image that is in line with a positive and caring self-concept (Katz, 1960). The empathizing arguements do not necessarily directly influence the link between the object (e.g., Jews) and the negative attribute (e.g., secretly manipulative), but they can provide an alternative evaluative dimension of the object, which can indirectly weaken the original link. From the perspective of the elaboration likelihood model (Petty and Cacioppo, 1986), contrary to the rational arguments, the empathic ones are related to the peripheral route. On the basis of the consistency theories (Abelson, 1968), empathy creates inconsistency on the level of the target group of the beliefs who have positive attributes besides the negative ones that a conspiracy believer mostly associates with them. Finally, since objects of CTs are generally prejudiced groups (e.g., Jews, speculators, bankers, Chinese, or Lizard people), on the basis of prejudice reduction research, empathy toward these groups can reduce the negative prejudices which may lead to the CT belief change (e.g., Pettigrew and Tropp, 2008; Berger et al., 2016).

The goal of the present study was to experimentally examine the above-described three strategies of CT belief change in an online setting on comprehensive samples. We expected that all three strategies would effectively reduce CT beliefs.

MATERIALS AND METHODS

Participants

This research employed a nationally representative probability sample of 813 Hungarians, selected randomly from an Internet-enabled panel, including 20,000 members, with the help of the Solid Data Ltd., in October–November 2014. For the preparation of the sample, a multiple-step, proportionally stratified, probabilistic sampling method was employed. Members of this panel used the Internet at least once a week. The demographic characteristics of the panel are permanently filtered. More specifically, individuals were removed from the panel if they responded too quickly (i.e., without paying attention to their response) and/or had fake (or not used) e-mail addresses. The sample was nationally representative in terms of gender, age, level of education, and location of residence. The study was conducted in accordance with the Declaration of Helsinki and with the approval of the Institutional Review Board of the Eötvös Loránd University. Before starting the questionnaire, participants received information about the study in terms of examining beliefs about how societies work. Subsequently, participants read and approved the informed consent.

Eight hundred and thirteen (813) individuals (50.8% female) participated in the present online experiment, between the ages of 18 and 75 ($M = 45.7$, $SD = 15.04$). Participants were randomly assigned to the conditions, taking into account the representativeness (age, gender, level of education, place of residence). In the experimental conditions, participants listened to the CTs instead of reading them. Only the participants, who listened to the CTs and the audio recordings of the experimental manipulations until the end, were selected. As a result, 104 participants were excluded. The final sample consisted of 709 participants (51.1% female), the average age was 46.43 ($SD = 14.74$), the age range being 18–75 years. Regarding the places of residence, 209 (29.5%) respondents lived in the capital, 217 (30.6%) lived in county capitals, 138 (19.5%) lived in other towns, and 145 (20.5%) lived in villages. Regarding the levels of education, 120 (16.9%) respondents had only received primary school education, 212 (29.9%) had a secondary level education, 377 (53.2%) had a higher level education, which implies that the sample was better educated than the offline population.

Procedure

In the present study, participants were recruited via Internet. After agreeing with the informed consent form, participants listened to the first audio recording (for the transcript, see Appendix 1 in Supplementary Material). This is a 4:30 min recording that presented a conspiracy super theory including the victimization of Hungary by the financial imperium, the hidden control of Jews over the world, the EU as a non-functional oppressive power, and the bankers who exploit the Hungarian financial system. The text provided vivid, but confusing details about the mechanisms that "actually" shape the fate of Hungary and the world. This super CT met the above mentioned characteristics of CTs in terms of nothing happens by chance, nothing is what it seems, everything is interconnected with everything, and the world is divided into good and evil.

Having listened to the recording, participants expressed their acceptance concerning eight questions on the four main topics (victimization of Hungary, EU, power of the Jews, bankers). Then, they were asked about their general acceptance of the listened CT. The final two questions referred to the perceived competence and intelligence of the speaker who reported the CT. After this questionnaire, participants were randomly assigned to one of the four conditions. They listened to another speech with, either rational (3:36 min), ridiculing (3:28 min), or empathetic (2:54 min) arguments against CTs. In the control condition (3:15 min), they listened to a weather forecast. The transcripts of each condition can be seen in Appendix 2 in Supplementary Material.

In the rational condition, the text tackled the claims made in the first recording in a logically plausible manner, using numbers to support the objections, and pointing out the discrepancy between high influence and concealment. This speech pointed out the logical flaws of the first speech and corrected it with in-depth arguments regarding the link between the beliefs' objects and attributes. The goal of this condition was to emphasize the logical inconsistencies and to create a more complex and coherent relationship between the objects of the belief and the attributes.

In the ridiculing condition, the script addressed the same logical flaws, but reasoned against them differently: instead of focusing on certain details, it derided the logical inconsistencies and concentrated on those who believe in the CTs, picturing them as evidently ridiculous (e.g., mentioning the believers of Lizard Men). This text intended to increase the distance between the respondents' self and those who believe in CTs.

The empathetic condition contested the original text's claim in a different manner: instead of focusing on content or those who believe in the content, it placed the objects of the CTs in the center, and compassionately called attention to the dangers of demonizing and scapegoating, while also pointing out the human character of the CT objects (i.e., Jews face similar conspiracy theories and persecution nowadays that the Early Christians faced). This condition intended to reduce the distance between the respondent and the objects of CTs and to raise empathy toward these groups.

In the control condition participants listened to a simple weather forecast which was not related to the content of the CT. After the recording, respondents answered the same 11 questions.

Measures

Conspiracy Assessment Tool (CAT)

An eight item scale was created specifically for the present experiment to measure the individual's attitudes toward conspiracies, assessing beliefs regarding conspiracies related to four aspects: (1) Hungary as a victim of conspiracy; (2) Jews as the leaders of the world; (3) the European Union is a parasitic formation without any function; and (4) the bankers as the leaders of the world. These specific topics were related to the CT audio they listened to previously. More precisely, they referred to the key elements of the text regarding these four topics. Respondents used an 11-point scale to indicate their level of agreement (0, Strongly Disagree; 10, Strongly Agree). This scale showed high levels of reliability with a Cronbach alpha value of 0.95 for the pre-manipulation and 0.96 for the post-manipulation.

In addition to the eight CAT items, one item measured the listener's level of agreement with the audio excerpts, using the response options of the previous eight items. Finally, two additional items were created: the first assessed the competence of the speaker on an 11-point scale (0, Not competent at all; 10, Completely competent), while the second item assessed the intelligence of the speaker on a 5-point scale (1, Far below average; 5, Far above average).

Conspiracy Mentality Questionnaire (CMQ)

This 5-item measurement was developed by Bruder et al. (2013) and was translated, by following Beaton et al.'s (2000) protocol. Furthermore, six additional items reflecting on the Hungarian societal context were added. The CMQ measures the tendency to engage in conspiracy-related ideations (Cronbach α: 0.80). Respondents used a 7-point scale for answering (1, Not true at all; 7, Completely true).

Balanced Inventory of Desirable Responding (BIDR)

The 40-item BIDR (Paulhus, 1991) was administered to assess social desirability. This measure contains two subscales (self-deceptive positivity and image management), with 20 items belonging to each. In the present study, internal consistency indices were acceptable (Cronbach $\alpha_{\text{self-deceptive enhancement}}$: 0.71; Cronbach $\alpha_{\text{impression management}}$: 0.55). Respondents used a 7-point scale for answering (1, Not true at all; 7, Completely true).

Big Five (BFI)

Personality-related dimensions were assessed by the Big Five thInventory (John and Srivastava, 1999). The BFI is a 45-item scale that measures the personality of the respondent according to five dimensions: extraversion (Cronbach α: 0.69), agreeableness (Cronbach α: 0.62), conscientiousness (Cronbach α: 0.62), emotional stability (Cronbach α: 0.74) and openness (Cronbach α: 0.84). In this study, a shorter, valid version

was used (Farkas and Orosz, 2013) that contained 15 items; respondents used a 5-point scale to indicate their level of agreement (1, Strongly disagree; 5, Strongly agree).

Demographic Variables

Participants were asked to indicate the following demographic variables: age, gender (1, female; 2, male), place of residence (1, capital; 2, county town; 3, town; 4, village), and level of education (1, primary level education; 2, secondary level education; 3, higher level education).

RESULTS

Descriptive statistics of the above-mentioned questionnaires with ranges, summed scores, standard deviations, and intercorrelations can be seen in **Table 1** (see the Dataset here). Individual differences in terms of Big Five traits and BIDR dimensions were either unrelated to or very weakly related to CAT scores. Only Openness and BIDR-SDE were negatively and weakly related to CAT scores. Finally, CMQ and CAT were highly associated with each other.

Measuring the Effectiveness of the Audio Excerpts

No significant differences were found between the baseline (pre-test) measures considering the four conditions (all $p > 0.208$). The CONDITION * TIME ANOVA predicting the change in the extent of believing in conspiracy theories revealed significant main effects of TIME, $F_{(1, 705)} = 32.49$, $p < 0.001$, $\eta_p^2 = 0.04$; but not of CONDITION, $F_{(1, 705)} = 1.38$, $p = 0.249$, $\eta_p^2 = 0.01$. The interaction of CONDITION * TIME was significant, $F_{(3, 705)} = 6.13$, $p < 0.001$, $\eta_p^2 = 0.03$. CAT scores did not significantly differ between the groups at baseline (lowest $p = 0.21$).

Paired-samples *T*-tests were conducted in order to investigate the change in pre-test and post-test CAT scores over time. CAT scores decreased significantly from pre-test to post-test among participants who participated in the rational condition, $t_{(171)} = 4.32$, $p < 0.001$, Cohen's $d = 0.13$ (for means, see **Figure 1**). Also, CAT scores decreased significantly from pre-test to post-test among participants who participated in the ridiculing condition, $t_{(177)} = 5.46$, $p < 0.001$, Cohen's $d = 0.11$. However, no significant decrease was found from pre-test to post-test in the other two conditions: empathetic, $t_{(185)} = 1.71$, $p = 0.090$, Cohen's $d = 0.05$, control, $t_{(172)} = -0.28$, $p = 0.782$, Cohen's $d = 0.01$. Compared to the post-test scores of the control condition, the rational condition had significantly lower post-test scores, $t_{(343)} = 2.55$, $p = 0.011$, Cohen's $d = 0.27$, the ridiculing condition tended to have lower scores, $t_{(349)} = 1.90$, $p = 0.059$, Cohen's $d = 0.20$, and the empathetic condition's mean was not different, $t_{(357)} = 0.97$, $p = 0.333$, Cohen's $d = 0.10$.

These results suggest that the manipulation in the rational and the ridiculing condition were successful. However, in the empathetic condition the extent of believing in conspiracy theories did not significantly decrease.

Measuring the Effect of Social Desirability on the Manipulation

The CONDITION * TIME ANCOVA controlling for BIDR-SE predicting the change in the extent of believing in conspiracy theories controlling for the self-deceptive enhancement factor of social desirability revealed significant main effect of TIME, $F_{(1, 704)} = 7.25$, $p = 0.007$, $\eta_p^2 = 0.01$; and of BIDR-SDE $F_{(1, 704)} = 4.53$, $p = 0.034$, $\eta_p^2 = 0.01$; but did not of CONDITION, $F_{(3, 704)} = 1.34$, $p = 0.262$, $\eta_p^2 = 0.01$. The interaction of CONDITION * TIME remained significant, $F_{(3, 704)} = 6.32$, $p < 0.001$, $\eta_p^2 = 0.03$, but the interaction of TIME * BIDR-SDE was only marginally significant, $F_{(1, 704)} = 3.79$, $p = 0.052$, $\eta_p^2 = 0.01$. These results suggest that self-deceptive enhancement had a direct effect on CAT scores, but it had no significant effect on the interaction.

The CONDITION * TIME ANCOVA controlling for BIDR-IM predicting the change in the extent of believing in conspiracy theories controlling for the impression management factor of social desirability revealed significant main effect of TIME, $F_{(1, 704)} = 6.30$, $p = 0.012$, $\eta_p^2 = 0.01$; but did not of BIDR-IM $F_{(1, 704)} = 1.53$, $p = 0.216$, $\eta_p^2 = 0.00$; and did not of CONDITION, $F_{(3, 704)} = 1.32$, $p = 0.268$, $\eta_p^2 = 0.01$. The interaction of CONDITION * TIME remained significant, $F_{(3, 704)} = 6.31$, $p < 0.001$, $\eta_p^2 = 0.03$, but the interaction of TIME * BIDR-IM was only marginally significant, $F_{(1, 704)} = 3.04$, $p = 0.082$, $\eta_p^2 = 0.004$. These results suggest that impression management did not have a direct effect on CAT scores, nor did it have an effect on the interaction.

Measuring the Effect of the Perceived Competency and Intelligence of the Speaker on the Manipulation

The CONDITION * TIME ANCOVA controlling for COMPETENCY predicting the change in the extent of believing in conspiracy theories controlling for the perceived competency of the speaker revealed only marginally significant main effect of TIME, $F_{(1, 704)} = 2.84$, $p = 0.093$, $\eta_p^2 = 0.004$; but did not of CONDITION $F_{(3, 704)} = 1.63$, $p = 0.180$, $\eta_p^2 = 0.01$; however, significant main effect was found of COMPETENCY, $F_{(1, 704)} = 60.83$, $p < 0.001$, $\eta_p^2 = 0.08$. The interaction of CONDITION * TIME was significant, $F_{(3, 704)} = 6.11$, $p = 0.025$, $\eta_p^2 = 0.03$, but the interaction of TIME * COMPETENCY was not significant, $F_{(1, 704)} = 0.19$, $p = 0.666$, $\eta_p^2 = 0.0003$. These results suggest that the perceived competency of the speaker had a direct effect on CAT scores, but it had no significant effect on the interaction.

The CONDITION * TIME ANCOVA controlling for INTELLIGENCE predicting the change in the extent of believing in conspiracy theories controlling for the perceived intelligence of the speaker revealed no significant main effect of TIME, $F_{(1, 704)} = 1.13$, $p = 0.289$, $\eta_p^2 = 0.002$; of CONDITION $F_{(3, 704)} = 1.26$, $p = 0.288$, $\eta_p^2 = 0.01$; however, significant main effect was found of INTELLIGENCE, $F_{(1, 704)} = 36.23$, $p < 0.001$, $\eta_p^2 = 0.05$. The interaction of CONDITION * TIME was significant, $F_{(3, 704)} = 6.13$, $p = 0.025$, $\eta_p^2 = 0.03$, but the interaction of TIME * INTELLIGENCE was not significant,

TABLE 1 | Descriptive statistics and correlations of the included questionnaires ($N = 709$).

Scales	Range	Mean	*SD*	1	2	3	4	5	6	7	8	9
1. Conspiracy Assessment Tool—pre	8–88	45.15	25.88	–								
2. Conspiracy Assessment Tool—post	8–88	43.28	26.11	0.94**	–							
3. Conspiracy Mentality Questionnaire	11–77	51.08	11.21	0.60**	0.61**	–						
4. Self-deception Enhancement factor of BIDR	20–140	92.13	12.46	−0.09*	−0.07	0.02	–					
5. Impression Management factor of BIDR	20–140	82.36	11.44	−0.06	−0.04	−0.01	0.29**	–				
6. Extraversion	3–15	10.62	2.67	−0.01	0.00	0.04	0.20**	0.04	–			
7. Agreeableness	3–15	11.42	2.13	0.07	0.08*	0.11**	0.20**	0.20**	0.25**	–		
8. Conscientiousness	3–15	10.34	2.53	−0.01	−0.03	0.04	0.33**	0.34**	0.09*	0.14**	–	
9. Emotional stability	3–15	9.93	2.73	−0.05	−0.04	0.01	0.43**	0.12**	0.11**	0.32**	0.14**	–
10. Openness	3–15	11.35	2.92	−0.13**	−0.13**	−0.05	0.17**	0.16**	0.16**	0.22**	0.11**	0.11**

*$p < 0.05$; **$p < 0.01$.

$F_{(1, 704)} = 0.03$, $p = 0.868$, $\eta_p{}^2 = 0.00004$. These results suggest that the perceived intelligence of the speaker had a direct effect on CAT scores, but it had no significant effect on the interaction.

Measuring the Effect of Personality-Related Variables on the Manipulation (ANCOVA)

Using Big Five traits as covariates in the CONDITION * TIME ANCOVAs did not show either the main effect or the interaction of personality traits, except for Openness which had a significant main effect, $F_{(1, 704)} = 12.48$, $p < 0.001$, $\eta_p{}^2 = 0.02$. These results suggest that none of the personality traits had a direct effect on CAT scores, and it had no significant effect on the interaction.

Measuring the Effect of Level of Engaging in Conspiracy-Related Ideations on the Manipulation

The CONDITION * TIME ANCOVA controlling for CMQ predicting the change in the extent of believing in conspiracy theories controlling for the level of engaging in conspiracy-related ideations revealed significant main effects of TIME, $F_{(1, 704)} = 9.40$, $p = 0.002$, $\eta_p{}^2 = 0.01$; and of CMQ $F_{(1, 704)} = 859.87$, $p < 0.001$, $\eta_p{}^2 = 0.55$; but did not of CONDITION, $F_{(3, 704)} = 0.22$, $p = 0.885$, $\eta_p{}^2 = 0.001$. The interaction of CONDITION * TIME remained significant, $F_{(3, 704)} = 5.63$, $p = 0.001$, $\eta_p{}^2 = 0.02$; however, the interaction of TIME * CMQ was not significant, $F_{(1, 704)} = 3.58$, $p = 0.059$, $\eta_p{}^2 = 0.01$. These results suggest that the level of engaging in conspiracy-related ideations had no significant effect on the results of the experiment.

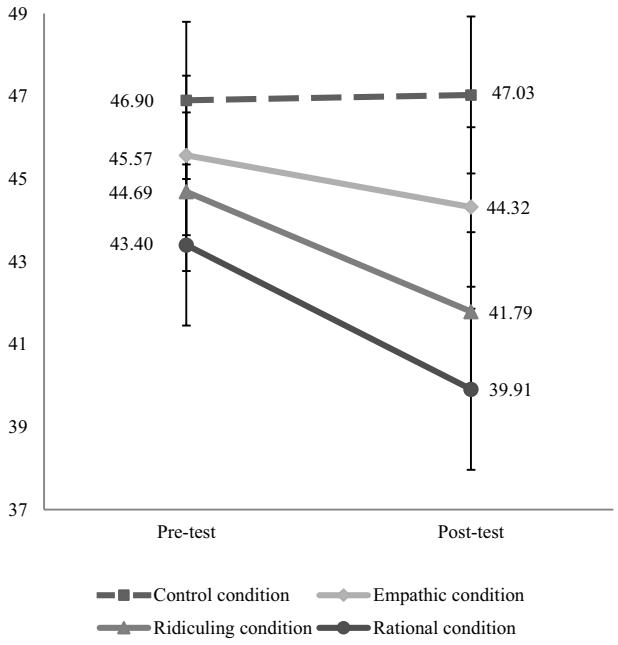


FIGURE 1 | Conspiracy Assessment Tool points before and after listening to audio excerpt related to conspiracy theory reduction in each condition.

DISCUSSION

Most of the existing studies regarding the nature of conspiracy theories are descriptive; moreover, experimental research exploring the possibility of CT belief change is very rare (Banas and Miller, 2013; Swami et al., 2014). In the present study, the immediate effects of three types of belief change strategies on conspiracy belief change were investigated on comprehensive samples. According to the results, the empathetic arguments were not very effective. However, ridiculing and rational arguments were effective in CT belief change.

Previously, it was assumed that CTs resisted rational arguments, because only those pieces of information that were consistent with them were processed, while the incompatible ones were rejected (Bartlett and Miller, 2010). The present results are challenging this idea. CTs are characterized by a bipolar, black and white logic, which divides the society into good and evil. The success of the rational argument can be justified by the elaborated processing of the logical link between the target and the attribute. It is also possible that rational arguments can reduce CT beliefs

by challenging the black and white thinking (Moscovici, 1987; Berlet, 2009). In the case of the rational condition, the convincing message aimed to elaborate the link between the objects (Jews, European Union, global financial system or bankers) and the attributes (exploitative, hidden, and manipulative). By pointing out the logical flaws and inconsistencies of CTs, it aimed to create a more complex and coherent link between the objects and the attributes. These results are in line with Swami et al.'s (2014) findings, according to which analytic thinking reduces conspiracist ideation. Helping analytic thinking by providing detailed explanations can reinforce deliberate processing of information. Swami et al. (2014) used a more tacit form of analytic thinking induction; nevertheless, on the basis of the present results it might be similarly effective if the rational arguments were directly given to the people. In both cases, skepticism becomes stronger and individuals become less willing to endorse those logical flaws, which are inherent parts of CT beliefs. In the rational condition, participants were informed about the logical flaws of the CT beliefs, but this speech did not refer directly to the characteristics of CT believers. Therefore, the stimulus of the rational condition was less threatening to those participants who were CT believers than the ridiculing condition, which might also contribute to the higher effectiveness of these arguments. One more explanation for the results is that it was not the rational arguments themselves, but the "rationality heuristics" associated with the message (logically-looking argumentation, many facts and numbers) that caused the impact of this condition. An experimentum crucis examining the two options should be done in order to be able to decide the real cause of the impact.

In the ridiculing condition, the arguments focused on the deficiencies of CT believers' thinking. This belief change can be expected as a result of the emerging distance between the self and those who hold CT beliefs. Ridiculing arguments are threatening for those who hold strong conspiracy beliefs, but among those who do not have very strong CT beliefs it can lead to disidentification from the group of CT believers. The stronger the belief in conspiracy, the stronger cognitive dissonance can be expected, and the results can be apparent in attitudes and behavior. We only examined beliefs, and in this field, cognitive dissonance can be resolved in two main ways: CT beliefs can be reduced and the new information regarding CT believers can be rejected. Considering the full sample, this strategy reduced CT beliefs. However, when we examined the effect of this condition among those who held strong vs. relatively weak CT beliefs separately, we found no significant difference between the effects of rational arguments: it was effective in both groups. Further, examination is needed in order to identify why ridiculing strategy did not have an overwhelming effect.

Among the experimental manipulations, the empathetic condition was the least effective. Previous studies found that perspective taking can effectively reduce CT beliefs (van Prooijen and van Dijk, 2014). In the present study, strengthening empathy toward the object of the CT beliefs did not seem to reduce CT beliefs effectively. Several reasons why we did not find this strategy effective can be considered. First, empathy and perspective taking can be considered as distinct constructs (Davis, 1983). Second, unlike van Prooijen and van Dijk (2014), the present study used CT beliefs with topics close to the respondents' everyday life (Hungary, EU, bankers, Jews); and these were probably more embedded than stories about distant events as in van Prooijen and van Dijk's study. We suggest that conspiracy beliefs can be more easily changed when they have less prevalent anchors in the life of the studied group. Consequently, more deeply rooted CT beliefs are harder to change by enhancing empathy toward the CT's object; however, emphasizing perspective-taking can be more beneficial for this purpose.

On the basis of these results, two belief changing strategies appeared to be effective: the rational and the ridiculing ones. From the perspective of the different theoretical backgrounds, there are alternative explanations for these findings. On the basis of the functional attitude theories (Katz, 1960), if someone wishes to reduce CT beliefs, the informational and ego-defensive functions of attitudes toward CTs could be equally employed in communication strategy building. From the perspective of the elaboration likelihood model (Petty and Cacioppo, 1986), both central and peripheral paths can be equally effective, especially if the peripheral one is more closely related to ridiculing those who hold these beliefs than empathizing with the victims of CT beliefs. Finally, the consistency theories (e.g., Abelson, 1968), in order to reduce the acceptance of CT beliefs, appear to be effective to create inconsistency between being a logical person (as a specific part of positive self-concept) vs. the irrationality of CT believers and between the informational content of the previous beliefs vs. the new information regarding events or people related to conspiracies.

Thanks to the rich literature regarding the links between individual differences in terms of personality (Abalakina-Paap and Stephan, 1999; Whitson and Galinsky, 2008; Swami et al., 2011; Brotherton et al., 2013; Bruder et al., 2013) and values (Abalakina-Paap and Stephan, 1999; Swami et al., 2011; Brotherton et al., 2013; Bruder et al., 2013), we presumed that individual differences could affect, to some extent, the effectiveness of the three strategies. According to the results, this is not the case. Individual differences in terms of Big Five traits and social desirability did not influence the experimental effects. Furthermore, very weak or non-significant links were found between conspiracy theory related variables and individual differences and these were not related to CT belief change. There might be several reasons for these results: it is possible that the effect of individual differences on CT beliefs is smaller among Hungarians than in other countries. It is also possible that we could not measure any effect of individual differences on the acceptance of CTs with the specific CT material used in the experiment. Finally, it is also possible that other, longer or more sophisticated personality or social desirability measures would better demonstrate the possible role of individual differences. Contrary to individual differences, situational variables influenced the belief in conspiracy theories (e.g., the perceived competence and intelligence of the person who argued against the CT, increased the effectiveness of the belief change).

The present study is not without limitations. The effect sizes were not large. However, measuring the effectiveness of different reasoning or convincing strategies is not easy. In the present study, the number of arguments was balanced, but the length of the audio recordings was different in the different conditions. Further, studies should balance the number of arguments, their length and pretest the effectiveness of each argument. Needless to say that it is a time consuming task. If we consider the present study as an intervention, it can first be said that this is not a wise one, as direct and confronting strategies were used to convince individuals regarding CT reduction. Second, this experiment did not have the very solid theoretical background that a good intervention requires. Third, this study only measured the short-term effects of different CT reduction strategies. Fourth, it targeted a general population instead of a specific subgroup of individuals. Fifth, the timing of the experiment was not related to a big CT-related scandal, which could have influenced the effectiveness of the conditions.

Besides these numerous deficiencies, the present study shows that rational arguments can reduce CT beliefs, while ridiculing also appears to be somewhat effective. Future studies are needed in order to explore the boundaries of these results. But, after careful investigation of these conditions (culture, timing, different groups with different characteristics, different speakers, etc.), media campaigns can be designed and in collaboration with competent public speakers, different CT reduction strategies can be tested.

CONCLUSION

Despite the extensive knowledge about the harmful effects of having CT beliefs, the reduction of CT beliefs with experimental methods is a relatively neglected topic of scientific investigation. In the present study, three convincing strategies were tested in order to reduce CT beliefs: rational arguments, ridiculing of CT believers, and expressing empathy toward the objects of CT beliefs. Providing rational arguments was found as being an effective strategy, along with providing ridiculing arguments, which could also reduce CT beliefs. Only very weak, or even non-significant links were found between conspiracy theory-related variables and individual differences. Considering these results and previous studies focusing on the benevolent effects of analytic thinking in CT belief reduction, it can be assumed that uncovering arguments regarding the logical inconsistencies of CT beliefs can be an effective way to discredit them. Our findings on the efficiency of rational argumentation go against the mainstream of the communication literature and "common wisdom," as well as the current affective wave of social psychology emphasizing that emotions constitute the most important factor behind shaping beliefs and attitudes. Considering the modest effect sizes, we assume that rationality has a bigger impact on shaping (sometimes irrational) beliefs than previously expected, given that in the current communication environment, people are overloaded with emotional messages coming from ads, political and social campaigns. Future studies should also investigate the role of rationality and the "rationality heuristic" in belief change.

AUTHOR CONTRIBUTIONS

GO contributed to the study design, manuscript writing, and data analyses; PK contributed to the study design, data gathering and interpretation, and literature review; BP contributed to the literature review and interpretation of the results and writing the manuscript; IT and BB contributed to the data analysis and interpretation, writing the manuscript, and the literature review; CR contributed to the manuscript writing and literature review. All authors commented on the draft and contributed to the final version, approved the publication of the manuscript, and agreed to be accountable for all aspects of the work.

ACKNOWLEDGMENTS

The first author (GO) was supported by the Hungarian Research Fund (NKFI PD 106027, 116686) and the Hungarian Academy of Sciences (Lendület Project LP2012-36).

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: http://journal.frontiersin.org/article/10.3389/fpsyg.2016.01525

REFERENCES

Abalakina-Paap, M., and Stephan, W. G. (1999). Beliefs in conspiracies. *J. Polit. Psychol.* 20, 637–647. doi: 10.1111/0162-895X.00160

Abelson, R. P. (1968). *Theories of Cognitive Consistency: A Sourcebook*. Chicago, IL: Rand-McNally.

Ajzen, I. (1985). "From intentions to actions: a theory of planned behavior," in *Action Control*, eds J. Kuhl and J. Beckmann (Berlin; Heidelberg: Springer), 11–39.

Ajzen, I. (1991). The theory of planned behavior. *Organ. Behav. Hum. Decis.* 50, 179–211. doi: 10.1016/0749-5978(91)90020-T

Aronson, E. (1969). The theory of cognitive dissonance: a current perspective. *Adv. Exp. Soc. Psychol.* 4, 1–34. doi: 10.1016/S0065-2601(08)60075-1

Banas, J. A., and Miller, G. (2013). Inducing resistance to conspiracy theory propaganda: testing inoculation and metainoculation strategies. *Hum. Commun. Res.* 39, 184–207. doi: 10.1111/hcre.12000

Barkun, M. (2003). *A Culture of Conspiracy: Apocalyptic Visions in Contemporary America*. Berkeley, CA: University of California Press.

Bartlett, J., and Miller, C. (2010). *The Power of Unreason: Conspiracy Theories, Extremism and Counter-Terrorism*. London: Demos.

Beaton, D. E., Bombardier, C., Guillemin, F., and Ferraz, M. B. (2000). Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine* 25, 3186–3191. doi: 10.1097/00007632-200012150-00014

Berger, R., Benatov, J., Abu-Raiya, H., and Tadmor, C. T. (2016). Reducing prejudice and promoting positive intergroup attitudes among elementary-school children in the context of the Israeli–Palestinian conflict. *J. School Psychol.* 57, 53–72. doi: 10.1016/j.jsp.2016.04.003

Berlet, C. (2009). *Toxic to Democracy*: *Conspiracy Theories, Demonization, and Scapegoating*. Political Research Associates. Available online at: http://www.publiceye.org/conspire/toxic2democracy/

Brotherton, R., French, C. C., and Pickering, A. D. (2013). Measuring belief in conspiracy theories: the generic conspiracist beliefs scale. *Front. Psychol.* 4:279. doi: 10.3389/fpsyg.2013.00279

Bruder, M., Haffke, P., Neave, N., Nouripanah, N., and Imhoff, R. (2013). Measuring individual differences in generic beliefs in conspiracy theories across cultures: conspiracy mentality questionnaire. *Front. Psychol.* 4:225. doi: 10.3389/fpsyg.2013.00225

Butler, L. D., Koopman, C., and Zimbardo, P. G. (1995). The psychological impact of the film JFK: emotions, beliefs, and political behavioral intentions. *Polit. Psychol.* 16, 237–257. doi: 10.2307/3791831

Crocker, J., Luhtanen, R., Broadnax, S., and Blaine, B. (1999). Belief in U.S. government conspiracies against blacks: powerlessness or system blame? *Pers. Soc. Psychol. Bull.* 25, 941–953.

Davis, M. H. (1983). Measuring individual differences in empathy: evidence for a multidimensional approach. *J. Pers. Soc. Psychol.* 44, 113–126. doi: 10.1037/0022-3514.44.1.113

Farkas, D., and Orosz, G. (2013). The link between ego-resiliency and changes in Big Five traits after decision making: The case of extraversion. *Pers. Indiv. Differ.* 55, 440–445. doi: 10.1016/j.paid.2013.04.003

Festinger, L. (1962). *A Theory of Cognitive Dissonance*, *Vol. 2.* Palo Alto, CA: Stanford University Press.

Fishbein, M., and Ajzen, I. (1975). *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*. London: Addison-Wesley.

Goertzel, T. (1994). Belief in conspiracy theories. *Polit. Psychol.* 15, 733–744. doi: 10.2307/3791630

Hamsher, J. H., Geller, J. D., and Rotter, J. B. (1968). Interpersonal trust, internal-external control, and the warren commission report. *J. Pers. Soc. Psychol.* 9, 210–215. doi: 10.1037/h0025900

John, O. P., and Srivastava, S. (1999). "The big five trait taxonomy: history, measurement, and theoretical perspectives," in *Handbook of Personality: Theory and Research*, *2nd Edn*, eds L. A. Pervin, and O. P. John (New York, NY: Guilford Press), 102–138.

Katz, D. (1960). The functional approach to the study of attitudes. *Public Opin. Q.* 24, 163–204. doi: 10.1086/266945

Krekó, P. (2015). "Conspiracy theory as motivated collective cognition," in *The Psychology of Conspiracy*, eds M. Bilewicz, A. Cichocka, and W. Soral (London: Routledge), 62–76.

Moscovici, S. (1987). "The conspiracy mentality," in *Changing Conceptions of Conspiracy,* eds C. F. Graumann, and S. Moscovici (New York, NY: Springer-Verlag), 151–169.

Paulhus, D. L. (1991). "Measurement and control of response bias," in *Measures of Personality and Social Psychological Attitudes*, eds J. P. Robinson and P. R. Shaver (San Diego, CA: Academic Press), 17–59.

Pettigrew, T. F., and Tropp, L. R. (2008). How does intergroup contact reduce prejudice? Meta−analytic tests of three mediators. *Eur. J. Soc. Psychol.* 38, 922–934. doi: 10.1002/ejsp.504

Petty, R. E., and Cacioppo, J. T. (1986). "The elaboration likelihood model of persuasion," in *Communication and Persuasion,* eds R. E. Petty, and J. T. Cacioppo (New York, NY: Springer New York), 1–24.

Swami, V., Chamorro-Premuzic T., and Furnham A., (2010). Unanswered questions: a preliminary investigation of personality and individual difference predictors of 9/11 conspiracist beliefs. *Appl. Cogn. Psychol.* 24, 749–761. doi: 10.1002/acp.1583

Swami, V., Coles, R., Stieger, S., Pietschnig, J., Furnham, A., Rehim, S., et al. (2011). Conspiracist ideation in Britain and Austria: evidence of a monological belief system and associations between individual psychological differences and real-world and fictitious conspiracy theories. *Brit. J. Psychol.* 102, 443–463. doi: 10.1111/j.2044-8295.2010.02004.x

Swami, V., Voracek, M., Stieger, S., Tran, U. S., and Furnham, A. (2014). Analytic thinking reduces belief in conspiracy theories. *Cognition* 133, 572–585. doi: 10.1016/j.cognition.2014.08.006

van Prooijen, J., and van Dijk, E. (2014). When consequence size predicts belief in conspiracy theories: the moderating role of perspective taking. *J. Exp. Soc. Psychol.* 55, 63–73. doi: 10.1016/j.jesp.2014.06.006

Whitson, J., and Galinsky, A. (2008). Lacking control increases illusory pattern perception. *Science* 322, 115–117. doi: 10.1126/science.1159845

Williams, J. (2013). *Conspiracy Theory Poll Results*. Available online at: http://www.publicpolicypolling.com/main/2013/04/conspiracy-theory-poll-results-.html (Accessed January 19, 2016).

Wood, M. J., and Douglas, K. M. (2013). "What about building 7?" A social psychological study of online discussion of 9/11 conspiracy theories. *Front. Psychol.* 4:409. doi: 10.3389/fpsyg.2013.00409

Wood, M. J., Douglas, K. M., and Sutton, R. M. (2012). Dead and alive: beliefs in contradictory conspiracy theories. *Soc. Psychol. Pers. Sci.* 3, 767–773. doi: 10.1177/1948550611434786

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

HYPOTHESIS AND THEORY
published: 10 March 2017
doi: 10.3389/fpsyg.2017.00358

Does Hunger Contribute to Socioeconomic Gradients in Behavior?

*Daniel Nettle**

Centre for Behaviour and Evolution, Institute of Neuroscience, Newcastle University, Newcastle, UK

Recent research has uncovered many examples of socioeconomic gradients in behavior and psychological states. As yet there is no theoretical consensus on the nature of the causal processes that produce these gradients. Here, I present the *hunger hypothesis*, namely the claim that part of the reason that people of lower socioeconomic position behave and feel as they do is that they are relatively often hungry. The hunger hypothesis applies in particular to impulsivity-hyperactivity, irritability-aggression, anxiety, and persistent narcotic use, all of which have been found to show socioeconomic gradients. I review multiple lines of evidence showing that hunger produces strong increases in these outcomes. I also review the literatures on food insufficiency and food insecurity to show that, within affluent societies, the poor experience a substantial burden of hunger, despite obtaining sufficient or excess calories on average. This leads to the distinctive prediction that hunger is an important mediator of the relationships between socioeconomic variables and the behavioral/psychological outcomes. This approach has a number of far-reaching implications, not least that some behavioral and psychological differences between social groups, though persistent under current economic arrangements, are potentially highly reversible with changes to the distribution of financial resources and food.

Keywords: socioeconomic position, hunger, food insecurity, impulsivity, ADHD, aggression, anxiety, addiction

OPEN ACCESS

Edited by:
Jacob B. Hirsh,
University of Toronto, Canada

Reviewed by:
Pete C. Trimmer,
University of Bristol, UK
Daniel M. T. Fessler,
University of California, Los Angeles, USA

***Correspondence:**
Daniel Nettle
daniel.nettle@ncl.ac.uk

Specialty section:
This article was submitted to Personality and Social Psychology, a section of the journal Frontiers in Psychology

Received: *07 September 2016*
Accepted: *24 February 2017*
Published: *10 March 2017*

Citation:
Nettle D (2017) Does Hunger Contribute to Socioeconomic Gradients in Behavior? Front. Psychol. 8:358. doi: 10.3389/fpsyg.2017.00358

INTRODUCTION

The last decade has seen an increasing appreciation that, within affluent societies, socioeconomic position (SEP) is an important predictor of variation in behavioral and psychological outcomes (e.g., Griskevicius et al., 2011a,b; Kraus et al., 2012; Haushofer and Fehr, 2014; Hill et al., 2016). Demonstrations of the central importance of SEP may come as no surprise to sociologists, but within psychology, SEP had been relatively neglected as a source of variation. One reason psychologists may not have been drawn to SEP as an explanatory variable is that, from a psychological perspective, SEP is just a proxy. The success of simple socioeconomic variables as statistical predictors suggests that they must roughly capture some set of inputs or experiences that entrains a specific pattern of psychological processes in response. However, there is as yet no theoretical consensus on what these experiences and processes are.

A general strategy for advancing understanding in this area is to identify states that: (1) occur more commonly in people of lower SEP, for reasons that follow directly from their poverty and disadvantage; and (2) can be demonstrated (independently of SEP) to cause psychological and

behavioral shifts of the kind that have been statistically associated with lower SEP. This article proposes that hunger is such a state. It presents the hypothesis that a number of the observed behavioral and psychological differences between people of low and high SEP within affluent societies are partly the consequences of people of low SEP being more often hungry. I am using hunger here to refer to the physiological need to eat food, though in many of the studies reviewed below, what is actually measured is the subjective sensation associated with that need. This is a broader definition of hunger than those used in some sources (e.g., Keys et al., 1950). Note also that hunger (an instantaneous state) is not to be equated with, and does not imply, undernutrition (which can only be evaluated over longer time periods).

Some immediate caveats are in order. The hunger hypothesis does not claim that all socioeconomic gradients in behavior or psychological variables are related to hunger, nor that, in those cases where hunger does play a role, hunger is the sole cause. Occupying lower SEP will have a whole range of (potentially separable) physical, emotional and social-cognitive consequences. Thus, explanations for observed socioeconomic gradients no doubt need to be heterogeneous. Hunger would be, even if the hypothesis were supported, a *partial* explanation for *some* of the observed gradients. This is all the more true since SEP itself is a multi-facetted construct, operationalised in a number of distinct ways (e.g., income, education, occupational status, perceived position on a social ladder). In view of this heterogeneity, it is important to delineate the scope of the hunger hypothesis. I am applying it here to four case studies of clusters of outcomes that show social gradients: impulsivity-hyperactivity, irritability-aggression, anxiety and persistent narcotic use. There are other behaviors and states, such as prosociality (Kraus et al., 2012; Korndörfer et al., 2015) and locus of control (Pepper and Nettle, 2017), that also vary by SEP. Whether hunger has any relationship to these differences is beyond the scope of this paper, and not a claim I wish to imply. There are also SEP differences in general intelligence. The interpretation of these is complex (Deary and Johnson, 2010; Marioni et al., 2014), and though it is possible that hunger has some relevance (see Mani et al., 2013), I do not consider this issue here. The hunger hypothesis is also most readily applicable to socioeconomic gradients defined in terms of income, since, as we shall see below, income is a strong determinant of hunger within affluent societies. Social gradients defined in terms of, for example, education, would only be explicable under the hypothesis to the extent that more education improves income or food access.

In what follows, I first review the evidence that the subjects of my four case studies– namely impulsivity-hyperactivity, irritability-aggression, anxiety and persistent narcotic use—all show SEP gradients within affluent societies. There then follows a review of the effects of hunger on behavior, in which I note that these same four clusters of variables appear consistently, from multiple sources of evidence. I then present evidence that hunger is strongly socioeconomically patterned. This leads to a consideration of alternative versions of the hunger hypothesis, and discussion of their predictions, testability and implications.

SOCIAL GRADIENTS IN BEHAVIORAL AND PSYCHOLOGICAL OUTCOMES: FOUR CASE STUDIES

In this section, I briefly discuss four clusters of behaviors and psychological states that have been recurrently identified in the literature as correlated with SEP, and whose correlations with SEP are not yet explained. My decision to focus on these particular clusters is not, of course, independent of my knowledge of the literature on the psychology of hunger. I could therefore be accused of having chosen the cases that suit the argument. This is in one sense true, but the purpose of this article is hypothesis generation rather than hypothesis testing. Thus it is important to bear in mind that what I present here is grounds for entertaining the hunger hypothesis, not evidence that the hunger hypothesis is correct (and it could turn out to be correct for some of the clusters but not the others). We will return to how the hypothesis can be tested in a later section. The four clusters, although in some cases possibly related, are heterogeneous in type. Narcotic use is a behavior, whereas anxiety is an affective state generally measured by self-report. This heterogeneity is not damaging to the present thesis, since the aim is not to equate the four clusters with one another (each no doubt has a distinct set of causes and consequences), but rather show that a parallel argument for the partially mediating role of hunger in the SEP gradient can be made for each of the four case studies.

Impulsivity-Hyperactivity

Impulsivity is a term with varied meanings (Reynolds et al., 2006), encompassing both measures of temporal discounting ('waiting') and of response inhibition ('stopping'). Whilst there is evidence of stable, personality-like individual differences in proneness to impulsivity (Odum, 2011), contemporary research has established that impulsivity can also vary markedly in relation to context or the subject's state (Kidd et al., 2013; Lempert and Phelps, 2016). Lower-SEP individuals have been found to be less patient in terms of waiting (Green et al., 1996; Adams and White, 2009) and more disinhibited in terms of stopping (Paál et al., 2015). The chief motivation for studying the SEP-impulsivity association in adults has been the hypothesis that greater impulsivity statistically mediates the relationships between SEP on the one hand and health-damaging behaviors on the other (Adams and White, 2009; Ward et al., 2009).

Impulsivity is not a psychological disorder. However, exhibiting impulsivity (along with inattention and hyperactivity) is a diagnostic criterion for the disorder attention-deficit hyperactivity disorder (ADHD) in children. Thus, the presence of more ADHD diagnoses in children of lower-SEP is a source of evidence for greater impulsivity amongst children from those groups. And indeed, ADHD is a highly social patterned disorder, more common in families of lower SEP. The odds of an ADHD diagnosis are over twice as high for families in the lowest tertile of SEP compared to the highest tertile (Russell et al., 2015b). In one British study using multiple socioeconomic variables, it was the presence of financial difficulties that was the strongest predictor of ADHD diagnosis (Russell et al., 2015a). Given that there is a greater rate of ADHD diagnosis in children from low-SEP groups,

it is a reasonable inference that there is a greater prevalence of sub-clinically elevated impulsivity too.

Irritability-Aggression

There are multiple lines of evidence for irritability-aggression being associated with low SEP. Crime rates in general are higher in low- than high- SEP communities, but *violent* crime, which is by definition evidence of aggression, shows a greater differential than other crime types (Krivo and Peterson, 1996; Nettle, 2015). The per capita murder rate, for example, is around five times as high in the poorest compared to the most affluent deciles of British neighborhoods (Shaw et al., 2005). There is also evidence for non-linearity in the gradients of violence and homicide: the rates increase continuously with increasing deprivation, but are markedly higher in extremely deprived communities than in moderately deprived ones (Krivo and Peterson, 1996; Shaw et al., 2005).

Several cross-sectional studies of adults have, assessed the triad of anger, hostility and aggression, using psychometric scales. This research has usually been motivated by the known health sequelae of these variables. The studies consistently find some or all components of the triad to be inversely associated with markers of SEP (see Gallo and Matthews, 2003 for a review of 12 such studies). We should also note a remarkable quasi-experimental study in children. Costello et al. (2003) examined the impact on children's psychopathology of an abrupt increase in family income due to royalties from a casino opened on Native American land. Poor families prior to the royalties had elevated rates of conduct and oppositional/defiant disorder. Irritability and aggression are central to these disorders, and thus the presence of the diagnosed disorders is strong evidence for the presence of the underlying psychological states. In families that began to receive royalties, the prevalence of conduct and oppositional/defiant disorders reduced to the level seen in affluent families, essentially immediately. The prevalence of the disorders did not change in those families that remained poor.

Anxiety

Several studies have found anxiety disorders to be substantially more common in lower-SEP population groups (Gallo and Matthews, 2003; Stansfeld et al., 2011; Green and Benzeval, 2013). The gradient for anxiety disorders is, in some studies at least, stronger than that for other disorders such as depression (Kessler et al., 1994; Miech et al., 1999). The gradient in sub-clinical experience of anxiety has been less thoroughly studied than that in diagnosed disorder. However, where it has been studied, it has been found, with SEP linearly and inversely related to average experienced anxiety (Warheit et al., 1975; Himmelfarb and Murrell, 1984). The causal nexus in the SEP-anxiety association could point in either direction: low SEP leads to greater anxiety, or greater anxiety leads to loss of SEP. Miech et al. (1999) used prospective longitudinal evidence in young people to attempt to differentiate these two pathways. Since familial SEP predicted anxiety at age 15, anxiety at 15 failed to predict subsequent educational attainment (as a marker of SEP), and educational attainment predicted change in anxiety into adulthood, they concluded that the causal process most consistent with the data was something about low SEP causing anxiety rather than the other way around. A more recent longitudinal study with longer follow up (Stansfeld et al., 2011) suggested that both directions of causality were operative. However, in the natural experiment constituted by the onset of casino royalties, described in the section "Irritability-Aggression," unlike oppositional/defiant disorder, anxiety symptoms were not reduced by the increase in income (Costello et al., 2003). This was despite poverty being associated with anxiety at baseline in this community.

Persistent Narcotic Use

The final case study is somewhat different from the first three, in that it concerns a specific behavior rather than broad states. Newly available narcotics are often adopted equally by all social groups, or even preferentially by those of high SEP, who have greater resources to buy them. However, once narcotics become known to be harmful, desistence is much greater in high-SEP groups, so that persistent use becomes more and concentrated in low SEP communities over time. This trajectory has been followed, for example, by tobacco smoking (Lawlor et al., 2003) and cocaine use (Miech, 2008). Much of the concentration of persistent narcotic use in lower-SEP groups is explained by greater likelihood of failure in attempts to quit amongst individuals of lower SEP (Miech, 2008; Hiscock et al., 2012). Their greater likelihood of failure in quitting is attributed, amongst other factors, to their increased impulsivity (see Impulsivity-Hyperactivity).

EFFECTS OF HUNGER ON BEHAVIOR

This section reviews the evidence for the behavioral consequences of hunger, in both humans and in non-human animals. As I will argue, the literature shows that hunger produces a behavioral phenotype centrally characterized by increased impulsivity and hyperactivity, increased irritability and aggression, and increased anxiety, and that has as a side effect greater proneness to use narcotics. Thus, the parallels with the four case studies of SEP gradients discussed in the section "Social Gradients in Behavioral and Psychological Outcomes: Four Case Studies" are clear.

The sources of data on the behavioral consequences of hunger are varied. They include: (1) Evidence from eating disorder patients whose condition involves extreme self-deprivation of food; (2) Evidence from medical food restriction applied as a treatment for morbid obesity; (3) Correlational studies in which behaviors or feelings are associated with hunger or some proxy for it; (4) Evidence from historic semi-starvation experiments with human volunteers; (5) Controlled experimental studies that manipulate moderate hunger in human volunteers; and (6) Studies of non-human animals. Data sources (1)–(5) provide a scale of increasing confidence about the causal consequences of hunger in humans. Sources (1) and (2) involve extreme hunger in highly selected groups whose appetite is potentially disordered in some way in the first place; source (3) is correlational; source (4) is experimental but extreme and involves small, self-selected samples and no control groups; source (5) is fully experimental,

incorporates control conditions, and studies variations in hunger within the range of everyday occurrence. Source (6) provides evidence that the human response to hunger is not exceptional from an evolutionary point of view, and at least in part represents a highly conserved pattern. Rather than reviewing the evidence trait by trait as in the previous section, I will briefly describe the relevant findings from each source of data.

Eating Disorders

Given that eating disorders such as Anorexia Nervosa involve extreme self-control in food ingestion, it seems paradoxical that its most common concomitants include impulsivity, hyperactivity, narcotic use, anxiety and irritability or aggression. Fessler (2002) reviews the evidence for impulsive behaviors in anorexia, describing several observational studies showing that rates of stealing and even armed robbery are surprisingly high during the disorder. Anorexia patients also show elevated impulsivity compared to controls using standard psychometric assessments (Askenazy et al., 1998). They tend to be physically hyperactive (Hebebrand et al., 2003), and eating disorders in general are accompanied by high rates of smoking, alcohol, and drug use (Blinder et al., 2006). Food restriction in eating disorders is strongly associated with anxiety; indeed, *most* inpatients with an eating disorder are diagnosed with a comorbid anxiety disorder (Blinder et al., 2006). Finally, irritability and aggression are very widely reported in eating disorders: in one study, 28% of sufferers experienced uncontrollable anger attacks (Fava et al., 1995); in another, 49% reported having engaged in violence (Thompson et al., 1999). One interpretation of these data is that behavior in eating disorders provides a window onto the psychological consequences of extreme hunger more generally. This is not the only possible interpretation, since this is a group with a severe psychopathology. However, fortunately, there are also other sources of evidence to which we can turn.

Crash Dieting and Therapeutic Starvation

An historic literature reviewed by Fessler (2002) describes the consequences of crash dieting and 'therapeutic' starvation as medical interventions for obese individuals. The consensus of this literature is that the traits of interest all appear as patients become hungrier. Fessler's (2002, p. 379) summary is worth repeating:

> Swanson and Dinello (1970) report that their patients were initially compliant, pleasant, and optimistic, yet became impulsively angry to the point of physical abuse during therapeutic starvation. Swanson and Dinello (1970, p. 124) note "One man asked for help. . . because he was so angry when in traffic that he feared he would kill any aggravator by smashing his car into them."

Interestingly, these studies report that the symptoms of impulsivity and aggression seen during treatment constituted marked character reversal, and diminished on refeeding (Fessler, 2002, pp. 378–379). This suggests the symptoms were acute consequences of extreme hunger, not trait-like pre-existing characteristics of the patient group.

Correlational Studies in General Populations

Correlational studies take a number of different forms. Some are mainly concerned with within-individual comparisons over time: how does the same person feel when he or she is hungry versus satiated? For example, a classic study simply asked participants to describe their sensations and emotions at different stages of hunger and satiety (Monello and Mayer, 1967). Whereas the typical affect during satiety was satisfaction, relaxation, and calmness, hunger was associated with restlessness and excitability. As the hunger became more severe (but still within the everyday range), 'nervousness' and irritability became prominent for the majority of respondents. A different type of correlational study makes between-individual comparisons to show that behavioral outcomes of interest are more frequent in individuals in whom hunger occurs more often. For example, Kleinman et al. (1998) used parental interviews to assess the extent to which children in a US sample went hungry (with questions such as 'Did your child(ren) ever say they were hungry because there was not enough food in the house?'), and also complete a standard measure of psychosocial functioning. Children rated as often hungry had 'worse' scores for psychosocial functioning. This is rather a non-specific outcome measure; however, when the researchers analyzed which sub-components of the psychosocial assessment were the ones significantly associated with hunger status, it was two factors called 'Oppositional behavior/aggression' and 'Irritability/anxiety/worry' (see Murphy et al., 1998b; Slack and Yoo, 2005 for similar findings).

Another source of correlational evidence is the very extensive literature on the psychological correlates of blood glucose levels (see Gailliot and Baumeister, 2007 for review). Blood glucose levels are not synonymous with hunger. They are, however, related: subjective feelings of hunger and desire to eat are associated with brief, transient declines of around 10% in blood glucose levels (Campfield et al., 1996; Melanson et al., 1999), and eating immediately boosts levels of blood glucose. Moreover, experimental infusion of insulin, which artificially induces a decline in blood glucose levels, causes the psychological experience of hunger (Campfield et al., 1996). By implication, participants experiencing low or falling blood glucose levels are either actually hungry, or behaving as if hungry due to problems of glucose regulation. Gailliot and Baumeister (2007) review decades of evidence associating low blood glucose or poor blood glucose regulation with outcomes they encompass under the heading 'self-control,' to wit (their terminology): poor attention control; emotion dysregulation; crime, aggression and violence; impulsivity; alcohol use; smoking; and difficulty coping with stress (see also 'Experimental studies with healthy volunteers', below).

Semi-Starvation Experiments

The principal source of experimental semi-starvation evidence is from the Minnesota Semi-Starvation Experiment, in which 36 male volunteers were drastically food-restricted for 24 weeks, and then refed (Keys et al., 1950). The researchers concluded

that severe food restriction produced a distinct psychological syndrome that disappeared on refeeding. The symptoms of this syndrome were restlessness, irritability, loss of inhibitions, and poor impulse control. Participants went on impulsive spending sprees, reported violent and angry impulses, and in some cases took risks to the extent of endangering themselves. A rise in accidents and unintended self-injury is also a frequent feature of non-experimental famines (Keys et al., 1950), as is a breakdown of social norms and an increase in social disorder of all kinds (Sorokin, 1942). Minnesota participants increased their consumption of tobacco during the deprivation phase. In summary, the syndrome described in the Minnesota Semi-Starvation Experiment, and by implication also seen in non-experimental famines, resembled an exaggerated form of the low-SEP end of the social gradients described earlier.

Experimental Studies with General Volunteers

A typical experimental design in this category involves fasting volunteers for a number of hours, followed by either a satiating meal or beverage (satiated condition), or no/non-satiating intake (deprived condition). The outcome is measured standardized behavioral task, and the effect of hunger is estimated using the between-group differences in performance (or change in performance if the measure is repeated). Whereas some studies use a satiating food such as tomato soup (e.g., Kirk and Logue, 1997), those specifically interested in effects of bioavailable glucose use a sugary drink in the experimental condition, and a non-sugary sweet drink in the control condition (Wang and Dvorak, 2010; Aarøe and Petersen, 2013). As explained earlier, hunger, carbohydrate consumption, and blood glucose are all linked, and so for present purposes we will consider all these experiments as informative about the consequences of hunger. Orquin and Kurzban (2016) recently conducted a meta-analysis of the extensive literature in this area (although, note, their set of studies includes both correlational and experimental designs). They found robust evidence across multiple studies that: (1) Hungry participants relative to satiated participants become more willing to work or pay for food, and less willing to work or pay for any kind of non-food reward; (2) Hungry participants relative to satiated have a higher rate of time discounting; that is, they are more impulsive in the waiting sense (interestingly this is true whether or not the reward to be waited for is food-related); and (3) Hungry participants relative to satiated tend to use a more intuitive, snap-judgment decision-making style. There is also experimental evidence for hunger increasing anxiety in human volunteers. In a study by Hausel et al. (2001), surgical patients who were randomly assigned pre-operation to be fasted, to drink water, or to drink a carbohydrate-rich drink. Patients receiving the carbohydrate were significantly less anxious, as well as less hungry, than the other two groups.

Evidence from Non-human Animals

It is well established that imposing food deprivation in many different species increases locomotor activity (Hebebrand et al., 2003). Intra-specific aggression tends to also increase; this has been documented in taxa as diverse as birds, mammals, and insects (Wallis, 1964; Rohles and Wilson, 1974; Drummond and Garcia Chavelas, 1989). At least part of the increase in aggression is due to the increase in locomotor activity, as active individuals encounter each other more (Wallis, 1964; Rohles and Wilson, 1974). Increased locomotor activity is part of the activation of the motivation to forage. We can think of increased foraging motivation as a kind of disinhibition, since as animals forage more under food deprivation, they expose themselves to greater risk of predation (Godin and Smith, 1988). There is more specific evidence of impulsivity increasing as energetic reserves become lower: Bateson et al. (2015) tested European starlings for relative preference of a smaller-sooner and later-larger food reward, and found that individuals with lower energetic reserves showed a greater preference for the smaller-sooner reward. Finally, there is a mature literature in laboratory animals showing that imposing food deprivation increases consumption of, or preference for, narcotic substances in a dose-dependent manner (see Bell et al., 1997 for review). This has been shown for all major classes of narcotics, including nicotine, cocaine, and alcohol.

Summary

Multiple lines of evidence converge to suggest that hunger produces a specific behavioral phenotype whose components include impulsivity-hyperactivity, irritability-aggression, anxiety, and a greater propensity to using rewarding narcotics. This evidence is not restricted to extreme food deprivation; hunger within the everyday range has the same consequences in milder form. Indeed, in progressive starvation, anxiety and hyperactivity eventually give way to depression and lethargy; it is mild and moderate hunger that most clearly produces behavioral phenotype described above (Keys et al., 1950). Not only are phenotypic effects of hunger on the four traits of interest established. In some cases, there is evidence of neurobiological mechanisms linking hunger to the behavioral traits too. For example, neuropeptide Y is a brain-expressed neuropeptide whose production is involved in the initiation of eating behavior (Beck, 2006; Nguyen et al., 2012). Elevated expression of neuropeptide Y is also associated with impulsive aggression in both humans and animal models (Coccaro et al., 2012).

Authors on the consequences of hunger have emphasized that the behavioral shifts associated with it do not represent pathology or system failure. Rather, they represent a patterned suite of responses whose function is to prioritize the detection, capture, defense and ingestion of resources in the immediate future over other activities (Loewenstein, 1996; Fessler, 2002; Aarøe and Petersen, 2013; Orquin and Kurzban, 2016). For example, not only does hunger enhance attention to, and increase salience of, food-related stimuli compared to control stimuli (Gilchrist and Nesberg, 1952; Saugstad, 1966); it improves perceptual sensitivity to such stimuli, and hence enhances the ability to detect them rapidly (Radel and Clement-Guillotin, 2012). The suite of responses to hunger is likely to be adaptive, since failure to acquire resources soon when hungry is catastrophic in fitness terms (Higginson et al., 2016). The only one of the four traits under review here that is unlikely to be fitness-enhancing as a response to hunger is increased narcotic use. This is likely to

be a maladaptive by-product of the fact that narcotic substances produce a dopaminergic response in mid-brain reward systems that mimics the natural reward signal produced by feeding when hungry (Small et al., 2003).

This and the previous section have laid the groundwork for the argument that several of the documented psychological correlates of having lower SEP are similar to the main known psychological consequences of being hungry. Indeed, the evidence is not just of shared phenotype, but possibly of shared mechanism too. Lower SEP has been shown to correlate with lower dopamine receptor availability in the striatum (Wiers et al., 2016); it is in the striatum that eating pleasant food produces dopamine release (Small et al., 2003). However, the hunger hypothesis as presented in this article is stronger than the claim that low SEP has consequences *like* those of hunger. Rather, it is the claim that some of the sequelae of low SEP are *due to* people of low SEP experiencing more hunger. To establish this claim, it is necessary to demonstrate that people of lower SEP in developed countries do indeed experience a significant burden of hunger. It is to this topic we now turn.

THE SOCIOECONOMIC DISTRIBUTION OF HUNGER

The claim that people of lower SEP in developed countries might be hungry initially meets with a credibility problem: underweight is very rare in such populations whilst rates of obesity are high, so it seems hard to argue that food is short. Indeed, in developed countries, lower SEP predicts increased probability of obesity, at least for women (Sobal and Stunkard, 1989; McLaren, 2007). However, fat reserves are built up when caloric intake exceeds metabolic requirements averaged over extended periods of time. There is thus no contradiction between overall over-nutrition and having many brief instances of hunger. Indeed, one explanation for overall over-consumption of calories by the poor is as a response to their experience of irregularity in the food supply (Dietz, 1995; Townsend et al., 2001; Nettle et al., 2017).

One way it is possible to put on weight whilst experiencing frequent hunger is by eating less satiating but higher-calorie meals. As we move from higher to lower SEP, diets are composed of progressively less whole grains, vegetables, fruit, and lean meat, and a greater proportion of fats and particularly refined sugars (Drewnowski and Specter, 2004). The consumption of sugar-sweetened beverages, a substantial source of calories in contemporary populations, is strongly socially patterned (Han and Powell, 2013). To a considerable extent, the shift from low- to high-energy density of foods with lower SEP is driven by cost: refined sugars provide many more calories per dollar than fruit or vegetables (Drewnowski and Specter, 2004). However, although energy-dense foods fulfill caloric requirements at low financial cost, they are less satiating than those higher in protein or fiber and lower in sugars (Bornet et al., 2007): that is, hunger returns sooner after eating them.

In addition to lower-SEP meals being less satiating, they may be less regular: studies have found that young people's omission of breakfast (Hoyland et al., 2012) and of family evening meals (Neumark-Sztainer et al., 2003) is more common in low-SEP groups. It is therefore a reasonable contention that people of lower SEP in developed countries tend to be more often hungry that those of higher SEP, even in the absence of lower total calorie intake or body masses. To demonstrate this unequivocally, one would need to use methods such as experience sampling (Csikszentmihalyi and Larson, 1987) that pinpoint subjective hunger states in time over the course of the participants' regular lives. Such evidence appears to be lacking at present. However, there is abundant survey evidence based on more global self-reports, to which we now turn.

The prevalence and importance of hunger within populations that are affluent overall began to be appreciated in the United States in the 1980s and 1990s (Kendall et al., 1995; Kleinman et al., 1998). Realizing that a burden of hunger in such populations, if one existed, would not be detectable in body masses, researchers developed two key self-report constructs relating to hunger: food insufficiency (Kleinman et al., 1998), and food insecurity (Kendall et al., 1995; Gundersen et al., 2011).

The concept of food insufficiency was developed particularly in the context of children, and essentially attempts to estimate the incidence of hunger within the life of the child and his or her family. It is assessed using eight questions to parents that specifically probe the occurrence of temporary food shortfall due to resource constraints (i.e., shortfalls due to religious abstinence or other causes are excluded). An example question is "Do your children ever say they are hungry because there is not enough food in the house?". The responses are most often used to form a discrete classification of children as 'hungry,' 'at risk from hunger' and 'not hungry.' The terms here do not refer to instantaneous states, but the incidence of hunger states over time; they might perhaps be better understood as 'frequently hungry due to constrained resources,' 'occasionally hungry due to constrained resources,' and 'never hungry due to constrained resources.' The social distribution of food insufficiency was extensively studied in the Community Child Hunger Identification Project (CCHIP), a linked series of 18 community studies in different US cities (see Kleinman et al., 1998). The CCHIP showed that food insufficiency was surprisingly prevalent: 8% of children under 12 were classified as 'hungry' with another 21% classified as 'at risk from hunger.' However, the social distribution was very uneven: in the lowest-income families, the proportion classified as 'hungry' rose to 21%, and 'at risk from hunger' to 50%. Thus, *most* children from low-income families in the US were classified as either hungry or at risk from hunger.

Food insecurity is defined as the state where the ability to acquire adequate and safe food is limited or uncertain (Kendall et al., 1995). It is routinely assessed in US social and nutritional surveys (Gundersen et al., 2011), and increasingly measured in Latin America and to a lesser extent in other regions too (Nettle et al., 2017). Although food insecurity is not exactly synonymous with hunger, high food insecurity does imply frequent hunger. Indeed, many of the questions in the standard 18-item USDA food insecurity questionnaire (reproduced in Gundersen et al., 2011) in fact address the experience of hunger: for example, "In the last 12 months, did you or other adults in the household ever cut the size of your meals or skip meals because there wasn't enough money for food?"; and "In the last 12 months, were you

ever hungry, but didn't eat, because you couldn't afford enough food?". Again, the responses are used to categorize respondents and their households. Two key categories for our purposes are (the slightly confusingly named) "food insecurity," which means more than one affirmative response to a food insecurity question, and "very low food security," which means more than 6 affirmative responses (8 for households with children), and necessarily entails reporting that some household members went hungry at least some times within the last year because of lack of resources. (All households categorized as very low food security by this typology are also food insecure).

The 2008–2009 US prevalence of food insecurity was estimated at around 16%, with around 6% for very low food security (Gundersen et al., 2011). The rate is, however, strongly related to income: of households whose income is half the poverty line, around 40% are classified as food insecure and around 20% as very low food security. This compares to less than 6 and 2% for affluent households. The strong dependence of food insecurity on income is unsurprising, since the construct specifically probes the inability to secure food due to scarce resources. What is important for present purposes is that a large proportion of low-income households report experiencing food insecurity. The implication is that a substantial fraction of people from such households experience an excess of hunger due to their SEP, at least some of the time.

To summarize this section, the available evidence shows clearly that within very affluent populations, individuals of lower SEP eat less satiating diets; do so on more irregular schedules; and a very sizable proportion, at least in the USA, report experiences such as food insufficiency and food insecurity that imply an increased frequency of hunger. Thus, the claim that people of lower SEP are more likely to be hungry at any given time—a necessary assumption of the hunger hypothesis—appears reasonable. However, the hunger hypothesis can be expressed in at least two subtly different versions, each of which makes slightly different predictions. These are the subject of the next section.

VERSIONS AND TESTING OF THE HUNGER HYPOTHESIS

The hunger hypothesis posits the following causal relationships: (1) lower SEP leads to more frequent hunger (because it constrains the types of food and the frequencies of high-quality meals that can be procured); and (2) hunger leads to changes in the behavioral and psychological variables of interest (since changes in these variables are part of the adaptive suite of responses to hunger we know exists in humans and other animals). A strength of the hunger hypothesis is that we already know that causal claim (2) is true, since many of the sources of evidence for this arm of the hypothesis (see Effects of Hunger on Behavior) involve experimental manipulation of hunger, in many cases within subjects, thus ruling out alternative causal interpretations.

Given causal claims (1) and (2), the hunger hypothesis predicts that the associations between SEP and the outcome variables of interest will be at least partially statistically mediated by variables to do with hunger. The test of the hypothesis then seems straightforward: measure SEP, measure the behavioral and psychological outcomes, measure hunger, and the rest is multiple regression. However, discussion of testing the hypothesis needs to be qualified by noting that different versions of the hunger hypothesis make slightly different predictions about the nature of the statistical mediation.

The Current State Version of the Hunger Hypothesis

The boldest version of the hunger hypothesis posits that lower-SEP individuals are on average more impulsive, more irritable, more anxious and more prone to narcotic use when they are studied simply because more of them are hungry at the moment of assessment (or, for outcomes assessed over a longer period, lower SEP participants are more often hungry during the period of observation). This version implies that what have been assumed to be trait-like differences between people of different social positions are in fact not so: they are due to a reversible acute state, one whose occurrence just happens to be non-randomly distributed across social groups. The current-state version of the hypothesis is the most easily falsifiable, since it makes both mediational and interventional predictions. It suggests that in correlational studies, current feelings of hunger should be measured contemporaneously with the other variables, and that current hunger will mediate any associations between SEP and the outcome variable. To spell this out, it predicts that SEP will be associated with current hunger; that current hunger will be associated with the outcome variable; and that any association between SEP and the outcome variable will be substantially attenuated once current hunger is controlled for. It also makes predictions for intervention studies. For example, it suggests that lower-SEP excesses of impulsivity, hyperactivity etc. could be almost immediately reduced by providing regular and satiating meals, whilst high-SEP individuals could be made indistinguishable from those of low SEP by simple food deprivation.

The Developmental Specialization Version of the Hunger Hypothesis

An alternative version of the hunger hypothesis is the following. Individuals of lower SEP experience acute hunger more often over the course of their lives. This leads to the behavioral propensities and psychological states typical of acute hunger becoming developmentally embedded, to the point where they are expressed (at least to some extent) even when the person is not currently hungry. This would be an example of incremental specialization of behavioral phenotype through multiple developmental exposures (Frankenhuis and Panchanathan, 2011; Panchanathan and Frankenhuis, 2016). The reason for entertaining the developmental specialization version of the hypothesis is the following. A number of recent studies have found that childhood SEP predicts behavior (including behaviors relating to impulsivity and to eating) under certain circumstances, even though current adult SEP does not (Griskevicius et al., 2011a,b, 2013; Mittal and Griskevicius, 2014;

Hill et al., 2016). The argument arising from these studies is that childhood experience produces some form of lasting developmental specialization or calibration. Applying the logic of this argument to the hunger hypothesis, we should therefore expect that the individual's whole developmental experience of hunger, not just their current state of hunger, is relevant to predicting their behavioral phenotype.

Under the developmental specialization version, the overall causal structure of the hypothesis remains the same. However, this version does not make the prediction that *current* hunger will mediate between SEP and the outcome of interest in correlational studies; SEP-outcome relationships should persist regardless of current satiety. Nor does it claim that dietary interventions should immediately abolish any SEP differences. This version is more difficult to falsify, but it is not impossible. For correlational studies, it suggests that what should be developed is some measure of cumulative lifetime exposure to hunger; it is this cumulative measure that should mediate between SEP and the outcome, whilst current hunger should not. Relatedly, it suggests that people with high cumulative exposure to hunger for reasons other than low SEP should look similar in phenotype to those of low SEP. For intervention studies, this version suggests that feeding interventions will not have a dramatic immediate impact, but if continued for a long time, should begin to show effects, effects that will not instantly reverse when the intervention is withdrawn.

The developmental specialization version as I have presented it predicts main effects of cumulative developmental exposure to hunger on behavioral and psychological outcomes. However, hybrid versions of the current state and developmental specialization hypothesis are also possible: developmental exposure to hunger may sensitize individuals to acute exposure. In this scenario, outcomes such as impulsivity and aggression would be predicted by the *interaction* of developmental exposure to hunger and current hunger (Griskevicius et al., 2011a,b, 2013). Neither current hunger without developmental exposure, nor developmental exposure without current hunger, would be sufficient for the phenotype to appear.

We are not currently in a position to adjudicate between the current state and developmental specialization versions of the hunger hypothesis (or a hybrid of the two). They do, however, make critical differential predictions. The current state version of the hypothesis predicts specifically that feeding improvement interventions should greatly attenuate SEP gradients in behavioral and psychological outcomes, and do so rapidly. This exact prediction has not been tested. However, there have been studies of the consequences of breakfast programs for school children. If the current state version of the hypothesis has merit, the effects of such programs on behavioral and psychological outcomes should be large and immediate. There is some evidence that this is the case, with increasing consumption of breakfast associated with immediate psychosocial changes, particularly in rated anxiety and hyperactivity, coupled with improved scholastic performance (Murphy et al., 1998a). It is possible that different outcome variables occupy different positions on the spectrum between immediate state influence and developmental specialization. Of note in this context is the finding in the casino quasi-experiment (Costello et al., 2003) that outcomes to do with aggression responded rapidly to the income boost, while those to do with anxiety did not. [Note, however, that the Costello et al. (2003) results are at variance with those of Murphy et al. (1998a), who detected an immediate change in anxiety in response to the intervention].

Testability

A key requirement for any testable scientific hypothesis is that it make distinctive predictions. The distinctive central prediction of the hunger hypothesis is that associations between SEP and the outcome variables of interest will be statistically mediated by hunger. However, the sections "The Current State Version of the Hunger Hypothesis" and "The Developmental Specialization Version of the Hunger Hypothesis" have established that this central prediction could in fact be rendered in several ways: a mediating role for current hunger; a mediating role for developmental exposure to hunger; or some kind of interaction between current hunger and developmental exposure. Clearly, this degree of 'negotiability' in exactly what the predictions are constitutes something of a theoretical peril. I would therefore recommend that studies initially focus on testing the current state version of the hypothesis, since this is the easiest version to falsify, and the one that is most radical in its implications for policy (see Implications of the Hunger Hypothesis and Recommendations). In the event of the current state version of the hypothesis being falsified, it is still possible that hunger may play a more subtle role in SEP gradients, as specified in a developmental specialization or hybrid version of the hypothesis. That would be a further possibility to turn to in the event of current state of hunger having no explanatory value on its own.

In a sense, we already know that the hungriest people in society are likely to be the most impulsive, most irritable, most anxious and most prone to narcotic use, on average. This is because, from evidence presented above, we know that people of lower SEP tend to exhibit those outcomes (see Social Gradients in Behavioral and Psychological Outcomes: Four Case Studies), and are the most prone to be hungry (see The Socioeconomic Distribution of Hunger). Thus, correlations are very likely to exist between hunger and the outcomes of interest in cross-sectional data. Demonstrating such correlations does not in itself support the hunger hypothesis (which makes causal, not just correlational, claims). Any number of other risk factors for, or consequences of, low SEP could constitute third variables associating hunger to behavioral and psychological outcomes without any direct causal nexus being present. It is for this reason that I have stressed the need to demonstrate statistical mediation of SEP-behavior associations by hunger. Many possible alternative explanations would be compatible with SEP, hunger, and behavioral outcomes all being related to one another. Mostly, they would not predict that the inclusion of the indirect pathway via hunger would substantially attenuate the direct relationship between SEP and the outcome variable. The mediation prediction generally implies that the associations between SEP and hunger, and between hunger and the outcome,

will be stronger than the simple association between SEP and the outcome.

Demonstrating statistical mediation, though, is still a relatively weak form of causal inference. For one thing, it does not necessarily exclude reverse causality (see Alternative Pathways). Stronger evidence for the causal account specified by the hunger hypothesis would come from experimental and quasi-experimental designs in which hunger or an instrument closely related to it were randomly or quasi-randomly varied. I have already mentioned feeding improvement interventions such as breakfast programs, which provide a stronger test of the hypothesis. Randomized control trials of such interventions—not just for children, and not just for scholastic outcomes—are a research priority. In addition, food assistance programs, which vary from jurisdiction to jurisdiction and can have a substantial impact on hunger (Ratcliffe et al., 2011) may provide quasi-experimental opportunities, as they have in the study of the association between food insecurity and obesity (DeBono et al., 2012).

Alternative Pathways

The purpose of this article is to lay out the grounds for further investigating the hunger hypothesis, not to claim that it is true. The critical studies have not yet been conducted. Nonetheless, it is clear even from what is known so far that there are alternative pathways that may contribute to the three-way associations of SEP, hunger, and behavioral outcomes. Some care will be required attempting to dissect out the contributions of these different pathways.

First, as mentioned above, there is a reasonable amount of evidence for the operation of reverse causality in associations between SEP and anxiety, and SEP and impulsivity. That is, in several longitudinal studies, experiencing anxiety problems (Stansfeld et al., 2011), or exhibiting impulsivity (Moffitt et al., 2011), predicts later downward social mobility and hence lower final SEP. This is inconsistent with the causal structure discussed so far: it implies that early-life anxiety- or impulsivity-proneness leads to lower SEP, which leads to more hunger. There are two points to make about reverse causality. The first is that the two directions are not mutually exclusive; both direct and reverse causality can operate over the life course (Stansfeld et al., 2011), constituting a feedback process. The second is that, given we already know that hunger has a causal impact on anxiety and impulsivity (see Effects of Hunger on Behavior), we should expect, even if reverse causality has an important role in the SEP-anxiety and SEP-impulsivity associations, that interventions or policy changes that reduce hunger would still ease the burden of anxiety and impulsivity in low SEP groups. In fact, such interventions might be particularly valuable in such groups if those groups contain a relatively high proportion of people temperamentally vulnerable to anxiety problems (Tambs et al., 2012).

Second, traditions of research on aggregate outcomes (e.g., variation in average levels of anxiety, or of violence, across countries) have implicated causal factors that are not themselves hunger, but may be associated with hunger. For example, anxiety has been found to be particularly frequent or elevated in rural Zimbabwe (Langhaug et al., 2010), the Central African Republic (Vinck, 2017), and the Gaza strip in the wake of the second uprising (Elbedour et al., 2007). These findings could be interpreted through the lens of the hunger hypothesis, since all of these places are likely to feature a substantial hunger burden, but the findings could equally well be interpreted in terms of levels of 'threat' more generally (including the threat of violence, which may or may not in turn be related to hunger). Comparative research on interpersonal violence has found it to be predicted by national poverty, and being located in the tropics (Burke et al., 2015; van Lange et al., 2017). Again, this could relate to the burden of hunger, but contemporary theorizing has focussed more on direct behavioral consequences of climate factors such as high temperatures. Given that adverse ecological factors (hunger, socio-political instability, and extreme climate) tend to co-occur, dissecting out the contributions of different causal pathways is extremely challenging. This is especially true with aggregate data, but applies to individual-level data too. This reinforces the conclusion of the previous section that experimental, quasi-experimental, and instrumental-variable study designs are a key priority.

As a final puzzle, there is cross-national variation in SEP gradients in outcomes such as anxiety. If hunger were the main operative factor, one might expect that SEP gradients in anxiety would be more marked in countries where the poor are very poor (hence hungry), and much less marked in countries such as Norway which are relatively economically equal with strong social protection. However, this does not appear to be the case: the gradient in anxiety disorder in Norway is steeper than many that have been observed in developing countries (Tambs et al., 2012). In Japan, it appears the gradient may even be reversed, at least for childhood SEP (Ochi et al., 2014). There are a number of possible explanations for these findings, not least involving sociocultural differences in diagnosis and reporting of medical disorders. Nonetheless, it remains to be seen whether and how these variations could be reconciled with the hunger hypothesis.

IMPLICATIONS OF THE HUNGER HYPOTHESIS AND RECOMMENDATIONS

I conclude with some implications of the hunger hypothesis (discussed below), and some recommendations for research (**Table 1**). The first of the implications is that the hunger hypothesis implies a more direct link between economic factors and psychological outcomes than is usual. To a considerable extent, food insufficiency and food insecurity are driven by available money; after all, their measures explicitly ask about the inability to procure healthy, balanced meals three times a day due to lack of financial resources, not for any other reasons. Available budget to spend is also a very good predictor of diet quality (Drewnowski and Specter, 2004). So if the

TABLE 1 | Recommendations for research arising from the hunger hypothesis.

1	Experience sampling should be used to map the experience of hunger over time during normal life for different social groups
2	Hunger (or where appropriate a related variable such as food insecurity) should always be measured in studies of SEP and behavioral or psychological outcomes, and considered as a key mediating variable
3	Experimental and intervention studies should investigate whether feeding can attenuate or abolish SEP differentials in behavior, not just in children but also in adults
4	Effects of policy changes that alter incomes or food security should be studied broadly to include not just physical health but behavioral and psychological outcomes
5	Measuring, and understanding the psychological consequences of, cumulative experience of hunger over the life course should be research priorities
6	The hypothesis that individuals of lower SEP show the cognitive profile of acutely hungry people, including both processing costs and processing advantages of that state, should be investigated

hunger hypothesis is correct, then disposable income should be a direct driver of rates of impulsivity, anxiety, aggression, and substance abuse. There is some evidence consistent with this view: for example, financial difficulties in the family are the strongest single predictor of child ADHD (Russell et al., 2015a); and conduct and oppositional-defiant disorder (though not anxiety) were radically reduced in a natural experiment that increased family income but left other factors such as education unchanged (Costello et al., 2003). This has strong implications for the evaluation of policy alternatives likely to change the distribution of income across social groups, and the likely impact of changing economic conditions. For example, the crisis of 2008–2009 produced a sharp increase in the prevalence food insecurity in US families (Gundersen et al., 2011). Under the hunger hypothesis, this should also have produced increases in impulsivity, anxiety and aggression, though the predicted pattern and timing of these increases would depend on the version of the hypothesis—current state, developmental specialization or hybrid—is adopted.

A second implication of the hunger hypothesis concerns the malleability of SEP differences in behavioral and psychological outcomes. These differences are often conceptualized as ingrained and difficult to change. The hunger hypothesis instead lays them at the door of a reversible acute state, with the strong implication that they could therefore be rapidly eliminated. This is a style of explanation (enduring patterns of individual differences explained in terms of transient visceral states) not often encountered; the only other example with which I am familiar is Van Cauter and Spiegel's (1999) parallel argument about the role of sleep in the relationship between SEP and health. The extent of the proposed malleability varies among the versions of the hypothesis: the current state version sees them as radically malleable and therefore reversible essentially instantaneously. The developmental specialization version sees them as malleable over the rather slower timescale of the life course. All versions agree that any social interventions or policy measures that alleviate food insufficiency and insecurity will have widespread effects that extend well beyond narrowly nutritional outcomes. Such interventions and measures should therefore, according to the hunger hypothesis, be accorded special consideration.

A third implication arises from the idea that the suite of traits associated with hunger is not a system failure, but an adaptation. That is, the psychological shifts brought on by hunger exist because (on average, over evolutionary time) they improve the location, capture and defense of food resources. In other words, these traits make individuals *better than they would otherwise be* at achieving a certain class of goals, albeit at the expenses of other classes of goals. If we accept that the psychological phenotype associated with low SEP stems from an adaptive response to hunger, then we should predict that individuals of lower SEP will be relatively advantaged at certain types of task, even if they are relatively disadvantaged at others. Research into social gradients in behavior is so deeply imbued with assumptions of deficit that these possibilities have been little explored (see Frankenhuis and de Weerth, 2013 for a related discussion). The hunger hypothesis suggests ways this possibility might be opened up. For example, children deprived of breakfast show a less focussed attention style, leading to poorer performance on many tasks. However, in one study they actually showed an advantage in incidental learning (recall of sources of information they had not been asked to attend to) (Pollitt et al., 1982). The hunger hypothesis predicts this will be true of low-SEP children more generally. It also predicts that low-SEP individuals would show a relative advantage on tasks broadly isomorphic to foraging or resource defense, for example involving rapid detection of food-related stimuli (Radel and Clement-Guillotin, 2012).

CONCLUSION

I have here presented the hypothesis that hunger could play an important role in some social gradients in behavioral and psychological outcomes within affluent countries. It is possible to establish: (a) that a suite of variables including impulsivity-hyperactivity, persistent narcotic use, anxiety, and irritability-aggression is consistently associated with measures of low SEP; (b) that hunger increases these same four variables; and (c) that there is a burden of hunger within affluent societies, at least the USA, and it falls especially on those of lower SEP. I cannot claim to have shown that (b) and (c) add up to an explanation of (a). However, the idea that they might provide at least a partial explanation is reasonable and deserves further investigation. In addition, as I have stressed, there are subtly different versions of the hypothesis that give slightly different accounts of *how* facts (b)

and (c) contribute to fact (a), accounts that lead to subtly different predictions. The hunger hypothesis certainly provides a novel and provocative view of a complex set of issues concerning how social inequalities (in this case, in the distribution of financial and nutritional resources) relate to variation in individual behavior.

AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and approved it for publication.

FUNDING

This research was supported by a grant from the European Research Council (ERC AdG 666669 COMSTAR).

ACKNOWLEDGMENTS

The author wishes to thank Melissa Bateson for discussion of these issues, and Willem Frankenhuis for comments on a draft version of the paper.

REFERENCES

Aarøe, L., and Petersen, M. B. (2013). Hunger games: fluctuations in blood glucose levels influence support for social welfare. *Psychol. Sci.* 24, 2550–2556. doi: 10.1177/0956797613495244

Adams, J., and White, M. (2009). Time perspective in socioeconomic inequalities in smoking and body mass index. *Heal. Psychol.* 28, 83–90. doi: 10.1037/0278-6133.28.1.83

Askenazy, F., Candito, M., Caci, H., Myquel, M., Chambon, P., Darcourt, G., et al. (1998). Whole blood serotonin content, tryptophan concentrations, and impulsivity in anorexia nervosa. *Biol. Psychiatry* 43, 188–195. doi: 10.1016/S0006-3223(97)00299-0

Bateson, M., Brilot, B. O., Gillespie, R., Monaghan, P., and Nettle, D. (2015). Developmental telomere attrition predicts impulsive decision making in adult starlings. *Proc. R. Soc. B Biol. Sci.* 282:20142140. doi: 10.1098/rspb.2014.2140

Beck, B. (2006). Neuropeptide Y in normal eating and in genetic and dietary-induced obesity. *Philos. Trans. R. Soc. Lond. B. Biol. Sci.* 361, 1159–1185. doi: 10.1098/rstb.2006.1855

Bell, S. M., Stewart, R. B., Thompson, S. C., and Meisch, R. A. (1997). Food-deprivation increase cocaine-induced conditioned place preference and locomotor activity in rats. *Psychopharmacology* 131, 1–8. doi: 10.1007/s002130050258

Blinder, B. J., Cumella, E. J., and Sanathara, V. A. (2006). Psychiatric comorbidities of female inpatients with eating disorders. *Psychosom. Med.* 68, 454–462. doi: 10.1097/01.psy.0000221254.77675.f5

Bornet, F. R. J., Jardy-Gennetier, A. E., Jacquet, N., and Stowell, J. (2007). Glycaemic response to foods: Impact on satiety and long-term weight regulation. *Appetite* 49, 535–553. doi: 10.1016/j.appet.2007.04.006

Burke, M., Hsiang, S. M., and Miguel, E. (2015). Climate and conflict. *Annu. Rev. Econom.* 7, 577–615. doi: 10.1146/annurev-economics-080614-115430

Campfield, L. A., Smith, F. J., Rosenbaum, M., and Hirsch, J. (1996). Human eating: evidence for a physiological basis using a modified paradigm. *Neurosci. Biobehav. Rev.* 20, 133–137. doi: 10.1016/0149-7634(95)00043-E

Coccaro, E. F., Lee, R., Liu, T., and Mathé, A. A. (2012). Cerebrospinal fluid neuropeptide Y-like immunoreactivity correlates with impulsive aggression in human subjects. *Biol. Psychiatry* 72, 997–1003. doi: 10.1016/j.biopsych.2012.07.029

Costello, E. J., Compton, S. N., Keller, M., and Angold, A. (2003). Relationships between poverty and psychopathology: a natural experiment. *J. Am. Med. Assoc.* 290, 2023–2029. doi: 10.1001/jama.290.15.2023

Csikszentmihalyi, M., and Larson, R. (1987). Validity and reliabity of the experience-sampling method. *J. Nerv. Ment. Dis.* 175, 526–536. doi: 10.1097/00005053-198709000-00004

Deary, I. J., and Johnson, W. (2010). Intelligence and education: causal perceptions drive analytic processes and therefore conclusions. *Int. J. Epidemiol.* 39, 1362–1369. doi: 10.1093/ije/dyq072

DeBono, N. L., Ross, N. A., and Berrang-Ford, L. (2012). Does the food stamp program cause obesity? A realist review and a call for place-based research. *Heal. Place* 18, 747–756. doi: 10.1016/j.healthplace.2012.03.002

Dietz, W. H. (1995). Does hunger cause obesity? *Pediatrics* 95, 766–767.

Drewnowski, A., and Specter, S. (2004). Poverty and obesity?: the role of energy density and energy costs. *Am. J. Clin. Nutr.* 79, 6–16.

Drummond, H., and Garcia Chavelas, C. (1989). Food shortage influences sibling aggression in the blue-footed booby. *Anim. Behav.* 37, 806–819. doi: 10.1016/0003-3472(89)90065-1

Elbedour, S., Onwuegbuzie, A. J., Ghannam, J., Whitcome, J. A., and Abu, F. (2007). Post-traumatic stress disorder, depression, and anxiety among Gaza Strip adolescents in the wake of the second Uprising (Intifada). *Child Abuse Negl.* 31, 719–729. doi: 10.1016/j.chiabu.2005.09.006

Fava, M., Rappe, S. M., West, J., and Herzog, D. B. (1995). Anger attacks in eating disorders. *Psychiatry Res.* 56, 205–212. doi: 10.1016/0165-1781(95)02577-J

Fessler, D. M. T. (2002). Pseudoparadoxical impulsivity in restrictive anorexia nervosa: a consequence of the logic of scarcity. *Int. J. Eat. Disord.* 31, 376–388. doi: 10.1002/eat.10035

Frankenhuis, W. E., and de Weerth, C. (2013). Does early-life exposure to stress shape or impair cognition? *Curr. Dir. Psychol. Sci.* 22, 407–412. doi: 10.1177/0963721413484324

Frankenhuis, W. E., and Panchanathan, K. (2011). Balancing sampling and specialization: an adaptationist model of incremental development. *Proc. R. Soc. B Biol. Sci.* 278, 3558–3565. doi: 10.1098/rspb.2011.0055

Gailliot, M. T., and Baumeister, R. F. (2007). The physiology of willpower: linking blood glucose to self-control. *Pers. Soc. Psychol. Rev.* 11, 303–327. doi: 10.1177/1088868307303030

Gallo, L. C., and Matthews, K. A. (2003). Understanding the association between socioeconomic status and physical health: do negative emotions play a role? *Psychol. Bull.* 129, 10–51. doi: 10.1037/0033-2909.129.1.10

Gilchrist, J. G., and Nesberg, L. S. (1952). Need and perceptual change in need-related objects. *J. Exp. Psychol.* 44, 369–376. doi: 10.1037/h0061823

Godin, J.-G. J., and Smith, S. A. (1988). A fitness cost of foraging in the guppy. *Nature* 336, 403–405. doi: 10.1038/332141a0

Green, L., Myerson, J., Lichtman, D., Rosen, S., and Fry, A. (1996). Temporal discounting in choice between delayed rewards: the role of age and income. *Psychol. Aging* 11, 79–94. doi: 10.1037/0882-7974.11.1.79

Green, M. J., and Benzeval, M. (2013). The development of socioeconomic inequalities in anxiety and depression symptoms over the lifecourse. *Soc. Psychiatry Psychiatr. Epidemiol.* 48, 1951–1961. doi: 10.1007/s00127-013-0720-0

Griskevicius, V., Ackerman, J. M., Cantú, S. M., Delton, A. W., Robertson, T. E., Simpson, J. A., et al. (2013). When the economy falters, do people spend or save? Responses to resource scarcity depend on childhood environments. *Psychol. Sci.* 24, 197–205. doi: 10.1177/0956797612451471

Griskevicius, V., Delton, A. W., Robertson, T. E., and Tybur, J. M. (2011a). Environmental contingency in life history strategies: the influence of mortality and socioeconomic status on reproductive timing. *J. Pers. Soc. Psychol.* 100, 241–254. doi: 10.1037/a0021082

Griskevicius, V., Tybur, J. M., Delton, A. W., and Robertson, T. E. (2011b). The influence of mortality and socioeconomic status on risk and delayed rewards: a life history theory approach. *J. Pers. Soc. Psychol.* 100, 1015–1026. doi: 10.1037/a0022403

Gundersen, C., Kreider, B., and Pepper, J. (2011). The economics of food insecurity in the United States. *Appl. Econ. Perspect. Policy* 33, 281–303. doi: 10.1093/aepp/ppr022

Han, E., and Powell, L. M. (2013). Consumption patterns of sugar-sweetened beverages in the United States. *J. Acad. Nutr. Diet.* 113, 43–53. doi: 10.1016/j.jand.2012.09.016

Hausel, J., Nygren, J., Lagerkranser, M., Hellstrom, P. M., Hammarqvist, F., Almstrom, C., et al. (2001). A carbohydrate-rich drink reduces preoperative discomfort in elective surgery patients. *Anesth. Analg.* 93, 1344–1350. doi: 10.1097/00000539-200111000-00063

Haushofer, J., and Fehr, E. (2014). On the psychology of poverty. *Science* 344, 862–867. doi: 10.1126/science.1232491

Hebebrand, J., Exner, C., Hebebrand, K., Holtkamp, C., Casper, R. C., Remschmidt, H., et al. (2003). Hyperactivity in patients with anorexia nervosa and in semistarved rats: Evidence for a pivotal role of hypoleptinemia. *Physiol. Behav.* 79, 25–37. doi: 10.1016/S0031-9384(03)00102-1

Higginson, A. D., McNamara, J. M., and Houston, A. I. (2016). Fatness and fitness: exposing the logic of evolutionary explanations for obesity. *Proc. R. Soc. B Biol. Sci.* 283:20152443. doi: 10.1098/rspb.2015.2443

Hill, S. E., Prokosch, M. L., DelPriore, D. J., Griskevicius, V., and Kramer, A. (2016). Low childhood socioeconomic status promotes eating in the absence of energy need. *Psychol. Sci.* 27, 354–364. doi: 10.1177/0956797615621901

Himmelfarb, S., and Murrell, S. (1984). The prevalence and correlates of anxiety symptoms in older adults. *J. Psychol.* 116, 159–167. doi: 10.1080/00223980.1984.9923632

Hiscock, R., Bauld, L., Amos, A., Fidler, J. A., and Munafò, M. (2012). Socioeconomic status and smoking: a review. *Ann. N. Y. Acad. Sci.* 1248, 107–123. doi: 10.1111/j.1749-6632.2011.06202.x

Hoyland, A., Mcwilliams, K. A., Duff, R. J., and Walton, J. L. (2012). Breakfast consumption in UK schoolchildren and provision of school breakfast clubs. *Nutr. Bull.* 37, 232–240. doi: 10.1111/j.1467-3010.2012.01973.x

Kendall, A., Olson, C. M., and Frongillo, E. A. (1995). Validation of the Radimer / Cornell measures of hunger and food insecurity. *J. Nutr.* 125, 2793–2801.

Kessler, R. C., McGonagle, K. A., Zhao, S., Nelson, C. B., Hughes, M., Eshelman, S., et al. (1994). Lifetime and 12 months prevalence of DSM-II-R psychiatric disorders in the United States. *Arch. Gen. Psychiatry* 51, 8–19. doi: 10.1001/archpsyc.1994.03950010008002

Keys, A., Brozek, J., Henschel, A., Mickelson, O., and Taylor, H. L. (1950). *The Biology of Human Starvation*. Minneapolis, MN: Minnesota University Press.

Kidd, C., Palmeri, H., and Aslin, R. N. (2013). Rational snacking: young children's decision-making on the marshmallow task is moderated by beliefs about environmental reliability. *Cognition* 126, 109–114. doi: 10.1016/j.cognition.2012.08.004

Kirk, J. M., and Logue, A. W. (1997). Effects of deprivation level on humans' self-control for food reinforcers. *Appetite* 28, 215–226. doi: 10.1006/appe.1996.0071

Kleinman, R. E., Murphy, J. M., Little, M., Pagano, M., Wehler, C. A., Regal, K., et al. (1998). Hunger in children in the united states: potential behavioral and emotional correlates. *Pediatrics* 101:E3. doi: 10.1542/peds.101.1.e3

Korndörfer, M., Egloff, B., and Schmukle, S. C. (2015). A large scale test of the effect of social class on prosocial behavior. *PLoS ONE* 10:e0133193. doi: 10.1371/journal.pone.0133193

Kraus, M. W., Piff, P. K., Mendoza-Denton, R., Rheinschmidt, M. L., and Keltner, D. (2012). Social class, solipsism, and contextualism: how the rich are different from the poor. *Psychol. Rev.* 119, 546–572. doi: 10.1037/a0028756

Krivo, L. J., and Peterson, R. D. (1996). Extremely disadvantaged neighborhoods and urban crime. *Soc. Forces* 75, 619–648. doi: 10.1093/sf/75.2.619

Langhaug, L. F., Pascoe, S. J., Mavhu, W., Woelk, G., Sherr, L., Hayes, R. J., et al. (2010). High prevalence of affective disorders among adolescents living in rural Zimbabwe. *J. Commun. Health* 35, 355–364. doi: 10.1007/s10900-010-9261-6

Lawlor, D. A., Frankel, S., Shaw, M., Ebrahim, S., and Smith, G. D. (2003). Smoking and Ill health: does lay epidemiology explain the failure of smoking cessation programs among deprived populations? *Am. J. Public Health* 93, 266–270. doi: 10.2105/AJPH.93.2.266

Lempert, K. M., and Phelps, E. A. (2016). The malleability of intertemporal choice. *Trends Cogn. Sci.* 20, 64–74. doi: 10.1016/j.tics.2015.09.005

Loewenstein, G. (1996). Out of control: visceral influences on behavior. *Organ. Behav. Hum. Decis. Process.* 65, 272–292. doi: 10.1006/obhd.1996.0028

Mani, A., Mullainathan, S., Shafir, E., and Zhao, J. (2013). Poverty impedes cognitive function. *Science* 341, 976–980. doi: 10.1126/science.1238041

Marioni, R. E., Davies, G., Hayward, C., Liewald, D., Kerr, S. M., Campbell, A., et al. (2014). Molecular genetic contributions to socioeconomic status and intelligence. *Intelligence* 44, 26–32. doi: 10.1016/j.intell.2014.02.006

McLaren, L. (2007). Socioeconomic status and obesity. *Epidemiol. Rev.* 29, 29–48. doi: 10.1093/epirev/mxm001

Melanson, K. J., Westerterp-Plantenga, M. S., Saris, W. H., Smith, F. J., and Campfield, L. A. (1999). Blood glucose patterns and appetite in time-blinded humans: carbohydrate versus fat. *Am. J. Physiol.* 277, R337–R345.

Miech, R. (2008). The formation of a socioeconomic health disparity: the case of cocaine use during the 1980s and 1990s. *J. Health Soc. Behav.* 49, 352–366. doi: 10.1177/002214650804900308

Miech, R. A., Caspi, A., Moffitt, T. E., Wright, B. R. E., and Silva, P. A. (1999). Low socioeconomic status and mental disorders: a longitudinal study of selection and causation during young adulthood. *Am. J. Sociol.* 104, 1096–1131. doi: 10.1086/210137

Mittal, C., and Griskevicius, V. (2014). Sense of control under uncertainty depends on people's childhood environment: a life history theory approach. *J. Pers. Soc. Psychol.* 107, 621–637. doi: 10.1037/a0037398

Moffitt, T. E., Arseneault, L., Belsky, D., Dickson, N., Hancox, R. J., Harrington, H., et al. (2011). A gradient of childhood self-control predicts health, wealth, and public safety. *Proc. Natl. Acad. Sci. U. S. A.* 108, 2693–2698. doi: 10.1073/pnas.1010076108

Monello, L. F., and Mayer, J. (1967). Hunger and satiety sensations in men, women, boys and girls. *Am. J. Clin. Nutr.* 20, 253–261.

Murphy, J. M., Pagano, M. E., Nachmani, J., Sperling, P., Kane, S., and Kleinman, R. E. (1998a). The relationship of school breakfast to psychosocial and academic functioning: cross-sectional and longitudinal observations in an inner-city school sample. *Arch. Pediatr. Adolesc. Med.* 152, 899–907. doi: 10.1001/archpedi.152.9.899

Murphy, J. M., Wehler, C. A., Pagano, M. E., Little, M., Kleinman, R. E., and Jellinek, M. S. (1998b). Relationship between hunger and psychosocial functioning in low-income American children. *J. Am. Acad. Child Adolesc. Pyschiatry* 37, 163–170. doi: 10.1097/00004583-199802000-00008

Nettle, D. (2015). *Tyneside Neighbourhoods: Deprivation, Social Life and Social Behaviour in One British City*. Cambridge: OpenBook Publishers.

Nettle, D., Andrews, C., and Bateson, M. (2017). Food insecurity as a driver of obesity in humans: the insurance hypothesis. *Behav. Brain Sci.* doi: 10.1017/S0140525X16000947 [Epub ahead of print].

Neumark-Sztainer, D., Hannan, P. J., Story, M., Croll, J., and Perry, C. (2003). Family meal patterns: associations with sociodemographic characteristics and improved dietary intake among adolescents. *J. Am. Diet. Assoc.* 103, 317–322. doi: 10.1053/jada.2003.50048

Nguyen, A. D., Mitchell, N. F., Lin, S., Macia, L., Yulyaningsih, E., Baldock, P. A., et al. (2012). Y1 and Y5 receptors are both required for the regulation of food intake and energy homeostasis in mice. *PLoS ONE* 7:e40191. doi: 10.1371/journal.pone.0040191

Ochi, M., Fujiwara, T., Mizuki, R., Kawakami, N., Mental, W., and Group, S. (2014). Association of socioeconomic status in childhood with major depression and generalized anxiety disorder: results from the World Mental Health Japan survey 2002 – 2006. *BMC Public Health* 14:359. doi: 10.1186/1471-2458-14-359

Odum, A. L. (2011). Delay discounting: trait variable? *Behav. Process.* 87, 1–9. doi: 10.1016/j.beproc.2011.02.007

Orquin, J. L., and Kurzban, R. (2016). A meta-analysis of blood glucose effects on human decision making. *Psychol. Bull.* 142, 546–567. doi: 10.1037/bul0000035

Paál, T., Carpenter, T., and Nettle, D. (2015). Childhood socioeconomic deprivation, but not current mood, is associated with behavioural disinhibition in adults. *PeerJ* 3:e964. doi: 10.7717/peerj.964

Panchanathan, K., and Frankenhuis, W. E. (2016). The evolution of sensitive windows in a model of incremental development. *Proc. R. Soc. B Biol. Sci.* 283:20152439. doi: 10.1098/rspb.2015.2439

Pepper, G. V., and Nettle, D. (2017). The behavioural constellation of deprivation: causes and consequences. *Behav. Brain Sci.* doi: 10.1017/S0140525X1600234X [Epub ahead of print].

Pollitt, E., Lewis, N. L., Garza, C., and Shulman, R. J. (1982). Fasting and cognitive function. *J. Psychiatr. Res.* 17, 169–174. doi: 10.1016/0022-3956(82)90018-8

Radel, R., and Clement-Guillotin, C. (2012). Evidence of motivational influences in early visual perception: hunger modulates conscious access. *Psychol. Sci.* 23, 232–234. doi: 10.1177/0956797611427920

Ratcliffe, C., McKernan, S., and Zhang, S. (2011). How much does the supplemental nutrition assistance program reduce food insecurity? *Am. J. Agric. Econ.* 93, 1082–1098. doi: 10.1093/ajae/aar026.How

Reynolds, B., Ortengren, A., Richards, J. B., and de Wit, H. (2006). Dimensions of impulsive behavior: personality and behavioral measures. *Pers. Individ. Dif.* 40, 305–315. doi: 10.1016/j.paid.2005.03.024

Rohles, F. H., and Wilson, L. M. (1974). Hunger as a catalyst in aggression. *Behaviour* 48, 123–129. doi: 10.1017/CBO9781107415324.004

Russell, A. E., Ford, T., and Russell, G. (2015a). Socioeconomic associations with ADHD: findings from a mediation analysis. *PLoS ONE* 10:e0128248. doi: 10.1371/journal.pone.0128248

Russell, A. E., Ford, T., Williams, R., and Russell, G. (2015b). The association between socioeconomic disadvantage and Attention Deficit/Hyperactivity Disorder (ADHD): a systematic review. *Child Psychiatry Hum. Dev.* 47, 440–458. doi: 10.1007/s10578-015-0578-3

Saugstad, P. (1966). Effect of food deprivation on perception-cognition. *Psychol. Bull.* 65, 80–90. doi: 10.1037/h0025136

Shaw, M., Tunstall, H., and Dorling, D. (2005). Increasing inequalities in risk of murder in Britain: trends in the demographic and spatial distribution of murder, 1981-2000. *Health Place* 11, 45–54. doi: 10.1016/j.healthplace.2004.01.003

Slack, K. S., and Yoo, J. (2005). Food hardship and child behavior problems among low-income children. *Soc. Serv. Rev.* 79, 511–536. doi: 10.1086/430894

Small, D. M., Jones-Gotman, M., and Dagher, A. (2003). Feeding-induced dopamine release in dorsal striatum correlates with meal pleasantness ratings in healthy human volunteers. *Neuroimage* 19, 1709–1715. doi: 10.1016/S1053-8119(03)00253-2

Sobal, J., and Stunkard, A. J. (1989). Socioeconomic status and obesity: a review of the literature. *Psychol. Bull.* 105, 260–275. doi: 10.1037/0033-2909.105.2.260

Sorokin, P. A. (1942). *Man and Society in Calamity*. New York, NY: Dutton.

Stansfeld, S. A., Clark, C., Rodgers, B., Caldwell, T., and Power, C. (2011). Repeated exposure to socioeconomic disadvantage and health selection as life course pathways to mid-life depressive and anxiety disorders. *Soc. Psychiatry Psychiatr. Epidemiol.* 46, 549–558. doi: 10.1007/s00127-010-0221-3

Swanson, D. W., and Dinello, F. A. (1970). Severe obesity as a habituation syndrome: evidence during a starvation study. *Arch. Gen. Psychiatry* 22, 120–127. doi: 10.1001/archpsyc.1970.01740260024004

Tambs, K., Kendler, K. S., Reichborn-Kjennerud, T., Aggen, S. H., Harris, J. R., Neale, M. C., et al. (2012). Genetic and environmental contributions to the relationship between education and anxiety disorders – a twin study. *Acta Psychiatr. Scand.* 125, 203–212. doi: 10.1111/j.1600-0447.2011.01799.x

Thompson, K. M., Wunderlich, S. A., Crosby, R. D., and Mitchell, J. E. (1999). The neglected link between eating disturbances and aggressive behavior in girls. *J. Am. Acad. Child Adolesc. Psychiatry* 38, 1277–1284. doi: 10.1097/00004583-199910000-00017

Townsend, M. S., Peerson, J., Love, B., Achterberg, C., and Murphy, S. P. (2001). Food insecurity is positively related to overweight in women. *J. Nutr.* 131, 1738–1745.

Van Cauter, E., and Spiegel, K. (1999). Sleep as a mediator of the relationship between socioeconomic status and health: a hypothesis. *Ann. N. Y. Acad. Sci.* 896, 254–261. doi: 10.1111/j.1749-6632.1999.tb08120.x

van Lange, P. A. M., Rinderu, M. I., and Bushman, B. J. (2017). Aggression and violence around the world: a model of Climate, Aggression, and Self-control in Humans (CLASH). *Behav. Brain Sci.* doi: 10.1017/S0140525X16000406 [Epub ahead of print].

Vinck, P. (2017). Association of exposure to violence and potential traumatic events with self-reported physical and mental health. *JAMA* 304, 544–552. doi: 10.1001/jama.2010.1065

Wallis, D. I. (1964). Aggressive behaviour in the ant, formica fusca. *Behaviour* 23, 149–176. doi: 10.1163/156853964X00120

Wang, X. T., and Dvorak, R. D. (2010). Sweet future: fluctuating blood glucose levels affect future discounting. *Psychol. Sci.* 21, 183–188. doi: 10.1177/0956797609358096

Ward, M. M., Guthrie, L. C., and Butler, S. C. (2009). Time perspective and socioeconomic status: a link to socioeconomic disparities in health? *Soc. Sci. Med.* 68, 2145–2151. doi: 10.1016/j.socscimed.2009.04.004

Warheit, G., Holzer, C. E., and Arey, S. A. (1975). Race and mental illness: an epidemiologic update. *J. Health Soc. Behav.* 16, 243–256. doi: 10.2307/2136874

Wiers, C. E., Shokri-Kojori, E., Cabrera, E., Cunningham, S., Wong, C., Tomasi, D., et al. (2016). Socioeconomic status is associated with striatal dopamine D2/D3 receptors in healthy volunteers but not in cocaine abusers. *Neurosci. Lett.* 617, 27–31. doi: 10.1016/j.neulet.2016.01.056

Conflict of Interest Statement: The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 24 May 2017
doi: 10.3389/fpsyg.2017.00802

General and Food-Specific Inhibitory Control As Moderators of the Effects of the Impulsive Systems on Food Choices

Xuemeng Zhang[1,2], Shuaiyu Chen[1,2], Hong Chen[1,2], Yan Gu[1] and Wenjian Xu[1]*

[1] Key Laboratory of Cognition and Personality (Ministry of Education), Southwest University, Chongqing, China, [2] School of Psychology, Southwest University, Chongqing, China

The present study aimed to extend the application of the reflective-impulsive model to restrained eating and explore the effect of automatic attention (impulsive system) on food choices. Furthermore, we examined the moderating effects of general inhibitory control (G-IC) and food-specific inhibitory control (F-IC) on successful and unsuccessful restrained eaters (US-REs). Automatic attention was measured using "the EyeLink 1000," which tracked eye movements during the process of making food choices, and G-IC and F-IC were measured using the Stop-Signal Task. The results showed that food choices were related to automatic attention and that G-IC and F-IC moderated the predictive relationship between automatic attention and food choices. Furthermore, among successful restrained eaters (S-REs), automatic attention to high caloric foods did not predict food choices, regardless of whether G-IC or F-IC was high or low. Whereas food choice was positively correlated with automatic attention among US-REs with poor F-IC, this pattern was not observed in those with poor G-IC. In conclusion, the S-REs had more effective self-management skills and their food choices were affected less by automatic attention and inhibitory control. Unsuccessful restrained eating was associated with poor F-IC (not G-IC) and greater automatic attention to high caloric foods. Thus, clinical interventions should focus on enhancing F-IC, not G-IC, and on reducing automatic attention to high caloric foods.

Keywords: restrained eaters, inhibitory control, impulsive system, food choice, eye movement

OPEN ACCESS

Edited by:
Martin S. Hagger,
Curtin University, Australia

Reviewed by:
Marleen Gillebaart,
Utrecht University, Netherlands
Derwin King Chung Chan,
University of Hong Kong, Hong Kong

****Correspondence:***
Hong Chen
chenhg@swu.edu.cn

Specialty section:
This article was submitted to Personality and Social Psychology, a section of the journal Frontiers in Psychology

Received: *28 February 2017*
Accepted: *02 May 2017*
Published: *24 May 2017*

Citation:
Zhang X, Chen S, Chen H, Gu Y and Xu W (2017) General and Food-Specific Inhibitory Control As Moderators of the Effects of the Impulsive Systems on Food Choices. Front. Psychol. 8:802. doi: 10.3389/fpsyg.2017.00802

INTRODUCTION

People in developed countries have a myriad of opportunities to eat. Food, especially highly palatable food, is readily available in almost every setting during the day (Thornton et al., 2013). The modern obesogenic environment has resulted in an increasing number of people who attempt to control their weight. People who adhere to an intentional, sustained restriction of caloric intake to lose or maintain body weight are referred to as REs (Herman and Mack, 1975). However, some REs are often unsuccessful in controlling their weight, continuing to choose and eat HC foods (Mann et al., 2007). Many explanations have been proposed for problems regulating eating

Abbreviations: F-IC, food-specific inhibitory control; G-IC, general inhibitory control; HC, high caloric; LC, low caloric; REs, restrained eaters; S-REs, successful restrained eaters; US-REs, unsuccessful restrained eaters.

behaviors. Often, eating behavior seems to be governed not only by goal-directed behavior, but also by automatic reactions, as defined in the reflective-impulsive model (Strack and Deutsch, 2004; Hofmann et al., 2007, 2008, 2009b, 2011; Kakoschke et al., 2015). Thus, the present study aimed to clarify some of the explanations for these observations.

The impulsive system guides behavior through associative links (i.e., implicit preferences for food cues) and motivational orientations (i.e., automatic attention to food cues); this is an automatic process, which is fast, implicit, and effortless (Strack and Deutsch, 2004; Hofmann et al., 2007, 2008, 2009b; Kakoschke et al., 2015). Hofmann et al. (2008) suggest that an implicit measurement tool is required to measure an impulsive system effectively. For example, implicit preferences can be measured using the Implicit Association Test and automatic attention can be measured by tracking eye-movements to minimize interference from consciously controlled processing. Studies have shown that a stronger impulsive system that includes attention to food and an implicit preference for HC foods is associated with unhealthy eating behaviors (Houben et al., 2010; Werthmann et al., 2011; Field et al., 2016). In particular, studies reviewed in our literature search indicate that the impact of the impulsive system (implicit preference) on eating behavior depends on inhibitory control.

Previous experiments have found that participants with a strong implicit preference or approach bias for snack foods, combined with low inhibitory control, gained the most weight (Nederkoorn et al., 2010) and consumed the most snack foods (Kakoschke et al., 2015). Furthermore, a study by Hofmann et al. (2009a) identified G-IC as a moderator of the relationship between implicit preferences and eating behavior, with high inhibitory control decreasing the influence of implicit preferences on eating behavior. Similarly, other research has found that the effect of the impulsive system was relatively strong when food-related self-control was weak (Honkanen et al., 2012). The results of a recent study indicate that the trait of self-control ability moderates the prediction of implicit preferences on eating behavior (Wang et al., 2015). In that study, implicit preferences predicted chocolate consumption among participants with low trait self-control, but the predictive power of the implicit preferences disappeared in participants with high levels of trait self-control. These results have consistently demonstrated that higher inhibitory control buffers the effect of the impulsive system on eating behavior, whereas lower inhibitory control induces the opposite pattern.

In the present study, we aimed to advance knowledge in several areas of inquiry. First, prior studies have focused on the role of implicit preferences in impulsive systems instead of automatic attention. The important role of attentional bias in eating behavior has been reported in the research literature. Specifically, REs were found to have an attentional bias (i.e., more attention) toward HC foods compared with LC foods and neutral stimuli, which was associated with more food intake (Hollitt et al., 2010; Meule et al., 2012b; Neimeijer et al., 2013; Kemps et al., 2014; Werthmann et al., 2014). However, there are two kinds of attentional mechanisms: bottom-up and top-down mechanisms. The former, which is involved in the automatic processing of the impulsive system, unconsciously prioritizes the information that is to be noticed (LaBerge, 2002; Knudsen, 2007), such as food cues, which can lead to excessive eating. Therefore, we aimed to explore the effects of automatic attention (impulsive systems) on eating behavior. Automatic attention has been assessed by tracking eye movements during the process of making food choices. During the decision-making process, numerous cognitive activities underlying food choices are not manifested before an eventual behavioral outcome. Therefore, tracking automatic attention by observing the number of initial direct gazes during the decision-making process should help us understand the causes of unhealthy dietary behavior.

Studies have also found that poor inhibitory control leads to excessive consumption of HC food (Guerrieri et al., 2009; Houben, 2011; Hall et al., 2014), which might be caused by the enhancement of the effect of impulsive systems on eating behavior through poor inhibitory control (Hofmann et al., 2009a; Nederkoorn et al., 2010; Kakoschke et al., 2015; Wang et al., 2015). Hence, we also examined the moderating effect of inhibitory control on impulsive systems. However, most studies on this topic have tested inhibitory control in general, but not inhibitory control related to food. Research findings indicate that excessive eating is related to poor inhibitory control that is food-specific, rather than G-IC (Batterink et al., 2010; Nederkoorn et al., 2012; Houben et al., 2014). Only Honkanen et al. (2012) measured food-specific self-control, but their data were collected using self-report measures. The present study, however, used the Stop Signal Task, which is a more implicit and reliable method of measuring G-IC and F-IC, in order to clarify which type of inhibitory control would have a moderating effect and which effect would be greater. Finally, studies have rarely investigated subgroups of REs, such as S-REs and US-REs. Previous studies have only found an association between US-REs and poor inhibitory control (Jansen et al., 2009; Kong et al., 2015) and a greater attentional bias toward HC foods (Zhang et al., 2016) compared to S-REs. The mechanisms underlying unsuccessful restrained eating remain unclear. Therefore, it was necessary for us to explore the cognitive processes of REs during decision making related to food choices, to gain a better understanding of the mechanisms underlying the success and failure of dietary restriction in order to promote healthful eating.

The current study explored the effects of automatic attention (the impulsive system) on food choices, and examined the moderating effects of G-IC and F-IC among S-REs and US-REs. We aimed to answer the following question: Which type of inhibitory control moderates the relationship between impulsive systems and food choices? The results of the study were intended to clarify the reasons for successful and unsuccessful restrained eating. As reported in previous studies, S-REs have greater restraint, a tendency for lower consumption, and more effective self-management strategies, compared to US-REs (Fishbach et al., 2003; Van Strien and Ouwens, 2007; Keller and Hartmann, 2016). Hence, we hypothesized that S-REs would not be affected by automatic attention (the impulsive system), regardless of whether their G-IC or F-IC were higher or lower. Lower G-IC and F-IC among the US-REs were expected to increase their automatic

attention (the impulsive system) to their food choices, and higher G-IC and F-IC were expected to have the opposite effect.

MATERIALS AND METHODS

Participants

The participants were 64 female undergraduate students. The inclusion criterion for participation was a score higher than 3 on the Restrained Eating subscale of the Dutch Eating Behavior Questionnaire (DEBQ) (Van Strien and Ouwens, 2007; Kong et al., 2015). Participants with scores on the Perceived Self-Regulatory Success in Dieting Scale (PSRS) that were above average were classified as S-REs, and those with below-average scores were classified as US-REs (Fishbach et al., 2003; Meule et al., 2012a; van Koningsbruggen et al., 2013; Nguyen and Polivy, 2014). Additional criteria for inclusion in the study were weight within the normal range (BMI between 18.5 and 25 kg/m^2) and right-handedness. Similar to a previous study, we excluded participants who followed a medically prescribed diet in the 6 months prior to the study and women with potential biases because of preferences for vegetarian foods (van der Laan et al., 2014). The experiment was approved by the Southwest University Human Ethics Committee and was conducted in accordance with the guidelines of the Declaration of Helsinki. Written informed consent was obtained from the participants prior to the study's commencement.

Procedures

Prior to the experiment, 400 questionnaires were distributed to students enrolled at Southwest University for the purpose of selecting participants, and 371 questionnaires were returned. The final sample consisted of 64 participants who were selected using the study's inclusion criteria.

The study consisted of two parts: a preliminary experiment and a formal experiment. During the preliminary experiment, participants evaluated the expected tastiness and perceived energy content of the food stimuli on a 9-point scale ranging from 1 = tasteless/very LC to 9 = very tasty/very HC. The food stimuli consisted of 50 HC food pictures and 50 LC food pictures. All the selected food stimuli had a tastiness rating of 4 or higher to avoid forcing participants to choose food for which they had a strong dislike. The energy content of the LC foods was below 4 points and the energy content of the HC foods was above 6 points. One week later, we conducted the formal experiment. Participants were prohibited from eating or drinking anything (except water) for at least 2 h before the second study to stimulate their craving for food. Upon their arrival, participants were told that the study was a survey about food preferences. First, they were asked to rate their hunger on a visual analog scale, which ranged from 0% (not hungry) to 100% (very hungry). Next, they performed the Stop-Signal Task (SST), which measures G-IC and F-IC. Afterward, they completed a food-choice task that required them to choose one food they wanted to eat when presented with an HC and an LC food. During the food-choice task, eye movements were recorded using the EyeLink 1000 (SR Research, Mississauga, ON, Canada), to measure participants' automatic attention to food.

Measures

Restrained Eating Subscale of the Eating Behavior Questionnaire (DEBQ)

Participants' restraint standards were assessed using the Restrained Eating Subscale of the DEBQ (Van Strien et al., 1986). The 10 items on the instrument (e.g., "When you put on weight, do you eat less than you usually do?") are rated on a 5-pointscale (1 = never, 2 = seldom, 3 = sometimes, 4 = often, 5 = very often). The mean score of the scale represents dietary restraint. Participants with high scores are concerned about their weight and controlling their food intake.

Perceived Self-Regulatory Success in Dieting Scale (PSRS)

The REs' success was measured using the PSRS, which requires participants to rate 3 items on a on a 7-point scale. The 3 items measure how successful the respondents have been in (1) losing weight, (2) monitoring their weight (e.g., 1 = very unsuccessful, 7 = very successful), and (3) how difficult they have found it to stay in shape (e.g., 1 = very easy, 7 = very difficult), the last item is reverse coded. A higher mean score indicates a higher level of success at restrained eating (Fishbach et al., 2003; Meule et al., 2012a; van Koningsbruggen et al., 2013; Nguyen and Polivy, 2014).

Stop-Signal Task

The SST involves two concurrent trials: A go trial, which is a choice-reaction time task, and a stop trial, which involves inhibiting responses to the go task (Logan et al., 1997). We adopted two variants of the SST based on a previous study (Houben et al., 2014): the first test measured G-IC, and the second measured F-IC. In both SST tasks, a fixation cross was presented first for 1,000 ms and the go stimuli were subsequently presented for 1,000 ms. In the general SST, the go stimuli were the left arrows or right arrows and participants were instructed to press "F" on a computer keyboard for the left arrow and "J" for the right arrow as fast as possible. In the food-specific SST, the go stimuli included pictures of HC foods. Participants were requested to press "F" on the keyboard if the food picture appeared on the left side of the screen and "J" if it was on the right side of the screen. In both SSTs, 25% of the trials presented a visual stop signal (×) after the go trial and participants were instructed not to respond to the go stimuli in such cases. The stop-signal delay (SSD) was initially set for 250 ms and was dynamically altered after each trial by a tracking procedure to enable participants to achieve correct inhibition in 50% of the stop trials. If participants successfully inhibited their response, the go-stop delay was increased by 50 ms. If they did not inhibit their response, the go-stop delay was decreased by 50 ms. Both of the SST variants consisted of one practice block without stop signals (16 trials) and two test blocks with stop signals (each block had 56 trials).The stop signal reaction time (SSRT) reflects inhibitory control (Mean SSRT = Mean Go RT-Mean SSD). Higher SSRTs indicate lower inhibitory control.

Eye-Movement Tracking during the Food-Choice Task

In each trial, a HC and LC food were shown side by side on a screen and participants had 3,000 ms to choose one of the two foods they would most like to eat. If they chose the food on the left side of the screen, they pressed the "F" key, and if they chose the food on the right side, they pressed the "J" key; the task was preceded by a 500 ms fixation cross. After participants made their choice, the screen was blank for 500 ms. In the food-choice task, participants made a total of 100 choices (the numbers of HC and LC foods presented on the left and right sides of the screen were balanced).At the end of the task, the percentage of participants who chose the HC foods was calculated. The participants were not told that their choices were always between pairs of HC and LC foods (van der Laan et al., 2014).

To investigate participants' automatic attention during the food-choice task, we used the EyeLink1000. Evidence has revealed that eye movements are guided by attention (Kowler, 1995); thus, we recorded the number of initial direct gazes on the HC foods. The number of initial direct gazes on an object reflects the degree of automatic attention to it (Garner et al., 2006). In this study, a higher number of initial gazes on the HC foods indicated greater automatic attention to them.

RESULTS

Preliminary Analyses

There were significant differences between the S-REs and US-REs on the PSRS [$t(62) = -9.69$, $p < 0.001$], with the S-REs scoring higher ($M = 4.55$; $SD = 0.55$) than the US-REs ($M = 3.21$; $SD = 0.55$); thus, the classification of the two groups was reasonable. In addition, the BMI ($M = 20.56$, $SD = 1.73$ vs. $M = 20.41$, $SD = 1.47$), age ($M = 20.77$, $SD = 1.41$ vs. $M = 21.15$, $SD = 1.15$), hunger ratings ($M = 0.51$, $SD = 0.29$ vs. $M = 0.44$, $SD = 0.26$), food cravings ($M = 0.28$, $SD = 0.28$ vs. $M = 0.39$, $SD = 0.30$), and negative mood ratings ($M = 0.17$, $SD = 0.18$ vs. $M = 0.17$, $SD = 0.18$) of the S-REs and US-REs, respectively, were not significantly different (all ts < 1.49, all ps > 0.14).

The descriptive statistics of the main variables are presented in **Table 1**. Except for participants' scores on the Restrained Eating subscale of the DEBQ [$t(62) = -2.47$, $p = 0.02$] and the PSRS [$t(62) = -9.69$, $p < 0.001$], no significant differences were found on the main variables between the S-REs and US-REs (all ts < -0.50, all ps > 0.15).

Automatic Attention as a Predictor of Food Choice

To test whether IC moderated the association of automatic attention with food choice, we analyzed zero-order correlations between automatic attention, food choice, and inhibitory control (**Table 2**). Automatic attention to HC foods was positively correlated with the proportion of HC foods that were chosen ($r = 0.41$, $p = 0.001$). Participants' HC food choices were not correlated with their PSRS, G-IC, or F-IC scores (all rs < 0.09, ps > 0.30).

TABLE 1 | Means and standard deviations on the measures of the main variables for the unsuccessful and successful restrained eaters.

	Unsuccessful restrained eaters		Successful restrained eaters	
	M	*SD*	*M*	*SD*
The number of initial direct gazes	52.83	8.59	53.97	7.58
Restraint eating	3.64	0.48	3.91	0.41
Perceived self-regulatory success in dieting	3.21	0.55	4.55	0.55
General inhibitory control	252.3	38.21	256.71	32.89
Food-specific inhibitory control	238.28	52.22	253.90	33.25
Food choices (%)	54.85	30.31	58.66	25.16

Furthermore, we performed a multiple regression analysis with the percentage of HC food choices selected as the dependent variable. We entered the PSRS, automatic attention, and IC (G-IC or F-IC) scores as the predictor variables. Next, we entered all possible two-way interaction terms for the PSRS, automatic attention, and IC (G-IC or F-IC) scores. Then, the three-way interaction terms were entered (Aiken et al., 1991; Hofmann et al., 2007; Wang et al., 2015).

The results of the regression analysis ($R^2 = 0.25$) with G-IC as the moderating variable, showed a three-way interaction of PSRS, automatic attention, and G-IC that was significant, $\beta = -0.34$, $p = 0.02$, power $(1-\beta) = 0.97$. Simple slope analyses revealed that among the US-REs (those with lower PSRS scores), automatic attention to the HC foods was positively related to the percentage of HC food choices for those with better G-IC ($\beta = 0.63$, $p = 0.05$), but not for those with poorer G-IC ($\beta = 0.47$, $p = 0.10$) (**Figure 1**). However, among the S-REs (those with higher PSRS scores), automatic attention to HC foods was not associated with the percentage of HC food choices, for either the participants with lower ($\beta = 0.08$, $p = 0.81$) or higher G-IC ($\beta = 0.41$, $p = 0.16$) (**Figure 2**).

The results of the regression analysis ($R^2 = 0.30$) with F-IC as the moderating variable, revealed a significant three-way interaction of PSRS, automatic attention, and F-IC, $\beta = -0.54$, $p = 0.01$, power $(1-\beta) = 0.99$. As confirmed by the simple slope test, among the US-REs (**Figure 3**), automatic attention to the HC foods was unrelated with the percentage of HC food choices when participants' F-IC was better ($\beta = 0.44$, $p = 0.12$), but it was positively associated with the percentage of HC food choices when F-IC was poorer ($\beta = 0.84$, $p = 0.003$). For the S-REs (**Figure 4**), automatic attention to HC foods was uncorrelated with the percentage of HC food choices for those with either higher F-IC ($\beta = 0.24$, $p = 0.44$) or lower F-IC ($\beta = 0.23$, $p = 0.35$) scores.

DISCUSSION

To the best of our knowledge, the present study is the first to examine the relationship between impulsive systems and REs'

TABLE 2 | Zero order correlations for the main variables.

	1	2	3	4	5	6
1 The number of initial direct gazes	—					
2 Restraint eating	0.18 (0.17)	—				
3 Perceived self-regulatory success in dieting	0.10 (0.43)	0.32 (0.01)	—			
4 General inhibitory control	−0.13 (0.31)	−0.07 (0.62)	0.12 (0.38)	—		
5 Food-specific inhibitory control	0.14 (0.27)	−0.16 (0.23)	0.16 (0.23)	0.24 (0.06)	—	
6 Food choices (%)	0.41 (0.001)	−0.046 (0.73)	0.09 (0.47)	−0.13 (0.31)	−0.13 (0.31)	—

The zero-order correlations are followed by their p-values, r(p).

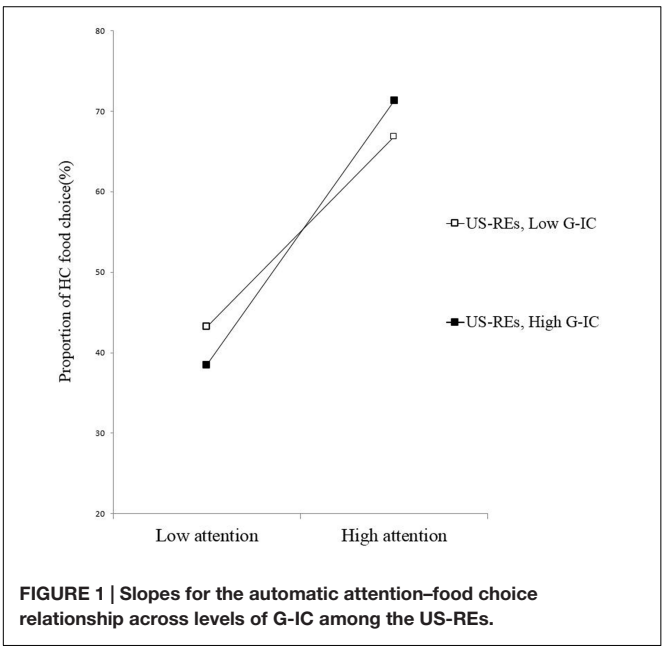


FIGURE 1 | Slopes for the automatic attention–food choice relationship across levels of G-IC among the US-REs.

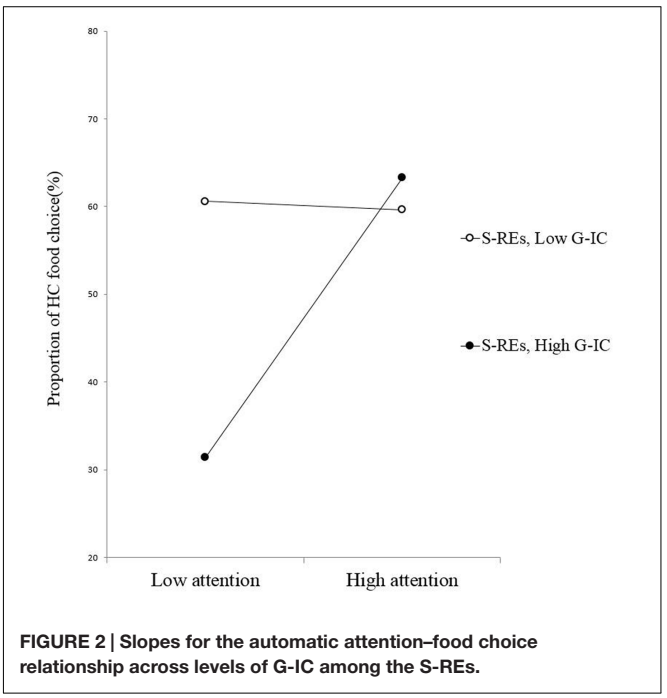


FIGURE 2 | Slopes for the automatic attention–food choice relationship across levels of G-IC among the S-REs.

food choices and the moderating effects of G-IC and F-IC among S-REs and US-REs. We hypothesized that S-REs would not be affected by automatic attention (the impulsive system), regardless of whether their G-IC or F-IC were higher or lower. Lower G-IC or F-IC among the US-REs was expected to increase their automatic attention (the impulsive system) to their food choices. We found that the food choices of the REs were affected by the impulsive system (automatic attention), which was moderated by G-IC and F-IC. As expected, automatic attention of the S-REs to HC foods did not influence their food choices, regardless of whether their G-IC or F-IC was high or low. Unexpectedly, an effect of automatic attention on food choice was found among the US-REs with poor F-IC, but not those with poor G-IC.

Previous studies have reported a positive correlation between attentional bias and HC food consumption (Werthmann et al., 2011). Moreover, studies in which attentional bias was experimentally manipulated found that increased attention to food was accompanied by increased food consumption, whereas decreased attention to food was accompanied by decreased food consumption (Kemps et al., 2014; Werthmann et al., 2014). The results of the present study extends existing knowledge of the relationship between attention to food and food choices. We found that this relationship was moderated by G-IC and F-IC; however, most studies have focused on another component of the impulsive system, namely, implicit preferences for snack foods (Hofmann et al., 2009a; Wang et al., 2015) and the tendency to buy snacks on impulse (Honkanen et al., 2012). They have also found that G-IC (Hofmann et al., 2009a; Wang et al., 2015) and F-IC (Honkanen et al., 2012) moderated the relationship between the impulsive system and food consumption. Based on these studies' findings, the premise has been accepted that the impulse system includes several types of mechanisms that affect eating behavior (including food consumption and food choice), especially the moderating effects of G-IC and F-IC on these relationships.

The most important finding of the present study was that the moderating effects of G-IC and F-IC differed among the US-REs. Among the US-REs with low F-IC, the impulsive system (automatic attention) had a stronger influence on eating behavior (food choice), whereas among those with low G-IC, the impulsive system did not influence eating behavior. The opposite moderating effect found for F-IC and G-IC, with poor F-IC (not poor G-IC) enhance the effect of impulsive system on

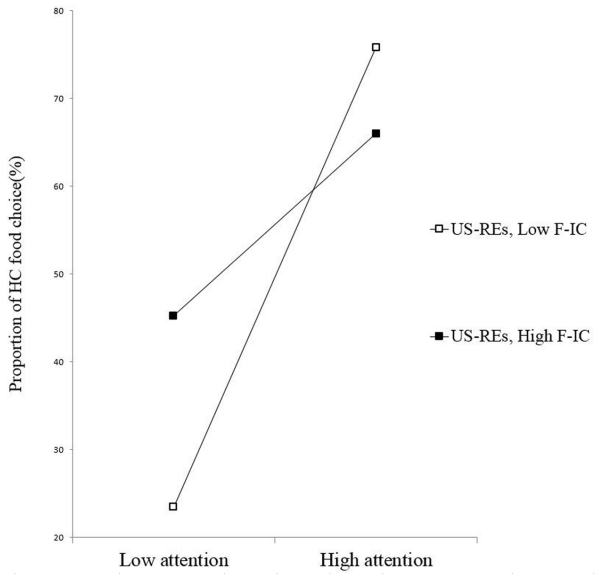


FIGURE 3 | Slopes for the automatic attention–food choice relationship across levels of F-IC among the US-REs.

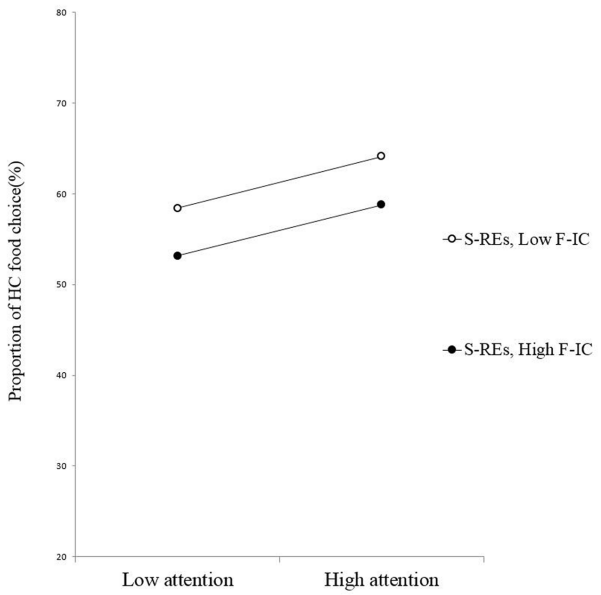


FIGURE 4 | Slopes for the automatic attention–food choice relationship across levels of F-IC among the S-REs.

food choice leading to unhealthy eating behaviors. However, the results were not surprising because many studies have reported an association between being overweight and inefficient F-IC, rather than G-IC (Nederkoorn et al., 2012; Houben et al., 2014). A recent investigation of the effects of F-IC and G-IC training on immediate snack food consumption found that the training effect involved only F-IC. When participants received F-IC training to inhibit their responses to pictures of food, their food intake decreased, but it did not decrease after G-IC training (Lawrence et al., 2015).These results showed that unhealthy dietary behaviors had a stronger association with poor F-IC, than with G-IC, which support the results of our study. Therefore, our results further demonstrate the premise that the roles of G-IC and F-IC of the impulsive system are different, with poor F-IC being the main cause of unhealthy eating among US-REs.

Conversely, the impulsive system in the present study was not associated with food choice, regardless of whether participants' G-IC or F-IC were high or low among S-REs. The findings indicated that S-REs were less affected by the impulsive system than the US-REs, which might have been due to differences in the strength of the impulsive systems between the two groups. Previous studies have observed that when confronted with food temptations, S-REs paid less attention to HC foods (Zhang et al., 2016), automatically activated more concepts about dieting goals and weight management (Fishbach et al., 2003; Stroebe et al., 2013), use more flexible cognitive-control strategies (Meule et al., 2011), compare to US-REs. These findings might be accounted for by: (1) the S-REs' impulsive systems, which are not stronger than those of US-REs, (2) S-REs' dieting goals and flexible cognitive-control strategies inhibited the power of impulsive systems. These characteristics might have helped S-REs minimize the effects of the impulsive system on food choice, regardless of whether their G-IC or F-IC scores were high or low. In summary, US-REs exhibited greater automatic attention to food (impulsive system) and poor F-IC (not poor G-IC), which cause unsuccessful restrained eating, whereas S-REs effectively regulate their dietary intake.

This investigation of the impulsive systems of REs revealed that their effects on food choices depended on their G-IC and F-IC. In particular, only lower F-IC (not G-IC) heightened the effect of impulsive systems on food choices among the US-REs in our study. This finding suggests that the failure to restrain one's eating is due to poor F-IC rather than poor G-IC. Consequently, the study provides constructive suggestions for clinical interventions, which should focus on F-IC training. In addition, low F-IC did not directly influence food choices; it played a moderating role by enhancing the effect of automatic attention to food choices. The US-REs with lower F-IC and greater automatic attention to HC foods chose HC foods more often. These results also suggest that interventions should not only focus on enhancing F-IC, but also on reducing automatic attention to HC foods. Finally, this study found that food choices were affected less by automatic attention, regardless of whether F-IC or G-IC were high or low among the S-REs. The differences in the mechanisms that were found among the S-REs and US-REs (S-REs were less affected by inhibitory control and automatic attention than US-REs), address the question of why some, but not all REs succeed.

This study has several limitations. First, the study sample only included individuals whose weight was within the normal range; therefore, a link between automatic attention, inhibitory control, and food choice in obesity cannot be inferred. Additionally, we cannot be sure of the role of the impulsive systems' mechanisms in weight change. Further research is needed to compare people with a normal weight with those who are obese to identify

the factors that induce weight gain, which should contribute to the development of interventions for obesity. Second, inhibitory control might fluctuate over time, similar to the state self-control. Actually, the trait of self-control, considered part of one's personality, has been reported to be a consistent predictor of behavioral outcomes (Tangney et al., 2004; de Ridder et al., 2012). Few studies have focused on trait self-control. Thus, the relationship between the impulsive system, trait self-control, and food choice should be examined in future research. Finally, future studies should revise the food-choice task by designing food-choice situations with ecological validity to increase the generalizability of the results to real-world settings and to improve our effectiveness in detecting decision-making processes during the task. Doing so should also allow us to elucidate further the factors influencing restrained eating and thereby help people improve their diets.

AUTHOR CONTRIBUTIONS

XZ and SC designed the study and wrote the protocol. HC conducted literature searches and provided summaries of previous research studies. YG and WX conducted the statistical analysis. XZ wrote the first draft of the manuscript and all authors contributed to and have approved the final manuscript.

FUNDING

This research was supported by National Natural Science Foundation of China Grants (31170981 and 31371037), the Science and Technology Innovation Fund for SWU graduate students (kb2011001), BaYu Scholar and Chongqing 100 Persons Fellowship Programs of the Chongqing Government, and Fundamental Research Funds for the Central Universities (SWU1709565).

ACKNOWLEDGMENT

The authors would like to thank Miss. Laura for helpful revision of the language.

REFERENCES

Aiken, L. S., West, S. G., and Reno, R. R. (1991). *Multiple Regression: Testing and Interpreting Interactions*. Newcastle upon Tyne: Sage.

Batterink, L., Yokum, S., and Stice, E. (2010). Body mass correlates inversely with inhibitory control in response to food among adolescent girls: an fMRI study. *Neuroimage* 52, 1696–1703. doi: 10.1016/j.neuroimage.2010.05.059

de Ridder, D. T., Lensvelt-Mulders, G., Finkenauer, C., Stok, F. M., and Baumeister, R. F. (2012). Taking stock of self-control: a meta-analysis of how trait self-control relates to a wide range of behaviors. *Pers. Soc. Psychol. Rev.* 16, 76–99. doi: 10.1177/1088868311418749

Field, M., Werthmann, J., Franken, I., Hofmann, W., Hogarth, L., and Roefs, A. (2016). The role of attentional bias in obesity and addiction. *Health Psychol.* 35, 767–780.

Fishbach, A., Friedman, R. S., and Kruglanski, A. W. (2003). Leading us not into temptation: momentary allurements elicit overriding goal activation. *J. Pers. Soc. Psychol.* 84, 296–309. doi: 10.1037/0022-3514.84.2.296

Garner, M., Mogg, K., and Bradley, B. P. (2006). Orienting and maintenance of gaze to facial expressions in social anxiety. *J. Abnorm. Psychol.* 115, 760–770. doi: 10.1037/0021-843X.115.4.760

Guerrieri, R., Nederkoorn, C., Schrooten, M., Martijn, C., and Jansen, A. (2009). Inducing impulsivity leads high and low restrained eaters into overeating, whereas current dieters stick to their diet. *Appetite* 53, 93–100. doi: 10.1016/j.appet.2009.05.013

Hall, P. A., Lowe, C., and Vincent, C. (2014). Executive control resources and snack food consumption in the presence of restraining versus facilitating cues. *J. Behav. Med.* 37, 587–594. doi: 10.1007/s10865-013-9528-3

Herman, C. P., and Mack, D. (1975). Restrained and unrestrained eating1. *J. Pers.* 43, 647–660. doi: 10.1111/j.1467-6494.1975.tb00727.x

Hofmann, W., Friese, M., and Roefs, A. (2009a). Three ways to resist temptation: the independent contributions of executive attention, inhibitory control, and affect regulation to the impulse control of eating behavior. *J. Exp. Soc. Psychol.* 45, 431–435. doi: 10.1016/j.jesp.2008.09.013

Hofmann, W., Friese, M., and Strack, F. (2009b). Impulse and self-control from a dual-systems perspective. *Perspect. Psychol. Sci.* 4, 162–176. doi: 10.1111/j.1745-6924.2009.01116.x

Hofmann, W., Friese, M., and Wiers, R. W. (2008). Impulsive versus reflective influences on health behavior: a theoretical framework and empirical review. *Health Psychol. Rev.* 2, 111–137. doi: 10.1080/17437190802617668

Hofmann, W., Friese, M., and Wiers, R. W. (2011). Impulsive processes in the self-regulation of health behaviour: theoretical and methodological considerations in response to commentaries. *Health Psychol. Rev.* 5, 162–171. doi: 10.1080/17437199.2011.565593

Hofmann, W., Rauch, W., and Gawronski, B. (2007). And deplete us not into temptation: automatic attitudes, dietary restraint, and self-regulatory resources as determinants of eating behavior. *J. Exp. Soc. Psychol.* 43, 497–504. doi: 10.1016/j.jesp.2006.05.004

Hollitt, S., Kemps, E., Tiggemann, M., Smeets, E., and Mills, J. S. (2010). Components of attentional bias for food cues among restrained eaters. *Appetite* 54, 309–313. doi: 10.1016/j.appet.2009.12.005

Honkanen, P., Olsen, S. O., Verplanken, B., and Tuu, H. H. (2012). Reflective and impulsive influences on unhealthy snacking. The moderating effects of food related self-control. *Appetite* 58, 616–622. doi: 10.1016/j.appet.2011.11.019

Houben, K. (2011). Overcoming the urge to splurge: influencing eating behavior by manipulating inhibitory control. *J. Behav. Ther. Exp. Psychiatry* 42, 384–388. doi: 10.1016/j.jbtep.2011.02.008

Houben, K., Nederkoorn, C., and Jansen, A. (2014). Eating on impulse: the relation between overweight and food-specific inhibitory control. *Obesity* 22, E6–E8. doi: 10.1002/oby.20670

Houben, K., Roefs, A., and Jansen, A. (2010). Guilty pleasures. Implicit preferences for high calorie food in restrained eating. *Appetite* 55, 18–24. doi: 10.1016/j.appet.2010.03.003

Jansen, A., Nederkoorn, C., van Baak, L., Keirse, C., Guerrieri, R., and Havermans, R. (2009). High-restrained eaters only overeat when they are also impulsive. *Behav. Res. Ther.* 47, 105–110. doi: 10.1016/j.brat.2008.10.016

Kakoschke, N., Kemps, E., and Tiggemann, M. (2015). Combined effects of cognitive bias for food cues and poor inhibitory control on unhealthy food intake. *Appetite* 87, 358–364. doi: 10.1016/j.appet.2015.01.004

Keller, C., and Hartmann, C. (2016). Not merely a question of self-control: the longitudinal effects of overeating behaviors, diet quality and physical activity on dieters' perceived diet success. *Appetite* 107, 213–221. doi: 10.1016/j.appet.2016.08.007

Kemps, E., Tiggemann, M., Orr, J., and Grear, J. (2014). Attentional retraining can reduce chocolate consumption. *J. Exp. Psychol.* 20, 94–102. doi: 10.1037/xap0000005

Knudsen, E. I. (2007). Fundamental components of attention. *Annu. Rev. Neurosci.* 30, 57–78.

Kong, F., Zhang, Y., and Chen, H. (2015). Inhibition ability of food cues between successful and unsuccessful restrained eaters: a two-choice oddball task. *PLoS ONE* 10:e0120522. doi: 10.1371/journal.pone.0120522

Kowler, E. (1995). Eye movements. *Vis. Cogn.* 2, 215–265.

LaBerge, D. (2002). Attentional control: brief and prolonged. *Psychol. Res.* 66, 220–233.

Lawrence, N. S., Verbruggen, F., Morrison, S., Adams, R. C., and Chambers, C. D. (2015). Stopping to food can reduce intake. Effects of stimulus-specificity and individual differences in dietary restraint. *Appetite* 85, 91–103. doi: 10.1016/j.appet.2014.11.006

Logan, G. D., Schachar, R. J., and Tannock, R. (1997). Impulsivity and inhibitory control. *Psychol. Sci.* 8, 60–64. doi: 10.1111/j.1467-9280.1997.tb00545.x

Mann, T., Tomiyama, A. J., Westling, E., Lew, A.-M., Samuels, B., and Chatman, J. (2007). Medicare's search for effective obesity treatments: diets are not the answer. *Am. Psychol.* 62:220. doi: 10.1037/0003-066X.62.3.220

Meule, A., Papies, E. K., and Kübler, A. (2012a). Differentiating between successful and unsuccessful dieters. Validity and reliability of the perceived self-regulatory success in dieting scale. *Appetite* 58, 822–826. doi: 10.1016/j.appet.2012.01.028

Meule, A., Vögele, C., and Kübler, A. (2012b). Restrained eating is related to accelerated reaction to high caloric foods and cardiac autonomic dysregulation. *Appetite* 58, 638–644. doi: 10.1016/j.appet.2011.11.023

Meule, A., Westenhöfer, J., and Kübler, A. (2011). Food cravings mediate the relationship between rigid, but not flexible control of eating behavior and dieting success. *Appetite* 57, 582–584. doi: 10.1016/j.appet.2011.07.013

Nederkoorn, C., Coelho, J. S., Guerrieri, R., Houben, K., and Jansen, A. (2012). Specificity of the failure to inhibit responses in overweight children. *Appetite* 59, 409–413. doi: 10.1016/j.appet.2012.05.028

Nederkoorn, C., Houben, K., Hofmann, W., Roefs, A., and Jansen, A. (2010). Control yourself or just eat what you like? Weight gain over a year is predicted by an interactive effect of response inhibition and implicit preference for snack foods. *Health Psychol.* 29, 389–393. doi: 10.1037/a0019921

Neimeijer, R. A., de Jong, P. J., and Roefs, A. (2013). Temporal attention for visual food stimuli in restrained eaters. *Appetite* 64, 5–11. doi: 10.1016/j.appet.2012.12.013

Nguyen, C., and Polivy, J. (2014). Eating behavior, restraint status, and bmi of individuals high and low in perceived self-regulatory success. *Appetite* 75, 49–53. doi: 10.1016/j.appet.2013.12.016

Strack, F., and Deutsch, R. (2004). Reflective and impulsive determinants of social behavior. *Pers. Soc. Psychol. Rev.* 8, 220–247. doi: 10.1207/s15327957pspr0803_1

Stroebe, W., Van Koningsbruggen, G. M., Papies, E. K., and Aarts, H. (2013). Why most dieters fail but some succeed: a goal conflict model of eating behavior. *Psychol. Rev.* 120, 110–138. doi: 10.1037/a0030849

Tangney, J. P., Baumeister, R. F., and Boone, A. L. (2004). High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. *J. Pers.* 72, 271–324.

Thornton, L. E., Cameron, A. J., McNaughton, S. A., Waterlander, W. E., Sodergren, M., Svastisalee, C., et al. (2013). Does the availability of snack foods in supermarkets vary internationally? *Int. J. Behav. Nutr. Phys. Act.* 10:56. doi: 10.1186/1479-5868-10-56

van der Laan, L. N., de Ridder, D. T., Charbonnier, L., Viergever, M. A., and Smeets, P. A. (2014). Sweet lies: neural, visual, and behavioral measures reveal a lack of self-control conflict during food choice in weight-concerned women. *Front. Behav. Neurosci.* 8:184. doi: 10.3389/fnbeh.2014.00184

van Koningsbruggen, G. M., Stroebe, W., and Aarts, H. (2013). Successful restrained eating and trait impulsiveness. *Appetite* 60, 81–84. doi: 10.1016/j.appet.2012.09.016

Van Strien, T., Frijters, J. E., Bergers, G., and Defares, P. B. (1986). The dutch eating behavior questionnaire (debq) for assessment of restrained, emotional, and external eating behavior. *Int. J. Eat. Disord.* 5, 295–315.

Van Strien, T., and Ouwens, M. A. (2007). Effects of distress, alexithymia and impulsivity on eating. *Eat. Behav.* 8, 251–257. doi: 10.1016/j.eatbeh.2006.06.004

Wang, Y., Wang, L., Cui, X., Fang, Y., Chen, Q., Wang, Y., et al. (2015). Eating on impulse: implicit attitudes, self-regulatory resources, and trait self-control as determinants of food consumption. *Eat. Behav.* 19, 144–149. doi: 10.1016/j.eatbeh.2015.09.011

Werthmann, J., Field, M., Roefs, A., Nederkoorn, C., and Jansen, A. (2014). Attention bias for chocolate increases chocolate consumption–an attention bias modification study. *J. Behav. Ther. Exp. Psychiatry* 45, 136–143. doi: 10.1016/j.jbtep.2013.09.009

Werthmann, J., Roefs, A., Nederkoorn, C., Mogg, K., Bradley, B. P., and Jansen, A. (2011). Can (not) take my eyes off it: attention bias for food in overweight participants. *Health Psychol.* 30, 561–569. doi: 10.1037/a0024291

Zhang, X. M., Chen, H., Gao, X., Jiang, Y. X., and Zhou, Y. Z. (2016). The energy effect of food information processing among successful and unsuccessful restrained eaters: an eye movement study about attention bias. *J. Psychol. Sci.* 39, 956–963.

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 20 June 2017
doi: 10.3389/fpsyg.2017.00861

Beyond "Monologicality"? Exploring Conspiracist Worldviews

Bradley Franks[1], Adrian Bangerter[2], Martin W. Bauer[1], Matthew Hall[1] and Mark C. Noort[1]*

[1] Department of Psychological and Behavioural Science, London School of Economics and Political Science, London, United Kingdom, [2] Institut de Psychologie du Travail et des Organisations, Université de Neuchâtel, Neuchâtel, Switzerland

Conspiracy theories (CTs) are widespread ways by which people make sense of unsettling or disturbing cultural events. Belief in CTs is often connected to problematic consequences, such as decreased engagement with conventional political action or even political extremism, so understanding the psychological and social qualities of CT belief is important. CTs have often been understood to be "monological," displaying the tendency for belief in one conspiracy theory to be correlated with belief in (many) others. Explanations of monologicality invoke a nomothetical or "closed" mindset whereby mutually supporting beliefs based on mistrust of official explanations are used to interpret public events as conspiracies, independent of the facts about those events (which they may ignore or deny). But research on monologicality offers little discussion of the content of monological beliefs and reasoning from the standpoint of the CT believers. This is due in part to the "access problem": CT believers are averse to being researched because they often distrust researchers and what they appear to represent. Using several strategies to address the access problem we were able to engage CT believers in semi-structured interviews, combining their results with analysis of media documents and field observations to reconstruct a conspiracy worldview – a set of symbolic resources drawn on by CT believers about important dimensions of ontology, epistemology, and human agency. The worldview is structured around six main dimensions: the nature of reality, the self, the outgroup, the ingroup, relevant social and political action, and possible future change. We also describe an ascending typology of five types of CT believers, which vary according to their positions on each of these dimensions. Our findings converge with prior explorations of CT beliefs but also revealed novel aspects: A sense of community among CT believers, a highly differentiated representation of the outgroup, a personal journey of conversion, variegated kinds of political action, and optimistic belief in future change. These findings are at odds with the typical image of monological CT believers as paranoid, cynical, anomic and irrational. For many, the CT worldview may rather constitute the ideological underpinning of a nascent pre-figurative social movement.

Keywords: conspiracy theories, monological belief system, worldviews, quasi-religion, interviews

OPEN ACCESS

Edited by:
Mark Hallahan,
College of the Holy Cross,
United States

Reviewed by:
Karen Douglas,
University of Kent, United Kingdom
Jimmy Parks,
University of Arkansas for Medical Science, United States
Rodney Michael Schmaltz,
MacEwan University, Canada

****Correspondence:***
Bradley Franks
b.franks@lse.ac.uk

Specialty section:
This article was submitted to Personality and Social Psychology, a section of the journal Frontiers in Psychology

Received: *21 December 2016*
Accepted: *10 May 2017*
Published: *20 June 2017*

Citation:
Franks B, Bangerter A, Bauer MW, Hall M and Noort MC (2017) Beyond "Monologicality"? Exploring Conspiracist Worldviews. Front. Psychol. 8:861. doi: 10.3389/fpsyg.2017.00861

INTRODUCTION

Explaining complex societal events is itself complex. The use of conspiracy theories (CTs) to make sense of destabilizing events (like the assassination of major public figures, the unpredicted destruction of major public buildings, sudden infectious disease outbreaks) is a widespread response to world complexity (e.g., van Prooijen, 2011). CTs involve symbolic coping which transmutes the diffuse anxiety arising from such events into specific threats caused by the purportedly malevolent action of powerful actors (e.g., Harrison and Thomas, 1997; Wagner-Egger and Bangerter, 2007; Byford, 2011). Since societal complexity and uncertainty appear to be increasing, conspiratorial thinking may increase as a response (e.g., Aupers, 2012).

A range of practical consequences of belief in CTs has been documented. For example, exposure to anti-vaccine CTs decreases people's intentions to vaccinate (Jolley and Douglas, 2014a). Similar society-wide public health implications arose for polio vaccination in Nigeria (Falade and Bauer, 2017), where the vaccine was seen as the instrument of a Western birth-control plot. In the United States, belief that birth control and HIV/AIDS are forms of genocide against African Americans is associated with negative attitudes toward contraception (Bogart and Thorburn, 2006). In broader terms, CT belief and exposure is associated with feelings of powerlessness (Abalakina-Paap et al., 1999; Jolley and Douglas, 2014b), which, for specific anti-government and climate change CTs decreases conventional political engagement and pro-environmental intentions. Moreover, CT belief correlates with political extremism (van Prooijen et al., 2015), and generalized CT beliefs have been argued to be precursors of terrorism-endorsing beliefs (Bartlett and Miller, 2010).

Since belief in CTs has significant practical consequences, it is important to understand their associated psychological and social factors. Psychological qualities associated with CT belief include Machiavellianism (Douglas and Sutton, 2011), schizotypy (Darwin et al., 2011), anomie, political cynicism, distrust in authority, (Goertzel, 1994; Abalakina-Paap et al., 1999; Swami et al., 2011). Specific aspects of cognitive processing associated with CT belief include higher tendency to detect agency where there may be none (e.g., Brotherton and French, 2015), which is reduced by higher levels of education (Douglas et al., 2016), an effect that may be explained by the general negative correlation between belief in CTs and analytic processing style (Swami et al., 2014). CT belief is also associated with processing errors and biases – such as the conjunction fallacy (tendency to overestimate the probability of co-occurring events: Brotherton and French, 2015), and the proportionality bias (attributing larger-scale causes to more significant events: Leman and Cinnirella, 2007). However, belief in CTs has also been found to be somewhat responsive to circumstances: van Prooijen and Jostmann (2013) found that inducing uncertainty increased conspiracy belief, whilst exposure to specific CTs (e.g., concerning Princess Diana: Douglas and Sutton, 2008; and John F Kennedy: Butler et al., 1995) also increased it.

This paper offers two contributions to the study of CTs – one theoretical, based on empirical data; and another methodological. The theoretical contribution concerns the contention that CTs are 'monological' (e.g., Swami et al., 2011; Wood et al., 2012; Sutton and Douglas, 2014): belief in one CT predicts belief in more CTs, providing the foundation of generalized conspiratorial perspective. We suggest that assessing the nature and degree of monologicality requires understanding the detailed contents of a *conspiratorial worldview*. The methodological contribution flows from the theoretical contribution; it concerns how researchers can access such contents given that CT believers are a "hard to access" population (Wood and Douglas, 2015). Sustained theoretical development and empirical assessment of monologicality requires addressing the methodological access problem.

Monologicality suggests that CT thinking is a stable cognitive style, disposition or trait. This possibility was outlined by Goertzel's (1994) suggestion that conspiratorial thinking offers a general set of assumptions about authority "cover ups" which are portable across specific topics or events. Social psychology findings also suggest a "monological" tendency, whereby belief in one conspiracy predicts belief in others. CTs may thus comprise a network of mutually supporting beliefs about the functioning of the social world (Swami et al., 2011; Wood et al., 2012; Sutton and Douglas, 2014). Belief in CTs, on this account, is driven less by the specific contents of each CT and more by a general conspiratorial mentality (Moscovici, 1987) or worldview (Koltko-Rivera, 2004), whose main tenet involves rejection of official explanations. This suggests that CT belief does not arise from inferences drawn from a set of observations, but rather from applying a conspiratorial worldview to those observations. Indeed, Goertzel's (1994, p. 739) original suggestion was that monological CTs expressed a "closed" mind, unlike "dialogical" belief systems, which "engage in a dialog with their context." He also suggested that CTs need not be monological – some may be dialogical, if they are open to facts and disconfirming evidence.

Similarly, Sutton and Douglas (2014) pointed out several related problems with monologicality. The idea that CT belief indicates closed mindedness is contradicted by its correlating with openness to experience (Swami et al., 2010). The idea that CT believers are politically cynical is contradicted by the finding that CT belief sometimes correlates with support for democratic principles (Swami et al., 2011). Moreover, people can hold mutually contradictory CT beliefs, suggesting that monologicality is less driven by the CT accounts *per se* than by a more general belief in the deceptive nature of official explanations. Monological explanation also lacks parsimony, since third variables (e.g., personality traits) may affect belief in various conspiracies, creating spurious correlations between them.

Pursuing these issues, we contend that previous discussions of monologicality have had little to say about the *contents* of a putative conspiratorial worldview. They typically sample members of student and general populations using questionnaires to investigate their degree of belief in CTs formulated as vignettes by the researchers: monologicality is defined as the degree of correlation between belief in multiple CTs. Such correlations are then correlated with other

psychological variables, offering an important picture of the structural landscape of CTs and those variables, as noted above. However, it is a landscape that is only sparsely populated by people's concerns and the contents of their beliefs. Most social psychology research on monologicality in CTs is thus deliberately content-free, offering little account of the symbolic resources – worldviews – people draw on in constructing CTs and their use in everyday sensemaking [exceptions include Byford's (2011) critical account of CTs, and Lewis and Kahn's (2005) description of the cosmogony of CT guru David Icke]. This inattention to symbolic content is surprising given that one key function of CTs is precisely to make symbolic sense of destabilizing events, which can allow individuals and groups to cope with them.

Such past findings hint that individuals may adhere to a conspiratorial worldview to varying degrees. This might explain some of the conflicting findings indicated by Sutton and Douglas (2014). However, it remains unclear how individuals use elements of a conspiratorial worldview in sensemaking. More open-ended methods (such as semi-structured interviews) would allow participants to frame the content and degree of commitment to CTs on their own terms and out of their concrete life situations. They thereby allow finer-grained assessments of the content of conspiratorial mentality and degree of monologicality. The extent of their monologicality would emerge from their own descriptions of their beliefs rather than from interpreting their endorsement of a series of pre-determined items. And further insight would be gained into the symbolic foundations of a conspiratorial worldview. For example, epistemically, does a person believe all of the CTs they believe in the same way – the same level of conviction, responding to the same kinds of doubts about societal events and threats, offering similar degrees of uncertainty management? And ontologically, do the CTs all draw on the same everyday commonsense ontology, or do they posit entities or properties that go beyond the everyday, perhaps positing a role for the supernatural?

However, any such research project is confronted by the "access problem": Wood and Douglas (2015, p. 6) note, people "with a high degree of conspiracist ideation" are likely to be averse to social science research, which is often associated with universities that are "part of the problem": distrust of authority applies to universities as much as to governments and corporations. The London School of Economics, for example, takes a prominent role in David Icke's conspiracist worldview (Vice, 2012).

The possibility that not all CT believers are monological, and that those who are may ground their monologicality in contents that are not confined to distrust of authority, flows from the quasi-religious approach to CTs (Franks et al., 2013). This suggests that CTs may be analogous to religious representations, involving explanations which use representations of conspiratorial actors with supernatural or super-human degrees of agency that reflect minimally counter-intuitive departures from commonsense explanations. These representations are communicated and reconstructed as part of the social sensemaking process, as in social representations theory (Bauer and Gaskell, 1999).

OUR STUDY

Against this backdrop, we aimed to document contents of CTs and link them to their use in sensemaking and symbolic coping by different individuals. These contents constitute materials for reconstructing a conspiracy worldview, as well as the potentially different ways in which individuals might subscribe to or engage with it. According to Koltko-Rivera (2004, p. 3), a worldview is a set of "beliefs and assumptions that describe reality. A given worldview encompasses assumptions about a heterogeneous variety of topics, including human nature, the meaning and nature of life, and the composition of the universe itself, to name but a few issues." Therefore, a *conspiracy worldview* should involve positionings on issues of ontology (the nature of reality), epistemology (the nature of knowledge, what can be known), and agency (human action and free will) (Koltko-Rivera, 2004). Moreover, a specifically *conspiracy* worldview might also offer resources for self-definition, enabling believers to make sense of their life situation by positioning themselves relative to society and reality, suggesting (following Moscovici, 1987) that it involves representations of *society*, featuring distinctions between groups, especially (pure, good) ingroups and (malevolent) outgroups. Byford (2011) has analyzed the "anatomy" of CTs as narratives and identified elements including conspiratorial groups, conspiratorial plans and motifs like "manipulation of the many by the few." Additionally, a conspiratorial worldview might function as a "meta-narrative" (Lyotard, 1979) that grounds individual CT stories.

We pursued this goal in a research project featuring open-ended collection and triangulation of qualitative data (most prominently discursive productions) from multiple sources (cultural products, participant observation, and semi-structured interviews) supported by thematic analysis over the course of two and a half years (May 2013 to December 2015). Like many qualitative endeavors (Golden-Biddle and Locke, 2007), our findings emerged progressively out of this process. The main implication of our study is a tentative typology along a spectrum of conspiracy worldviews and the thematic dimensions that constitute them. This typology is informed by our empirical data as well as by theoretical insights from relevant domains of social psychology, sociology, and anthropology.

Data Collection

To investigate the detailed contents of the CT worldview, we sought to engage CT believers in interviews, and had to address the access problem, unlike past research which, in using student or general population samples, or written and on-line media, has thereby sought to circumvent it.

Recruitment of participants took place in two stages. These stages were not prospectively planned: Stage 2 emerged from the challenges arising in Stage 1. Stage 1 corresponds to a more informal, explorative moment, whereas in Stage 2, we conducted more formal data collection (interviews according to a specific sampling strategy). In Stage 1, we aimed to approach CT believers to understand the contents of their beliefs, and document some of the cultural products that circulate in their milieu (in websites, podcasts and their transcripts, books and

mass media). As might be expected (Wood and Douglas, 2015), accessing participants was not straightforward: Several direct attempts failed. Individuals contacted via website chat-rooms dedicated to CTs[1] were unwilling to be interviewed by university researchers, and one of us (MN) was subsequently excluded from those chat-rooms. Similarly, MB attempted to make contact with a CT source via a personal contact acting as middleman; contact was refused because the London School of Economics was deemed "part of the conspiratorial world." Again, MH's invitation for an interview was rejected on the grounds that the team of which he was a part were co-authors of a paper the respondent had read and considered to misrepresent those with conspiracy beliefs (Franks et al., 2013). A final example arose at a protest gathering outside the Bilderberg Group meeting in Watford, United Kingdom (June 8–9, 2013). After speaking with a participant, MN asked them to take part in an interview on CTs; this resulted in his being threatened and physically assaulted. These altercations echo the "recursive fury" over scientific analysis of conspiracist ideation (Lewandowsky et al., 2013).

We nevertheless managed to recruit one respondent for an interview via the Icke website as well as two other respondents via a personal relation of MB. All three respondents attended a presentation by David Icke at Wembley Stadium, United Kingdom. The couple was subsequently interviewed at their home abroad. We also engaged in participant observation at two conspiracy theory-related events – the protest meeting outside the Bilderberg Group meeting and a protest outside the Royal Courts of Justice in London regarding the death of Dr David Kelly (July 18, 2013).

In Stage 2 we learned lessons from Stage 1, approaching access more indirectly. We addressed two aspects of our recruitment attempts which appeared to compound the access problem. One concerned participants' perceptions of how they and their beliefs would be characterized by the research. Another concerned the participants' overall perception of the research and the researchers – their broader sense of our trustworthiness. These are often cited as key issues in accessing hard-to-reach samples in ethnography or other fieldwork (e.g., Norman, 2009; O'Reilly, 2009; Bengry-Howell and Griffin, 2012; Browne and McBride, 2015). While we did not engage in ethnography, our approach used methods frequent in such research.

Regarding the first, our experience in Stage 1 confirmed Wood and Douglas's (2015) finding that CT believers resist the label "conspiracy theory," which they take to stigmatize them and their attempts to understand the world – excluding them from "the imagined community of reasonable interlocutors" (Husting and Orr, 2007, p. 127). They instead preferred self-descriptions as being involved in "research" about how to explain unsettling events, seeking the truth about them, and thereby having an interest in "alternative explanations" or "alternative worldviews." The use of non-stigmatizing labeling during recruitment was thus essential to communicate our aim of understanding CT beliefs from the perspectives of the participants, rather than imposing a particular perspective on them or seeking to debunk them. We thus were careful to avoid the term "conspiracy theory" during recruitment and the interviews (except when participants were themselves invited to qualify or debate its meaning and application). Additionally, to enhance trust we used descriptions CT believers employed to describe themselves. Hence, our invitation described people who were "truth seekers" or "change seekers," who "have alternative worldviews and beliefs, and may be critical of mainstream media, politics, economics, religion, or society."

Regarding the second aspect, our Stage 1 experience suggested that direct contact with potential participants would be difficult, since LSE is often seen as 'part of the problem.' We thus adopted an indirect approach, via a trusted intermediary or gatekeeper, whom the participants themselves would accept as indicating our credibility. This was achieved via the webmasters of several on-line communities in the South East of England. MH asked the webmasters to place a request for participants on their community websites. Interested members then contacted MH directly to ask any questions before committing themselves to involvement and to arrange timing and locations of interviews. This ensured that the research project was first framed within a non-judgmental context which supported the free expression of participants' beliefs. Although indirect, the approach did not conceal MH's academic affiliation; to withhold this information until later would likely have suggested deception and undermined the development of trust.

Participants

We interviewed participants between July 2013 and May 2015. In Stage 1, we recruited three participants who were interviewed on July 19, 2013, in London (a 43-year-old man, hereafter R1.1), and August 4–5, 2013, and in a location outside the United Kingdom hereafter R1.2 (man, 57 years) and R1.3 (woman, in her late 40s). In Stage 2, 36 interviews took place with each of 18 participants being interviewed twice. We only report findings here from the first interview with each participant (hereafter, R1–R18), as the second interview focused on political participation in general and less on CTs. Initial interviews took place between 9 and 23 March, 2015, in Kent ($n = 2$), Central London ($n = 9$), Greater London ($n = 1$), Suffolk ($n = 2$), and via remote communication, e.g., Skype ($n = 4$). Follow-up interviews took place in the same locations in late May 2015. There were 10 men and 8 women, ages ranging from 23 to 70.

Interviews

In both stages, we used semi-structured interviews, which outlined the research purpose, after which participants gave consent to take part; interviews were conducted in English and audiorecorded. The Stage 1 interview protocol focused on respondents' personal backgrounds, on the ideas of David Icke, on religion and spirituality, and on contacts with like-minded others or non-believers. The Stage 2 interview protocol developed from Stage 1 and asked participants to describe how they came to be interested in alternative explanations, to indicate the kinds and range of CTs (if any) they believed, to reflect on the content of those beliefs and their connections with "new age" and other beliefs, and to indicate the kinds of social and political actions

[1] www.davidicke.com

and relations they typically engaged in. Interviews typically lasted 60–90 min.

Data Preparation and Thematic Analysis

All interviews were transcribed verbatim, but without detailed transcription of backchannel utterances, disfluencies, or other paralinguistic information. We employed thematic analysis to discover the range of contents produced by participants. Thematic analysis is widely used in the analysis of texts and transcripts, well-suited to exploring worldviews and social representations (e.g., Braun and Clarke, 2006; Joffe, 2012). It assesses and categorizes the kinds of meanings that are expressed, in a way that stays close to the texts themselves. Our thematic analysis combined both bottom-up, data-driven and theory-driven, top-down elements. Our method was abductive, the simultaneous ordering of data and emergence of a conceptual framework into a coherent logic that offers a productive guide for research.

Given the prior research on worldviews and CT rhetoric described above, we started from an initial list of theoretically relevant themes like "the nature of reality", "the ingroup," "the outgroup," "the self," or "sense of agency." In Stage 1, we triangulated data from several sources: interview transcripts (with R1.1, R1.2, and R1.3), blogs and materials produced by CT entrepreneurs (most prominently David Icke, e.g., a DVD recording of his Wembley event, books and web discussions) and participant observations. Subsequently, the original themes were modified (and developed into more specific subthemes) in discussions amongst the authors. The outcome was an initial, informal mapping of key themes of a conspiratorial worldview. In Stage 2, the 18 interview transcripts (R1-18) were distributed amongst AB, MB, BF, and MH, who coded the interviews individually according to the themes generated in Stage 1. This procedure suggested that while Stage 1 themes also arose in Stage 2 interviews, they could not fully accommodate the range and details of contents in Stage 2. As a consequence, over a series of meetings, we refined the Stage 1 themes to accommodate new variations that emerged. This resulted in a final list of six themes:

(A) Reality: Participants' views of reality – the causal forces in society that might sustain any CTs to which they subscribed, and whether appearances can be taken at face value or not.
(B) Self: Participants' views of themselves – their biography and any significant events by which they became interested in CTs, and their subsequent personal development.
(C) The outgroup(s): Participants' views of any outgroups defined relative to CTs – e.g., conspiratorial group(s), other non-conspiring members of society.
(D) The ingroup: Participants' views of any community or ingroup to which they belonged – e.g., other CT believers, prominent individuals who act as leaders or 'heroes' in those communities or in the promulgation of those beliefs.
(E) Action: Participants' CT-related actions – e.g., political engagement, social meetings.
(F) The Future: Participants' views of how the world will be in future – based on continuation of conspiracies or on successful challenges to those conspiracies.

In analyzing the Stage 2 interviews, the variations in the way participants talked about these themes suggested potentially different depths of engagement with the contents of the CT worldview: starting from an inkling that "things are not what they seem to be" and moving toward full endorsement of a conspiracy worldview via various stages. This observation was the basis for our typology.

RESULTS: AN ORDERED TYPOLOGY OF CONSPIRATORIAL MENTALITIES

We present results as follows. In section "The Conspiracy Worldview Reconstructed", we describe our reconstruction of the conspiratorial worldview in its fully fledged form, as an overview of our findings. In section "Typology of Individual Variations on the Conspiracy Worldview", we describe our typology of individual variations on the conspiratorial worldview, according to the themes identified. In section "Thematic Variations", we describe variations on each of the themes. Wherever appropriate, we reference individual interviews or include verbatim quotations from the interviews as illustrations.

The Conspiracy Worldview Reconstructed

A graphical summary of the reconstructed conspiracy worldview is given in **Figure 1**: this features the five main themes – the outgroup, the self, the ingroup, action, and the future, as below.

The outgroup is structured around the official narratives of events, which are illusions that hide the reality that is depicted in CTs. There are three hierarchically ordered subgroups in the outgroup. The first group is the "sheep," the masses of anonymous people who believe in official narratives. They are dormant, being sedated by fast food, popular culture and entertainment, religion, chemtrails, vaccines, and the pursuit of normative goals like money, family and the like. They are also monitored via invasive surveillance techniques. The second group is the "middle management," individuals and groups who occupy visible positions of expertise and power in society, including politicians, police, the military, business consultants, or scientists. They are responsible for maintaining the sheep in thrall, and they answer to the third group, the "evil elites" (Campion-Vincent, 2005). These latter are the actors who have true power: secret cabals acting in the shadows, controlling middle management to achieve and maintain world domination to further their own ends. Evil elites can be government organizations like the CIA or MI6, multinational corporations or conglomerates (e.g., Big Pharma), networks (e.g., the Bilderberg group), royalty, particular ethnic groups (the Jews) or even reptilian aliens.

The self is seen as on an epistemic and/or spiritual journey of discovery that can involve several stages. We distinguish five types of CT belief which correspond to those stages, with qualitatively different ways of being conspiratorially minded based on different degrees of elaboration of CT ideation; the process along them may indicate a path of conversion. Type 0 comprises individuals who subscribe to the official version of events, the sheep in the outgroup. The CT journey begins

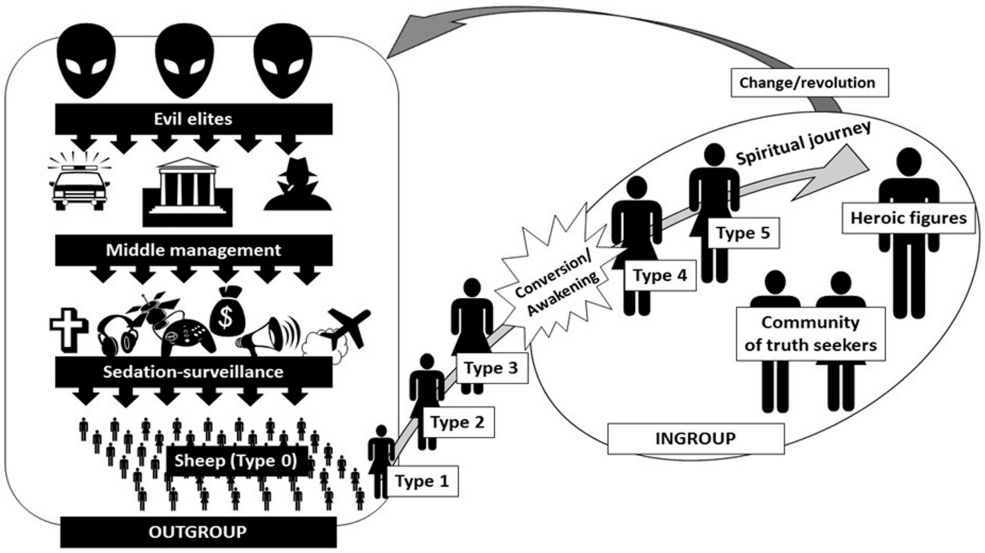


FIGURE 1 | The conspiracist worldview: an elaborate hierarchy of deception and progressive degrees of insight.

with unease with the way the world is, or a sense of being different or not fitting in. Interactions or altercations with sheep lead to the self being ridiculed or criticized, pushing him/her further out of the system and toward initial belief in specific CTs (this corresponds to Types 1–3). At some point, a conversion experience or spiritual awakening occurs, sometimes triggered by a traumatic personal experience (illness, loss of a loved one) or a public event like 9/11. It is at this point that the self subscribes to a fully fledged conspiratorial worldview, either postulating a conventional ontology of evil elites (Type 4) like "Big Pharma" or MI6 or a supernatural ontology (Type 5) like reptilian shapeshifting aliens. Types 4 and 5 are thus not differentiated by the extent of their conspiratorial belief but by the content of that belief.

The ingroup comprises individuals who have awakened to the reality behind CTs: like-minded truth seekers on similar research or spiritual journeys, sometimes acquiring an almost mystical sense of collective agency. Related to this community are leader figures or "CT heroes," varying types of individual to whom participants may have different forms of allegiance – e.g., maverick intellectuals or scientists with contra-establishment views (e.g., Chomsky), gurus like David Icke, or historical figures like Christ or Buddha. This ingroup has porous boundaries interviews typically lasted 60–90 min, with other communities (e.g., hackers or the Occupy movement). Ingroup members communicate with each other *in vivo* and on-line and sometimes engage in coordinated political action (e.g., organizing protests, joining a commune).

The fully elaborated conspiratorial worldview involves a vision of the future where change will come, overthrowing the evil elites. This may arise "naturally" from increasing public awareness of cover-ups, or from additional direct actions. So the sensemaking function of conspiratorial mentality is connected to mobilizing or demobilizing political action. The personal future of the self is entwined with this macrodestiny in that it is the culmination and vindication of the journey.

Typology of Individual Variations on the Conspiracy Worldview

The data revealed substantial variation between participants' beliefs, which forms a typology (see **Table 1**).

Type 1: Something Is Not in Order

One participant (R6) expressed this dissatisfaction with the status quo and mainstream problem solutions, a sense that the world is out of joint, and a desire to proffer solutions within commonsense ontology and conventional values. R6 explicitly disavows the relevance of CTs, not considering their potential truth or falsity: "I don't mean to make that sound like there's a conspiracy such as the Illuminati conspiracy. I am not, I don't delve into that. Just, is there an over-influence? I don't mean, I don't believe that our politicians are evil people." R6 saw themself as an "issue entrepreneur," offering a website and criteria for developing societal solutions like "regulated capitalism" with a "greater happiness index." So Type 1's unease is an entirely conventional questioning of political orthodoxies, which does not see the relevance or potential truth of CTs. No particularly high degree of epistemic uncertainty attaches to this position.

Type 2: There Is More to Reality Than Meets the Eye

Two participants (R4 and R15) expressed this dissatisfaction with the status quo and a sense that there is really more at play in the world than appears to be the case to ordinary observers. This is broadly skeptical, aiming not to make "false negative" assumptions about reality, suspending (dis)belief pending further evidence. By contrast with Type 1, Type 2 sees CTs as relevant and possibly believable: R15 says (re 9/11): "In my opinion, the

TABLE 1 | Typology of Conspiracy theorie (CT) believers leading to conspiracist worldview as a function of key themes.

Theme		Type 1	Type 2	Type 3	Type 4	Type 5
Reality		Something is not in order	There is more to reality than meets the eye	Some official narratives are not real	All official narratives are illusions	All of reality is an illusion; to understand real reality requires an unusual ontology
Self	Self-view	Outsider keeping an open mind	Outsider keeping an open mind	Outsider committed to a specific CT	Outsider relative to wider society, member of enlightened community	Outsider relative to wider society, member of enlightened community
	Self-development	Questioning process	Questioning process	Questioning process	Truth seeking Conversion	Truth seeking Conversion
Ingroup	Leaders	Identification/admiration General epistemic followership – role model researchers	Acknowledgment Interest in privileged source concerning specific topic(s)	Acknowledgment Interest in privileged source concerning specific topic(s)	Identification/admiration General epistemic followership – role model researchers	Identification/admiration General epistemic followership – role model researchers
	Community			Sense of community based on questioning	Sense of community based on shared CT perspective	Mystical sense of connectedness; a sense of having been initiated and awaken by an existential experience
Outgroup	Conspirators			Isolated outgroups	Outgroups linked in network, ordinary ontology	Outgroups linked in network, supernatural ontology
	Sheep			Do not see through specific cover-ups	"Asleep", unware of being controlled by external forces	"Asleep," unware of being controlled by external forces
Action				CT-based political action	CT-based political action; engaging with CT community	CT-based political action; engaging with CT community
The Future					Optimism conditional on revealing conspiracies: universal awakening	Optimism conditional on understanding one's relation to the supernatural: awakening for the selected few

mainstream story is a load of crap but at the same time, I can't say with any certainty what really happened. I just don't think it is as it appears . . . I can't say what has happened but I don't believe with certainty." And R4 suggests that the decision about whether to follow CTs is an active one: "We have the choice of what we will buy into," and chooses not to do so because "belief in this is pretty damned sinister," and leads "people [to] give their energy to negativity." This uses commonsense ontology and expresses uncertainty about official explanations. R15 says, "I really hate it when people shoot down . . . 'CTs' and I'm like, 'why, why, why did you shoot this down? Because BBC News told you that Al Qaeda flew a plane into a building.' That to me is the definition of narrow-mindedness. I mean I don't know what happened, I have no idea what happened . . . I can't say with any certainty this did happen and this didn't happen." R15 explicitly juxtaposes a potentially believable specific CT with unbelievable general CTs: "Like 9/11, I think it is perfectly reasonable and not crazy to say that one is suspicious of the mainstream story and that's fine most people can get on board with that. The minute you put David Icke into the mix with his Reptilian nonsense, you are then devaluing a whole field." R4 also expressed open-mindedness about CT and non-CT explanations: "that middle zone of 'I believe it and I don't believe it.' I don't have to come down to one side or the other." Type 2's unease thus runs deeper than Type 1, accepting the relevance and the possible truth of specific CTs.

Type 3: Some Official Narratives Are Not True

One participant (R10) expressed this view, advancing a CT to address one specific issue, but disavowing generalized CTs. This CT used commonsense ontology and assumptions to explain the behavior of specific conspiratorial agents. R10 suggested that "chemtrails" produced by aeroplanes have not been satisfactorily explained; following investigation, R10 suggests it may connect to weather manipulation, but believes there is a cover-up. For R10 this CT belief has no monological extrapolation: for example, of the Illuminati, and New World Order, they say: "I don't know. I'm not too familiar with that. I don't really know what I believe about that." However, the general uncertainty is not ameliorated – other conspiracies could be possible, though there is no clear evidence either way. For R10 this is because of a lack of accurate information: "If you are going to have a society where a lot of truth isn't told and if there are outlets for truth-tellers why would you allow that? It would be so easy to create a misinformation site to discredit that," created by "people who are currently in control of society." This lack of trust in authority and its explanations does not generate monologicality: CTs apply to specific cases but are not the default frame of reference In Type 3, but even more in Type 4, participants indicate increasing concern with the deceptive nature of official narratives (Sutton and Douglas, 2014).

Type 4: All Official Narratives Are Illusions: The Mainstream versus Reality

Several participants (R2, R8, R11, R12, R13, R14, and R16) expressed this monological conspiratorial worldview as a default frame of reference. This uses commonsense ontology of conspiring agents with, as the quasi-religious account of CTs (Franks et al., 2013) suggests, a minimally counter-intuitive understanding of their actions and agency; ordinary people and groups able to control things which are usually seen as outside human control, e.g., financial markets, climate change and variation. Supernormal agency in specific areas is ascribed to normal actors. Analogous religious representations (e.g., Sperber, 1996; Boyer, 2001) involve uncertainty because their implications are not fully processed – for example, in the Roman Catholic Mass the wine is simultaneously wine and the blood of Christ (Franks, 2003). The uncertain but potentially malign qualities of authority agents supports a mistrust of authority. For example, R2 aims to develop a "unifying theory of political economy," to explain financial crises and governments' complicitness in them, and explain 9/11, where "what can't be true is an official story"; this lack of trust extends to official 'false flags' regarding other CTs by R2 (e.g., the murder of JFK on November 22, 1963, or the Charlie Hebdo attacks of January 7, 2015). R11 mirrors this pattern: one CT – the legal issues surrounding the United Kingdom's decision to go to war in Iraq in 2002 – is used as the paradigm case for generalizing to others (e.g., 9/11/2001, 7/7/2005), so that ultimately, "we can no longer trust our government." Hence, a monological lack of trust in official sources generates widespread CTs.

Type 5: All of Reality Is an Illusion: The Ontological-Symbolic Turn

Several participants (R1.1, R1.2, R1.3, R1, R3, R5, R7, R9, R17, and R18) expressed this fully fledged conspiratorial worldview. However, unlike Type 4, at least some of the key agents hypothesized go beyond commonsense ontologies to supernatural explanations incorporating non-human agents or human agents with non-human lineages. R1, following David Icke, speaks of alien reptilian entities which "feed on fear and lower energies which is why there is again a certain control because they are manipulating the planet." R5 refers to contacts with UFOs, and a controlling human "cabal" originating in non-human aliens. R7 also refers to controlling aliens, but does not suggest these are reptilian nor any human contact with them. Such entities are able to demonstrate control via capacities that go beyond the human – an ontology of supernatural entities possessing supernatural agency. Whereas for Type 4 there appears an essential connection between the espoused CTs and their monological generalization, for Type 5 there is no such connection; instead, what guarantees monologicality is the appeal to an ontology populated with supernatural agency which permeates all important areas of life. Here we hear of the lizards and shapeshifters who control things behind the scenes. The distrust of authority may be a consequence rather than a cause of monologicality. The all-embracing explanation renders the CTs immune from doubt. Nor do they answer to publicly available empirical data in the way that Type 4 at least has the scope to do. As R1 comments, "It doesn't matter if you think, 'oh this guy that everybody is talking about is absolutely nuts,' because it is part of my journey of understanding my existence."

Summary of Typology

Several key points arise from this typology. First, not all CT belief is monological – it is possible to entertain or believe in single CTs (Types 2 and 3) but reject others and not subscribe to a full-blown conspiratorial worldview (Types 4 and 5). Second, some monologicality may derive from a lack of trust in official explanations (Type 4), but other cases derive from an all-encompassing supernatural explanation of reality (Type 5). Third, overlaying this typology appears to be a curvilinear pattern of degree of epistemic certainty. The end-points of the typology express epistemic "closure" or certainty. Types 0 and 1 involve an acceptance of the commonsense ontology of agents and causes that frame official narratives. Type 2 uses the same ontology but adds doubt in questioning whether all official narratives are true. Type 3 offers more doubt in explicitly distrusting specific official narratives, but expresses closure in adhering to single CTs. Type 4 involves generalized distrust of official narratives, introducing doubt as part of an overarching conspiracy worldview. Type 5 involves a supernatural ontology that reframes official narratives in its own terms – here, distrust of authority is framed by a lack of doubt about how to explain its untrustworthiness (i.e., the supernatural ontology). Such a general curvilinear pattern of epistemic certainty suggests that CTs are likely to succeed most clearly in symbolic coping or anxiety reduction when they are part of a monological worldview – single CTs seem likely rather to exacerbate anxiety. Fourth, Types 4 and 5 participants expressed complex sets of interconnected beliefs in which there was no blanket rejection of authority or embracing of all CT-supporting evidence – they were suspicious not only of authority but also (though to a lesser degree) alternative explanations; moreover, beyond merely denying authorized explanations, they advanced complex narratives about the interconnections between specific conspiracies (e.g., using the differentiation of the outgroup in **Figure 1**). The worldview that underpins monologicality, for our participants, goes beyond the denialism or "closed" mind (Goertzel, 1994) often expressed in the literature. Our observations thus suggest that monologicality is not a defining feature of belief in conspiracy, but a variable end-point on an escalating spectrum of conspiracy-mindedness.

Thematic Variations

Reality and Ontology

Sutton and Douglas (2014) suggested that a potential underlying feature of monologicality is the deceptive nature of official narratives. This corresponds in our interviews to different positions on the nature of reality. Broadly, the nature of reality is unproblematic for Types 0–3 participants, even though uncertainty is expressed as to some anomalies. Some Types 4 and 5 participants expressed variations on the theme that the fabric of everyday reality is an illusion which is intelligible only to the selected few, similar to the Platonic cave allegory (R16) or films like "The Matrix" (R16). Some (Type 5) opined that "real" reality is beyond the three-dimensional world of the five senses, to be sensed by engaging in practices like meditation or reiki (R10 and R16). Such engagement involves mystical experiences like feeling energy flows or developing a collective consciousness: "in what the Vedics call the Cochic record, the cloud hard drive in the sky that we all share, so each of us has a folder in that hard drive that we record our memories, thoughts and feelings and emotions and whatnot. And as long as you're in this life form and you're held with the five senses in the three dimensions in the time-based worldview, then all you can ever recall is anything you've written in your own folder. But at some point you become capable of receiving information from the whole cloud" (R17).

Self-view and Self-development

Many participants explicitly rejected the label "conspiracy theory," corroborating findings of Wood and Douglas (2015). This rejection was independent of participants' positioning in the typology. Some suggested the label is used to deliberately undermine alternative explanations, since it categorizes together both "reasonable" alternative explanations using everyday ontologies for single events and more complex conspiratorial narratives using more novel ontologies (e.g., R1.1, R5, and R11). The evident oddity of novel ontologies is used by association to undermine reasonable explanations (see Husting and Orr, 2007). The CT label may also diminish the force of the argument by shifting the focus onto the credibility of the CT believer (R10, R11, and R7). R15 suggests, "I think unfortunately, these things do get lumped together, these alternative viewpoints or CTs, everything gets lumped together. And when you have got some crazy man like David Icke spouting nonsense all the people who are then saying quite sensible things, all get lumped together as loony, tin-foil crazies." One suggested the label 'conspiracy theory' was coined by the CIA in the 1950s to discredit people inquiring into governmental "black ops" activities (R2). Another suggested the label was a way to shut down a potentially illuminating conversation: "It's become . . . a weapon to close down the conversation. "Oh, so you believe in CTs, do you?" Where can you go with that? Quite often it's a putdown" (R1.1). As a consequence, participants preferred to describe themselves as researchers who are "seeking after the truth" or knowledge, or developing alternative explanations (R8, R1, R15, R9, R13, and R11). As R11 says, "I am always after the truth. It's probably why I am considered a conspiracy theorist."

When asked how their interest in alternative explanations began, many cited a gradual progression based on a combination of personal issues and "projects," which had been expedited by their experiences of major public events. Types 4 and 5 participants referred to early experiences of being different (R1.3), traumatic personal experiences such as severe illness of self or a close other, or bankruptcy and homelessness (R3, R12, R13, R9, R18, and R11); some reported specific exceptional episodes such as out of body experiences, experience of UFOs and aliens (R9 and R16). Against this backdrop of general questioning of reality, specific public events were often referred to by Types 4 and 5 participants as catalysts for their interest in CTs – e.g., 9/11/2001 (R2: "9/11 did it for me"; R17, R12, R7, and R11), the financial crash of 2008 or the Iraq War (R2 and R7).

Some participants (independently of type) referred to family problems and enmeshing social relationships (R7 and R4), and others to an interest in meditation and psychological processes

(R5, R10, R1, and R3). These appear to have progressively triggered questioning of received explanations. For some, this generated an intensive interest in philosophical questions or 'mysteries' (R7, R16, R4, and R10) – e.g., R16 wanted "to be part of the 1% that understands Plato's cave."

These findings are striking: to understand why CT thinking is "sticky" (i.e., an attractive and persuasive way of thinking, which resists change), we may need to consider not only its content and role in individual and social anxiety reduction. We also need to consider how CTs emerge from the personal-development, epistemic and social-political "projects" that first led people to consider alternative explanations. Some such projects suggest a gradual process punctuated by "conversion" episodes leading to Types 4 or 5 monological outcomes, consonant with the quasi-religious approach (Franks et al., 2013).

The Outgroup: The Conspirators and the Majority

Participants described a structured outgroup. Types 2 and 3 participants typically referred to only two subgroups: the conspirators and the controlled majority. They also expressed uncertainty about whether the conspirators really performed all of the alleged actions. Thus, R15 (Type 2) suggested a role for United States governmental and military organizations in covering up their own deliberate engineering of major events (such as Pearl Harbor, 9/11) to deflect attention away from their real activities and to legitimize attempts to further extend their reach. R10 (Type 3) mentioned that some people have beliefs about the Illuminati aiming to establish a New World Order, but "I'm not really sure."

Greatest differentiation of the outgroup was offered by Types 4 and 5 participants, who differentiated three subgroups: the wider controlled, non-agentic class who believe in conventional explanations ("sheep" in **Figure 1**), plus two parts of the "ruling class." The "evil elites" (**Figure 1**) are hidden agents who define the ends and nature of the conspiracies, and the mid-level proximal agents ("middle management" in **Figure 1**) are observable actors that provide the means for the elite groups' ends and promulgate the authorized explanations.

This results, for some (R1, R3, and R12), in a society managed by fear. Middle management (e.g., governments, armed forces, police and the "Big Four" accounting firms) engage in conspiracies that are understood by ordinary conventional explanations, using everyday ontology and possessing commonsense qualities (Type 4). But these are merely the agents of the real elite. R3 suggests that governments are "puppets," the police are "minions" and the real rulers are in the shadows. Others gave examples of conspiracies – e.g., in dealing with pedophilia in establishment circles, the United Kingdom Prime Minister was sidestepped (R14), and one or two figureheads from middle management were "sacrificed," allowing allow the evil elite to maintain its conspiracies whilst giving the appearance to the sheep of rooting out the culprits (R1). Middle management is thus a buffer against real change, even when apparently held to account.

The true evil elites are hidden from view, possessing qualities that depart from ordinary ontology to varying degrees, often viewed as shadowy entities with mythical histories. Most are understood in terms of powerful families with associated bloodlines or religious dynasties with associated forms of initiation and membership, such as the United Kingdom Royal Family, the Rothschilds, Rockefellers, Bushes, Clintons, all of whom are interconnected with the Holy Roman Empire, Saudi Arabia (R16, R2, R9, R13, and R12), or the Illuminati (R1 and R5). Together they form a "structural power elite, with interlocking structures" (R2), closed to all outsiders. They share an aim for self-replication in the pursuit of power and the maintenance of control – at any cost to human life.

As R17 comments, "fish rots from the head downward": evil elites control the establishment, setting up educational, industrial, financial, and governmental institutions to serve their malign aims in controlling what the sheep do and believe. In Type 5, the account of evil elites appeals to non-commonsense ontological assumptions about agents – e.g., the elite really are "reptilians" (R1), directly expressing Icke's "alien lizard" iconography (Lewis and Kahn, 2005); or they have a lineage in other alien life forms and UFOs (R5, R7, and R17). For some, this issues in the sweeping metaphor that "earth is a slave ship" (R5) or a "prison planet" (R1) controlled by those aliens or their descendants.

When talking about the sheep, Types 4 and 5 participants in particular referred to middle management's "sedation" of the populace – e.g., via alcohol, entertainment (football, TV, the royal family, fast food), and having to work hard and be self-interested in order to make a living (R1.1, R12, R9, R3, and R7). As R7 put it, "Yeah, you know the 'normies' is what I call them, people going to work, doing their job, not questioning anything, but all they're doing is spending money on the system and keep it circulating so that banks are corporating the money." The sheep are thereby happy to be part of a passive, ignorant "herd" or "hive" (R9, R13, R14, and R12), leading to a state of "collective unconsciousness" (R9). Interactions with sheep about CT-related topics often led to conflict or ostracism (R1: "try to ridicule you and try to convince you that you have lost the plot"), requiring them to be circumspect in raising such topics (R1.1: "Most of the time, people don't want to listen, you have to get people into a certain mental space for them to listen properly") or even to progressively avoid them.

All participants referred to the mass media as a significant part of the control process: filtering information, leaving out important issues and presenting infantile, sound-bite journalism and entertainment (R1, R3, R4, R5, and R10). The media sets the agenda for what can and cannot be discussed; as R15 put it, the "dog doesn't bark, the journalistic machine doesn't work, politics is broken", perhaps because as R5 notes, the mass media worldwide are "controlled by the same three or four organizations." However, alternative media may be no more reliable: "I would say for every conspiracy theory 'theory,' there's an equal number of misinformation sites" (R10).

The ingroup: Truth Seekers, Awake and Connected

Regarding ingroups, participants reported a mixed picture, independent of CT type. Developing CT interests, for some, created difficulties in their relational ingroups: family, friends, or colleagues mocked or discredited their views (R1, R7, R14, R18, R3, and R15), leading them to be reluctant to discuss the issues

with them. This led some to seek social contacts with other people interested in CTs. Their on-line and *in vivo* contacts generally involved developing alternative explanations (R3: "helping you connect the dots by talking together"), by talking with like-minded people who are critical, open-minded, anti-establishment and well-read (R2, R10, R14, and R15). The social connections are key to reinforcing, rehearsing and maintaining CTs, with some noting that group membership had made them "more convinced" of CTs (R7), perhaps because it "keeps you knowing" (R14).

What connects the CT ingroup is that they are all truth-seekers, and "It's wanting a fair and just society, and what wakes people up? I don't know, you are either asleep or awake because once you are awake, you can't ignore it" (R12). The metaphor of truth-seekers being "awake" (a recurrent motif in Icke's writings) compared to the "sleeping" sheep, was widespread (R1, R2, R4, R9, R10, R12, and R14). Other expressions also differentiated the ingroup from the controlled class – "we" have greater "awareness" (R3, R5, R8, R13, R14, and R17), or "our" eyes are "open" and theirs are closed (R3, R7, R9, R15, and R18). As with all in-group communication, the informational and the affiliational overlap (Enfield, 2006). There were two significant aspects to this. First, participants refer to the groups as offering a "community" (R17, R3, R4, and R8), a "spiritual side" (R8) which supports collaboration and connections that "express humanity," helping people to "wake up, get back to connecting rather than atomized" (R4). Second, for some, the group offers a sense of positive, collective agency, which could substitute for the failed or inappropriate agency of governments and media. In the groups, they "realize that we are more than we think we are collectively" (R17), and "collectively there's a quickening, raising of awareness, things ain't right" (R17), so that the group identity has the common denominator of a positive outlook in the battle for social change (R4). In the groups, R14 suggests, "you feel like you could make a change because everyone felt like that, we could make a change because we have the power because we are the consumers. We could break down the 1% if we all agreed". More succinctly, R5 expressed this as "we are a supreme minority, but growing."

Although our Types 4 and 5 participants all saw themselves as connected to communities or groups affiliated around a general CT stance, Type 5 added a pan-human dimension based on their spiritual beliefs: "We are an organism collectively" (R17), or 'I believe that somehow we are all connected universally." Some saw this as the origin of their beliefs (e.g., R5: "I get these knowings. I know things is all I can say and I guess it comes from some sort of universal collective wisdom"), or as a basis for understanding themselves (e.g., R1: "It's like everybody is on the same journey, same path, but people are at different stages").

But group membership also brings the possibility of schism, and two participants expressed unhappiness at the restrictions of previous groups. One indicated disenchantment with the Occupy Movement, which led them to be less active in meet up groups, and to limit interaction to only "talking" to national and international groups, principally on the internet: (R2). Another (R9) was frustrated that the meet up group's committee structure "paralyzed" discussions, effectively censoring the range of CTs and issues canvassed.

One key aspect of reinforcing beliefs and norms, and supporting ingroup coherence, is the relation between a group and a leader (Haslam et al., 2011): more successful (and more positively evaluated) leaders are often seen as highly prototypical or ideal members of the ingroup. Our participants had a highly developed sense of who were the prototypical – leading – truth seekers, and often deferred to their knowledge and referred to them in discussion. Some were domain-specific – "maverick" scientists with expertise in areas like chemistry, physics and archeology (R2, R9, R10, and R18), or economics and politics (R1, R2, R13, R6, and R14); such references often used rhetorical devices indicating the arcane knowledge at stake and positioning the CT believer relative to the interviewer: for example, "have you heard of . . .?" (R2). Others – particularly Types 4 and 5 – were more general, identifying with or admiring a key figure as a prototypical truth seeker or CT researcher; many cited David Icke as an inspiration in uncovering conspiracies long before other people (R1.1, R1.2, R1.3, R1, R2, R3, R5, R8, R16, and R17). For example, R3 suggested that David Icke "caused me to expand my way of thinking and join dots and put this and that together." However, some acknowledged mixed feelings about the respectability of some of his material (R9 and R17), even though "not one of his books has ever been challenged or faced with a law suit" (R5). Others also cited figures from popular culture (e.g., Russell Brand: R10, R12, and R14) or those who run CT-focused internet sites (e.g., Alex Jones: R1, R6, and R9). Some also referred to historically "great figures" who revealed hidden wisdom – marking the lineage of the ingroup as part of a long history of being critical of and vilified by the mainstream: the Buddha (R1 and R3), Jesus (R3), Gandhi (R1 and R14). Others cited major intellectual figures, again indicating the apparent reasonableness of their own stance: Orwell (R1 and R17), Marx or Chomsky (R13). Participants typically cited individuals who have accepted the threat to worldly status associated with challenging the status quo, making what Henrich (2009) calls CREDs (credibility enhancing displays) in which CT declarations gain extra force by their declarers' paying the costs of exposure to public opprobrium. Public vilification amounts to proof of concept. Such people are therefore respected for epistemic reasons but also admirable for personal and moral reasons. This is another aspect of the conspiracist worldview consonant with quasi-religiosity. Interestingly, whilst most of our participants expressed admiration for fearless researchers and respect for their empirical work, the strategy of placing *oneself* in such an illustrious lineage (epistemic and personal identification) was used only by participants of Types 4 and 5 and Type 1 (R6) – evidently, for quite different rhetorical and epistemic reasons.

We note three implications of deference to CT leaders: first, it is selective – CT believers employ many information sources, and few accept everything the leaders promulgate (they retain a degree of criticality even about their heroes); second, they are conscious of those leaders' public credibility and of the need to persuade others of the reasonableness of their own stance. Third, such deference varies according to CT type.

The connection with other believers in CTs (whether in promoting ingroup identity or developing ingroup schisms) challenges the notion that CT belief is inherently socially

disengaged: rather, there is a sense of wanting to re-make society and the inchoate hope that being involved with other CT believers may contribute to this.

Political Action

Our follow-up interviews in Stage 2 took place just after the time of a United Kingdom General Election in 2015. When asked, 13 participants reported having voted in the election (and voting/not voting was not connected to particular CT type). Participation in other forms of political activity was varied and unconnected to the typology. Some talked of general, sweeping political aims. For example, R7 asserted, "Political systems in every country need to be abolished and redone," whilst R4 mentioned the aim to "transform representative politics into enactment politics" – direct action replacing voting. Others engaged in more specific activities – for example, attending meet ups (R3 and R17), setting up websites (R6) or writing books on relevant topics (R3 and R 6). Whereas some were involved in organizing demonstrations and meetups (R12 and R17), others expressed a sense of powerlessness concerning political action (R11, R16, and R15) – for example, taking part in demonstrations is the least effective form of political action, and so is encouraged by governments: "if you can get people marching, demonstrating, protesting, it keeps them focussed on ineffective action. And the real effective action is financial action, legal action or political action, but none of that happens if they go on a demonstration" (R11). Others suggest that the potential for successful political action is vitiated by the very nature of the ingroup (R2, R9). For example, R2 stated, "my main frustrations with Occupy and all these other activist organizations that we could quite easily win if we addressed and stuck to the main causes. In other words we presented a coherent narrative but you have all these demonstrations talking about symptoms and they never come together and so they are ineffectual in that sense." Taken together, this theme suggests that embracing CTs does not necessarily entail political cynicism or disengagement from all democratic processes; rather, CT believers appear potentially engaged in politics and citizenship but skeptical about the available means in conventional politics. Thus, the conspiratorial worldview might relate to *prefigurative* political or social mobilization, in particular the imaginary construction of "alternatives," with little account of detailed means for achieving that goal (see Yates, 2015).

The Future

The question of the future concerned the degree of optimism about possible personal and collective change. The broad pattern was intuitively paradoxical: the more monological our participants were, the more optimistic they seemed to be, though that optimism was contingent. For Type 4, a non-conspiratorial future was contingent on the discovery and public knowledge of the conspiracies in the political world: when everyone wakes up, the political world would be transformed into a non-conspiratorial world [paralleling Byford's (2011) "naïve optimism"]. For Type 5, the positive future was more contingent on individuals coming to understand their relation to the supernatural forces that govern the universe: self-discovery allows coming to terms with those forces, though not thereby removing the supernaturally based conspiracies. Monologicality thus leads to the possibility of major future change. By contrast, those with a less monological worldview tended to be less optimistic about the future, because each conspiracy must be assessed and challenged on its own terms. Type 3 participants, for example, see the likelihood of change as restricted by the reality of specific, concrete conspiracies and their entanglement with power relations.

DISCUSSION

Monologicality and the Spectrum of Conspiratorial Worldviews

Monologicality designates the empirical tendency for belief in one CT to be correlated with belief in others. Explanations of monologicality often invoke a nomothetical or "closed" mindset (Goertzel, 1994) whereby mutually supporting beliefs about the nature of the world are used to interpret public events as conspiracies. But research on monologicality typically has little discussion of the content of beliefs and reasoning from the standpoint of the CT believers. This in part arises from the access problem (Wood and Douglas, 2015): CT believers are averse to being researched because they often distrust researchers as "part of the problem."

Our study investigated the symbolic resources underlying monologicality by reconstructing a conspiracy worldview – an escalating set of beliefs held by CT believers about important dimensions of ontology, epistemology, and human agency (Koltko-Rivera, 2004). To do this, we analyzed media documents, conducted field observation, and engaged in semi-structured interviews, using a variety of strategies to overcome the access problem. We described six main dimensions of such a putative worldview: The nature of reality and its ontology, the description of self, the outgroup, the ingroup, action, and the future. Patterns of positions on these dimensions led us to construct a typology of five types of escalating CT believers. Our findings converge with prior explorations of the content of CT beliefs: Some are similar to Byford's (2011) generic "anatomy" of CTs, derived from the analysis of documents, cultural artifact and mass media sources. However, we also discovered novel aspects of the conspiracy worldview. Perhaps most surprising concerned the ingroup, which was structured and subtle, embracing both epistemic and affiliative dimensions. Byford does suggest that from the 1960s onward, "conspiracy theory became a call to mobilization, inspiring readers to gather 'evidence,' share it with others and become part of a community" (p.67), but there is little detailed analysis of such community. This is perhaps unsurprising, since his data sources (written outputs expressing CTs) do not offer straightforward means of assessing relations to group membership and identity. Moreover, we find evidence of a leader-follower relation, with experts viewed as "hero" researchers, fearless in their critical inquiry and uncovering of unpalatable truths. Another novel finding is the trajectory toward becoming a CT believer – a personal journey of conversion or development. For our participants, this was key to why they believed in CTs, and the type of CT to which they subscribed. Final novel aspects

of our findings concerned the connection between participants' beliefs in CTs and their tendency to engage in political action (as opposed to being disengaged from the political process), and their belief in the possibility that such action could lead to a positive future (as opposed to being cynically resigned to there being no possibility of a non-conspiratorial world).

All of these novel aspects – the sense of community, the pantheon of leaders, the personal conversion journey, the link to political action, and the optimistic future – are at odds with the typical image of monological CT believers as paranoid, cynical, anomic, irrational individuals (Douglas et al., 2016). Instead, the CT worldview may be the underpinning of a nascent social movement, prefigurative political mobilization, or at the very least an inchoate, but distributed community of engaged citizens, albeit with alternative beliefs. In this respect, our findings echo Waters's (1997) finding that African American CT believers were better educated, more politically active, and more socially engaged that non-believers. Our findings can also explain the otherwise incongruous results (Swami et al., 2010, 2011, 2014) that CT believers may be more open to experience and more strongly support democratic principles than non-believers.

Limitations

Our study has some limitations. First, the sample of interviews is rather limited in size, geographical location and political-ideological bent – all of which limit generalizability of our findings. We interviewed only a small number of people and mostly in the South East of the United Kingdom. Perhaps the most serious is the political bent: the majority of our participants were on the left of the political spectrum, self-identifying as interested in "alternative" explanations. It is unclear to what degree the elements of the conspiratorial worldview would hold equally for a similar sample of the milieu on the political right. Is the CT worldview of right-wing CT believers fundamentally different? There is little research on this issue, but some data suggest that it may not be. A report on the right-wing milieu in Germany commissioned by the Amadeu Antonio Foundation (Rathe et al., 2015) suggests that many elements may be similar; other analyses also suggest that right-wing conspiracy worldviews are analogous in their ingredients to what we have documented, although they may focus more systematically on Zionism in their characterization of evil elites (Byford, 2011; Imhoff, 2015).

The small sample suggests caution in a specific aspect of our interpretation: most of our participants cluster in Types 4 and 5, and fewer in Types 1–3. As noted above, our data coding combined both bottom-up, data-driven elements (hence all of the novel findings above), and top-down, theory-driven (or past findings-driven) elements. The latter grounds our postulation of Types 1–3: they are internally consistent patterns of response to destabilizing issues, which reflect different degrees of dissatisfaction with official stories. They also allow us to make coherent the idea of a conversion-related trajectory from skeptical conventional thinking (Type 1) through specific CT beliefs (Type 3) to monologicality (Types 4 and 5).

Notwithstanding this, our findings broadly converge with Byford's (2011) analyses based on a broad set of political documents and commentary, with perhaps those concerning the sense of community afforded by CT believers and the nature and role of Type 3 requiring further empirical substantiation.

Accessing CT Believers and other Methodological Issues

Our research approached the problem of gaining access to CT believers using methods from ethnography in two ways, both of which are time-consuming and painstaking. One was to gain trust of participants during recruitment by avoiding stigmatization through terms like "conspiracy theory" and adopting an open-minded attitude to their beliefs. The second was to increase the credibility of the research team by recruiting participants via gatekeepers who were themselves already in a position of trust.

Our results suggest that findings of quantitative, questionnaire-based studies of CTs may benefit from being supplemented by qualitative studies that seek to uncover nuances of the contents and social implications of CT belief. In this way, a rounded view of conspiratorial worldviews may be achieved. Content-wise, the kinds of CTs offered for assent or dissent in questionnaire studies typically fall under our Type 3 or Type 4, which deploy everyday ontology often with specific claims of supernormal agency on the part of the conspirators. The result is a classic, negative monologicality. There is, interestingly, little quantitative investigation of possible CTs *based on* supernatural ontologies, though CT belief itself has been found to correlate with non-conspiratorial supernatural beliefs (Darwin et al., 2011; Swami et al., 2011).

Conspiracist Worldviews and the Quasi-Religious Approach to CTs: Research Directions

The quasi-religious approach to CTs (Franks et al., 2013) suggests that CTs can – to differing degrees – function in a manner analogous to religious beliefs, which may suggest that some CT belief should correlate with actual religious or supernatural beliefs (as for Type 5 participants). Belief in CTs might more generally be based on the form of religiosity called "quest" (Batson et al., 1993). This reflects a search after meaning that poses existential questions, regards doubting and skepticism as positive forces, and allows that answers to those questions may be tentative and partial – perhaps connecting to agnosticism (e.g., Donahue, 1985), or a cognitive style expressing symbolic doubt, rather than a specifically religious motivation (e.g., Neyrinck et al., 2010). For many of our participants, this is apt: CTs and alternative explanations are a secular "quest," which may or may not end in belief in supernatural ontology (Type 5) or in ascribing exceptional agency to conspiring groups (Type 4).

So in our view, monologicality may be less a defining feature of believing in CTs, but rather a variable consequence of the set of CTs believed. To the extent that the set of espoused CTs grows, a degree of monologicality may emerge – but built on two foundations. One is a negative claim (rejection of official explanations, as in many past findings), and the other is a positive claim (Type 5 imputing of supernatural agents with exceptional agency, or Type 4 imputing of exceptional control or power to the conspiratorial group (Franks et al., 2013; Douglas et al., 2016).

Together they express a clear conviction of our participants – that CTs may not merely express cynicism and disengagement from the status quo, but also involve positive attempts to understand and explain events leading to prescriptions for political action.

Secondly, the approach also offers a substantive view of how people can represent apparently contradictory CTs (see Wood et al., 2012). As for many religious representations, the element of uncertainty means that the content of CTs may not be fully explicated by believers: Types 4 and 5 CTs represent conspiring groups with greater-than-natural agency, but precisely what those qualities are and how those agents actually operate may remain unclear. Contradictions between CTs may not be detected or experienced as contradictions by believers, because the representations of the CTs do not have precise interpretations, and so do not support a sharp sense of conflict. They may thus permit coexistence of apparently contradictory knowledge systems (Legare and Gelman, 2008) or cognitive polyphasia (Jovchelovitch, 2006; Falade and Bauer, 2017), in which aspects of conventional and conspiratorial worldviews offer complementary, rather than competing explanations of destabilizing events.

Thirdly, our findings and the quasi-religious approach suggest further investigation of the active social cognitive processes of 'bricolage' of CT beliefs (e.g., how far they follow the heuristics suggested by Sunstein and Vermeule, 2009) – since CT believers are not only choosy with the contents that they draw from official sources, but also with content from alternative sources.

Fourthly, as noted our typology requires further investigation: how robust is it across participants with different demographic and political profiles? And, delving inside it, are there quasi-religious conversion processes from Type 1 where the world seems out of joint to Type 5 where reality is perceived as an illusion and an alternative ontology is invoked? What psychological processes lead from domain-specific distrust of authority (Type 3) to domain-general distrust (Type 4): when and why does the request for positive reasons to trust official explanations transition into an assumption that no reasons can be provided? It seems likely that group membership plays an important role here; this is a core feature of our Types 4 and 5, but is absent from the others. When and why does dissatisfaction with ordinary explanations (or with general CTs using ordinary ontologies – Type 4) transmute into the positive espousal of alternative ontologies in monological CTs – Type 5? This may have its root in the specific type of inquiry that characterizes the person's quest – for example, a more political issue of control versus a more personal issue of identity. Answering such questions may require longitudinal studies focusing on the personal developmental trajectories – in biographical–idiographical terms – of CT believers.

Fifthly, the social and inter-group relations also warrant further investigation. The role of the internet in sharing and discussing CTs has been emphasized recently (e.g., Wood and Douglas, 2013, 2015). Our research demonstrates that the internet is also important in developing and supporting *in vivo* social relations and social group and social identity formation. CTs are not static, but rather dynamic beliefs that relate to individual life projects and to social behavior of various kinds. We found communicating about CTs can underpin definition and critique of outgroups, as in past research, but also formation of coherent ingroups with implications for social identity (Jovchelovitch, 2006). This suggests a further potentially fruitful area of research – how do such groupings form on-line and offline? How do individuals move from blogging on-line to meeting *in vivo*? What are the social functions of CTs, as well as their social consequences? What role do on-line and off-line group leaders perform in curating CT beliefs, and how do they relate to the ideas publicized by more widely known "CT heroes"?

Sixth, our findings suggest broadening the canvas of political actions relevant to CTs. Our participants held nuanced views of political action and – whilst some were cynical about its effect – most saw a requirement of their self-representation as "truth seekers" as putting forward concrete positive explanations and proposals for change.

Seventh – practically, our findings may have implications regarding addressing the consequences of CT belief. They suggest the need to consider not only the degree or strength of CT belief but also its content, in entertaining any practical measures to address problematic consequences of a CT worldview. Location of CT believers in our typology might, for example, moderate the impact of educational measures to combat potential effects of negative CTs (Douglas et al., 2016), or the engagement with CT social groups and leaders to ameliorate CT-related political extremism (Bartlett and Miller, 2010).

Eighth – methodologically, our typology might be the basis of an alternative quantitative measurement of CT mentality, one which involves the detailed symbolic resources of CTs rather than (as in more typical, Likert-like survey methods) sketches of those resources to measure their connection to other variables. Our typology is based on specific configurations of values of the key features of reality, self, ingroup, outgroup, action and the future. One construal of our Types 1 and 5 CT beliefs is that they combine the least elaborated and most highly elaborated conspiracist ideation, respectively, and between them there is a continuum of elaboration. Such a relation between a hierarchy of specific beliefs and an emergent continuum is typically discussed as a Guttman-type approach to developing a unidimensional scale for beliefs. This approach has been taken by researchers in the sociology of religion (Michelat, 1991), and might find some utility in quasi-religious conspiracy beliefs.

A final question that arises is: if at least some CT belief is not monological, how should it be described? What is the alternative to monologicality? Returning again to Goertzel (1994: p. 740), he claims, "Dialogical belief systems engage in a dialog with their context, while monological systems speak only to themselves, ignoring their context in all but the shallowest respects." We used the subsequent empirical operationalisation of monologicality as the idea that belief in one CT is predictive of belief in (many) more, and found that even our most monological participants (Types 4 and 5) were still dialogical in Goertzel's terms; that is, they utilized non-conspiratorial symbolic contents in the framing of their CTs and drew selectively and critically on both conspiratorial and non-conspiratorial evidence in their justification. Future work might investigate the

possible connections with the contrast between monological and dialogical approaches to communication (Linell, 2009), which is likely to be important to the social sense-making function of CTs, as part of understanding how CT believers manage the coexistence of conspiratorial and conventional beliefs in explaining events.

CONCLUSION

Conspiracy theories are widespread and important cultural forms of mind that enable symbolic sense making about threatening events or situations. Past quantitative research has suggested that CT belief may be monological, such that belief in one CT is predictive of belief in others. We sought to investigate the symbolic resources that form the contents of such beliefs by carrying out qualitative interviews with people who espouse them; in doing so, we developed an approach to address the difficulty of accessing the population of CT believers. Our results confirm, augment and to some degree challenge past findings, suggesting that different elements of CT beliefs coalesce to form a distinctive conspiratorial worldview, within which particular patterns form an escalating typology of CT mentality, only some of which are monological. Monologicality is thus not a defining feature of conspiratorial mentality, but only a special case. This finding and our concept of CT as quasi-religious lead to new directions for future research and possible methodological and practical implications.

ETHICS STATEMENT

This study was carried out in accordance with the ethical guidelines of the British Psychological Society. The design and protocol were approved by the Ethics Committee of the Department of Psychological and Behavioral Science at the London School of Economics. All participants gave their written informed consent. All participants gave written informed consent in accordance with the Declaration of Helsinki.

AUTHOR CONTRIBUTIONS

BF, AB, and MB developed main conceptual framework. BF, AB, MB, and MH analyzed the data. MH collected 85% of the data, and MN collected 15% of the data. BF wrote first draft and produced final draft. AB edited first draft. MB edited final draft.

REFERENCES

Abalakina-Paap, M., Stephan, W. G., Craig, T., and Gregory, L. (1999). Beliefs in conspiracies. *Polit. Psychol.* 20, 637–647. doi: 10.1111/0162-895X.00160

Aupers, S. (2012). 'Trust no one': modernization, paranoia and conspiracy culture. *Eur. J. Commun.* 27, 22–34. doi: 10.1177/0267323111433566

Bartlett, J., and Miller, C. (2010). *The Power of Unreason: Conspiracy Theories, Extremism and Counter-Terrorism*. London: Demos.

Batson, C. D., Schoenrade, P., and Ventis, L. W. (1993). *Religion and the Individual: A Social Psychological Perspective*. New York, NY: Oxford University Press.

Bauer, M. W., and Gaskell, G. (1999). Towards a paradigm for research on social representations. *J. Theory Soc. Behav.* 29, 163–186. doi: 10.1111/1468-5914.00096

Bengry-Howell, A., and Griffin, C. (2012). Negotiating access in ethnographic research with 'hard to reach' young people: establishing common ground or a process of methodological grooming? *Int. J. Soc. Res. Methodol.* 15, 403–416. doi: 10.1080/13645579.2011.600115

Bogart, L. M., and Thorburn, S. T. (2006). Relationship of African Americans' socio demographic characteristics to belief in conspiracies about HIV/AIDS and birth control. *J. Natl. Med. Assoc.* 98, 1144–1150.

Boyer, P. (2001). *Religion Explained, or Uncovering the Mental Instincts that Fashion Gods, Ghosts and Ancestors*. New York, NY: Random House.

Braun, V., and Clarke, V. (2006). Using thematic analysis in psychology. *Qual. Res. Psychol.* 3, 77–101. doi: 10.1191/1478088706qp063oa

Brotherton, R., and French, C. C. (2015). Intention seekers: conspiracist ideation and biased attributions of intentionality. *PLoS ONE* 10:e0124125. doi: 10.1371/journal.pone.0124125

Browne, B., and McBride, R. (2015). Politically sensitive encounters: ethnography, access and the benefits of "hanging out". *Qual. Sociol. Rev.* 11, 34–48.

Butler, L. D., Koopman, C., and Zimbardo, P. G. (1995). The psychological impact of viewing the film *JFK*: emotions, beliefs and political behavioral intentions. *Polit. Psychol.* 16, 237–257. doi: 10.2307/3791831

Byford, J. (2011). *Conspiracy Theories: A Critical Introduction*. Basingstoke: Palgrave MacMillan. doi: 10.1057/9780230349216

Campion-Vincent, V. (2005). "From evil others to evil elites. A dominant pattern in conspiracy theories today," in *Rumor Mills: The Social Impact of Rumor and Legend*, eds G. A. Fine, V. Campion-Vincent, and C. Heath (New Brunswick, NJ: Aldine Transaction), 103–122.

Darwin, H., Neave, N., and Holmes, J. (2011). Belief in conspiracy theories. The role of paranormal belief, paranoid ideation and schizotypy. *Pers. Individ. Dif.* 50, 1289–1293. doi: 10.1016/j.paid.2011.02.027

Donahue, M. J. (1985). Intrinsic and extrinsic religiousness: a review and meta-analysis. *J. Pers. Soc. Psychol.* 48, 400–419. doi: 10.1037/0022-3514.48.2.400

Douglas, K. M., and Sutton, R. M. (2008). The hidden impact of conspiracy theories: perceived and actual influence of theories surrounding the death of Princess Diana. *J. Soc. Psychol.* 148, 210–221. doi: 10.3200/SOCP.148.2.210-222

Douglas, K., and Sutton, R. M. (2011). Does it take one to know one? Endorsement of conspiracy theories is influenced by personal willingness to conspire. *Br. J. Soc. Psychol.* 50, 544–552. doi: 10.1111/j.2044-8309.2010.02018.x

Douglas, K., Sutton, R. M., Callan, M. J., Dawtry, R. J., and Harvey, A. J. (2016). Someone is pulling the strings: hypersensitive agency detection and belief in conspiracy theories. *Think. Reason.* 22, 57–77. doi: 10.1080/13546783.2015.1051586

Enfield, N. J. (2006). "Social consequences of common ground," in *Roots of Human Sociality: Culture, Cognition, and Interaction*, eds N. J. Enfield and S. C. Levinson (Oxford: Berg), 399–430.

Falade, B., and Bauer, M. W. (2017). I have faith in science and in God': common sense, cognitive polyphasia and attitudes to science in Nigeria. *Public Underst. Sci.* doi: 10.1177/0963662517690293 [Epub ahead of print].

Franks, B. (2003). The nature of unnaturalness in religious representations: negation and concept combination. *J. Cogn. Cult.* 3, 41–68. doi: 10.1163/156853703321598572

Franks, B., Bangerter, A., and Bauer, M. W. (2013). Conspiracy theories as quasi-religious mentality: an integrated account from cognitive science, social representations theory and frame theory. *Front. Psychol.* 4:421. doi: 10.3389/fpsyg.2013.00424

Goertzel, T. (1994). Belief in conspiracy theories. *Polit. Psychol.* 15, 731–742. doi: 10.2307/3791630

Golden-Biddle, K., and Locke, K. (2007). *Composing Qualitative Research*. London: Sage. doi: 10.4135/9781412983709

Harrison, A. A., and Thomas, J. M. (1997). The Kennedy assassination, unidentified flying objects, and other conspiracies: psychological and organizational factors in the perception of "cover-up". *Syst. Res. Behav. Sci.* 14, 113–128. doi: 10.1002/(SICI)1099-1743(199703)14:2<113::AID-SRES154>3.0.CO;2-2

Haslam, S. A., Reicher, S. D., and Platow, M. J. (2011). *The New Psychology of Leadership: Identity, Influence and Power*. New York, NY: Psychology Press.

Henrich, J. (2009). The evolution of costly displays, cooperation and religion. *Evol. Hum. Behav.* 30, 244–260. doi: 10.1016/j.evolhumbehav.2009.03.005

Husting, G., and Orr, M. (2007). Dangerous machinery: "Conspiracy theorist" as a transpersonal strategy of exclusion. *Symb. Interact.* 30, 127–150. doi: 10.1525/si.2007.30.2.127

Imhoff, R. (2015). "Beyond (right-wing) authoritarianism: conspiracy mentality as an incremental predictor of prejudice," in *The Psychology of Conspiracy*, eds M. Bilewicz, A. Cichocka, and W. Soral (London: Routledge), 122–141.

Joffe, H. (2012). "Thematic analysis," in *Qualitative Research Methods in Mental Health and Psychotherapy: An Introduction for Students and Practitioners*, eds D. Harper and D. A. Thompson (Chichester: Wiley-Blackwell), 209–223.

Jolley, D., and Douglas, K. M. (2014a). The effects of anti-vaccine conspiracy theories on vaccination intentions. *PLoS ONE* 9:e89177. doi: 10.1371/journal.pone.0089177

Jolley, D., and Douglas, K. (2014b). The social consequences of conspiracism: exposure to conspiracy theories decreases the intention to engage in politics and to reduce one's carbon footprint. *Br. J. Psychol.* 105, 35–56. doi: 10.1111/bjop.12018

Jovchelovitch, S. (2006). *Knowledge in Context*. London: Routledge.

Koltko-Rivera, M. E. (2004). The psychology of worldviews. *Rev. Gen. Psychol.* 8, 3–58. doi: 10.1037/1089-2680.8.1.3

Legare, C. H., and Gelman, S. A. (2008). Bewitchment, biology, or both: the co-existence of natural and supernatural explanatory frameworks across development. *Cogn. Sci.* 32, 607–642. doi: 10.1080/03640210802066766

Leman, P. J., and Cinnirella, M. (2007). A major event has a major cause: evidence for the role of heuristics in reasoning about conspiracy theories. *Soc. Psychol. Rev.* 9, 18–28.

Lewandowsky, S., Cook, J., Oberauer, K., and Marriott, M. (2013). Recursive fury: conspiracist ideation in the blogosphere in response to research on conspiracist ideation. *Front. Psychol.* 4:73. doi: 10.3389/fpsyg.2013.00073

Lewis, T., and Kahn, R. (2005). The reptoid hypothesis: utopian and dystopian representational motifs in David Icke's alien conspiracy theory. *Utop. Stud.* 16, 45–74.

Linell, P. (2009). *Rethinking Language, Mind, and World Dialogically: Interactional and Contextual Theories of Human Sense-Making*. Charlotte, NC: Information Age Publishing.

Lyotard, J.-F. (1979). *The Post-Modern Condition. A Report on Knowledge*. Minneapolis, MN: University of Minnesota Press.

Michelat, G. (1991). "Ce que se dire catholique veut dire – les facette de l'appartenance au Catholicism," in *Les Francais Sont-ils Encore Catholique?*, eds G. Michelet, J. Potel, J. Sutter, and J. Maitre (Paris: Cerf), 129–209.

Moscovici, S. (1987). "The conspiracy mentality," in *Changing Conceptions of Conspiracy*, ed. S. Moscovici (New York, NY: Springer), 151–169. doi: 10.1007/978-1-4612-4618-3_9

Neyrinck, B., Lens, W., Vansteenskiste, M., and Soenens, B. (2010). Updating Allport's and Batson's framework of religious orientations: a reevaluation from the perspective of selfdetermination theory and Wulff's social cognitive model. *J. Sci. Study Relig.* 49, 425–438. doi: 10.1111/j.1468-5906.2010.01520.x

Norman, J. (2009). "Got trust? The challenge of gaining access in conflict zones," in *Surviving Field Research: Working in Violent and Difficult Situations*, ed. C. L. Sriram (London: Routledge), 71–91.

O'Reilly, K. (2009). *Key Concepts in Ethnography*. London: Sage. doi: 10.4135/9781446268308

Rathe, J., Kahane, A., Baldauf, J., and Lauer, S. (2015). *"No World Order": Wie Antisemitische Verschwörungsideologien die Welt Verklären*. Berlin: Amadeu Antonio Foundation.

Sperber, D. (1996). *Explaining Culture: A Naturalistic Approach*. Oxford: Blackwell.

Sunstein, C. R., and Vermeule, A. (2009). Conspiracy theories: causes and cures. *J. Polit. Philos.* 17, 202–227. doi: 10.1111/j.1467-9760.2008.00325.x

Sutton, R. M., and Douglas, K. (2014). "Examining the monological nature of conspiracy theories," in *Power, Politics, and Paranoia: Why People are Suspicious of their Leaders*, eds J. W. van Prooijen and P. A. M. van Lange (Cambridge: Cambridge University Press), 254–272. doi: 10.1017/CBO9781139565417.018

Swami, V., Chamorro-Premuzic, T., and Furnham, A. (2010). Unanswered questions: a preliminary investigation of personality and individual difference predictors of 9/11 conspiracist beliefs. *Appl. Cogn. Psychol.* 24, 749–761. doi: 10.1002/acp.1583

Swami, V., Coles, R., Stieger, S., Pietschnig, J., Furnham, A., Rehim, S., et al. (2011). Conspiracist ideation in Britain and Austria: evidence of a monological belief system and associations between individual psychological differences and real-world and fictitious conspiracy theories. *Br. J. Psychol.* 102, 443–463. doi: 10.1111/j.2044-8295.2010.02004.x

Swami, V., Voracek, M., Stieger, S., Tran, U. S., and Furnham, A. (2014). Analytic thinking reduces belief in conspiracy theories. *Cognition* 133, 572–585. doi: 10.1016/j.cognition.2014.08.006

van Prooijen, J., Krouwel, A., and Pollet, T. (2015). Political extremism predicts belief in conspiracy theories. *Soc. Psychol. Pers. Sci.* 6, 570–578. doi: 10.1177/1948550614567356

van Prooijen, J.-W. (2011). "Suspicions of injustice: the sense-making function of belief in conspiracy theories," in *Justice and Conflict: Theoretical and Empirical Contributions*, eds E. Kals and J. Maes (Berlin: Springer-Verlag), 121–132.

van Prooijen, J.-W., and Jostmann, N. B. (2013). Belief in conspiracy theories: the influence of uncertainty and perceived morality. *Eur. J. Soc. Psychol.* 43, 109–115. doi: 10.1002/ejsp.1922

Vice, D. (2012). *David Icke: Conspiracy of the Lizard Illuminati (Part 2/2) [Video file]*. Available at: https://www.youtube.com/watch?v=qjbTBpc8-dU [accessed November 29, 2016].

Wagner-Egger, P., and Bangerter, A. (2007). La vérité est ailleurs?: corrélats de l'adhésion aux théories du complot. *Rev. Int. Psychol. Soc.* 4, 31–61.

Waters, A. M. (1997). Conspiracy theories as ethnosociologies. *J. Black Stud.* 28, 112–125.

Wood, M. J., and Douglas, K. (2013). What about Building 7?" A social psychological study of online discussion of 9/11 conspiracy theories. *Front. Psychol.* 4:409. doi: 10.3389/fpsyg.2013.00409

Wood, M. J., and Douglas, K. (2015). Online communication as a window to conspiracist worldviews. *Front. Psychol.* 6:836. doi: 10.3389/fpsyg.2015.00836

Wood, M. J., Douglas, K., and Sutton, R. M. (2012). Dead and alive: belief in contradictory conspiracy theories. *Soc. Psychol. Pers. Sci.* 3, 767–773. doi: 10.1177/1948550611434786

Yates, L. (2015). Rethinking prefiguration: alternatives, micropolitics and goal in social movements. *Soc. Mov. Stud.* 14, 1–21. doi: 10.1080/14742837.2013.870883

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 22 November 2019
doi: 10.3389/fpsyg.2019.02591

What Does Our Personality Say About Our Dietary Choices? Insights on the Associations Between Dietary Habits, Primary Emotional Systems and the Dark Triad of Personality

Rayna Sariyska[1], Sebastian Markett[2], Bernd Lachmann[1] and Christian Montag[1]*

[1] Department of Molecular Psychology, Institute of Psychology and Education, Ulm University, Ulm, Germany, [2] Department of Psychology, Humboldt-Universität zu Berlin, Berlin, Germany

OPEN ACCESS

Edited by:
John F. Rauthmann, Universität zu Lübeck, Germany

Reviewed by:
Peter Karl Jonason, Western Sydney University, Australia
Marius Leckelt, Johannes Gutenberg University Mainz, Germany

****Correspondence:***
Rayna Sariyska
rayna.sariyska@uni-ulm.de

Specialty section:
This article was submitted to Personality and Social Psychology, a section of the journal Frontiers in Psychology

Received: *06 March 2019*
Accepted: *31 October 2019*
Published: *22 November 2019*

Citation:
Sariyska R, Markett S, Lachmann B and Montag C (2019) What Does Our Personality Say About Our Dietary Choices? Insights on the Associations Between Dietary Habits, Primary Emotional Systems and the Dark Triad of Personality. Front. Psychol. 10:2591. doi: 10.3389/fpsyg.2019.02591

The awareness of the consequences of consuming animal products for the environment and one's own health has been growing in recent years. The aim of the present research project was to examine the relationship between individual differences in biologically rooted primary emotional systems arising from phylogenetically old brain areas and dietary habits including being a vegan/vegetarian or omnivore (Study 1). Additionally, the link between the Dark Triad personality traits and dietary habits was investigated (also Study 1). In Study 2 it was aimed to replicate the associations between the Dark Triad traits and dietary habits in a new sample. In total 1140 (Study 1) and 444 (Study 2) participants took part in the research project. The Affective Neuroscience Personality Scales (ANPS) were applied to assess individual differences in six primary emotional systems. The Short Dark Triad Scale (SD3) was administered to assess individual differences in Machiavellianism, psychopathy and narcissism. The eating style of participants was measured with the Eating Behavior Questionnaire (EBQ). Results of Study 1 demonstrated higher CARE, SADNESS and spirituality scores, and lower PLAY scores in vegans/vegetarians than in omnivores. However, after the sex of the participants was included in the model, the effect on CARE got weaker. Additionally, omnivores scored higher on Machiavellianism, however, this association disappeared when sex was added to the model. In Study 2, higher scores in Machiavellianism, narcissism and psychopathy were reported for the group of omnivores compared to vegans/vegetarians, however, those effects got weaker or disappeared after the sex of participants was added to the model. The present research project adds to the literature by investigating the ANPS model and the Dark Triad of personality in the context of eating style for the first time. The findings of these two studies might help to better understand how people following different types of diet, might differ in their personalities.

Keywords: personality, ANPS, Machiavellianism, narcissism, psychopathy, diet

INTRODUCTION

The number of consumers following a plant-based diet has dramatically increased in recent years (The Guardian, 2018). Vegan and vegetarian diets attract the attention for different reasons such as health, weight loss, ethical, environmental or religious purposes to name a few (Janssen et al., 2016). The manifold reasons to endorse such a diet might also vary depending on the cultural background or sex of individuals, as well as social norms (Ruby, 2012).

One commonly used definition describes vegetarianism on a scale ranging from *least strict* to *most strict* resulting in six types (Beardsworth and Keil, 1992). The first type includes people characterizing themselves as vegetarians, although they occasionally consume meat. While the second type vegetarians avoid the consumption of meat, the third type also excludes fish and the forth type also eggs from their diet. Type five vegetarians avoid additionally the consumption of dairy products, while type six vegetarians (also called vegans) consumes solely plant-based foods. In a representative study from Germany, 2.74% of the investigated participants reported to be vegetarians who avoid the consumption of meat and fish (Pfeiler and Egloff, 2018a).

In Western societies, sex differences regarding attitudes and beliefs with respect to dietary habits have been demonstrated. Women express more favorable attitude toward animals, while men believe that meat consumption makes them "manlier" (Rothgerber, 2013). These attitudes are mirrored in statistics, showing that vegetarian women outnumber vegetarian men (see Ruby, 2012). Additionally, higher meat consumption has been linked to beliefs in human's supremacy and the perception of vegetarianism as a threat for traditional dietary choices in Leite et al. (2018). Furthermore, associations between veganism and/or vegetarianism and higher empathy (e.g., Preylo and Arikawa, 2008; Filippi et al., 2010), as well as between meat consumption and political ideology (e.g., conservatism) have been shown (Hodson and Earle, 2018).

Next to the variables listed above, individual differences in personality might also play a significant role in explaining one's own food choices. In this context, the Five-factor model of personality has been often investigated. Here, high openness for experiences seems to be a rather robust predictor of vegetarian food choices (e.g., Forestell and Nezlek, 2018; Pfeiler and Egloff, 2018a,b). However, also associations between openness and meat consumption, which vary depending on the type of meat to be consumed, have been reported (Pfeiler and Egloff, 2018c). The associations with respect to conscientiousness and meat consumption vary, where positive and negative relationships have been reported in different studies (e.g., Pfeiler and Egloff, 2018a,b). Extraversion has been linked to higher meat consumption (Pfeiler and Egloff, 2018c), neuroticism to a higher probability of having a vegetarian diet, whereas studies exploring associations between agreeableness and dietary style demonstrated mixed results (e.g., Forestell and Nezlek, 2018; Pfeiler and Egloff, 2018b). It also needs to be mentioned that there are studies which failed to find significant differences between vegans/vegetarians and omnivores with respect to the Big-Five personality traits (e.g., Kessler et al., 2018).

Aside from the Five-factor model of personality, to our knowledge, only a few other personality traits have been tested in the context of dietary choices. However, since the consumption of food is necessary in order to survive and is, thus, of high evolutional significance, it is of high interest to investigate biologically based models of personality going beyond the Five-factor model to get further insights into eating style.

Panksepp (2004) administered deep brain stimulation and pharmacological challenges in the mammalian brain and discovered seven primary emotional systems which shape humans' behavior and personality in a bottom up fashion (Davis et al., 2003; Montag and Panksepp, 2017; Davis and Montag, 2018; Montag and Davis, 2018). Those emotional systems have been linked to specific subcortical areas in the mammalian brain and to distinct neurotransmitter systems (Panksepp, 2004, 2005). These ancient emotional systems can be grouped into positive affect (SEEKING, CARE, PLAY, and LUST[1]) and negative affect (ANGER, FEAR, SADNESS). Compared to the Five-factor model that has been developed based on a lexical approach, Panksepp's Affective Neuroscience theory places human's personality on a strong biological fundament (Montag and Davis, 2018). The investigation of primary emotional systems in the context of eating behavior is also of importance, because individual differences in primary emotional systems could be the fundament of the Big Five of Personality (perhaps with the exception of conscientiousness; see Montag and Panksepp, 2017). Thus, next to the evolutionary importance of both, nutrition and the primary emotional systems, another link that connects them are studies examining the associations between diet and personality. Since it has been demonstrated that both, the primary emotional systems (Davis and Panksepp, 2011) and diet, are linked to the Five-factor model, such studies might help to further narrow down the focus on particular primary emotional systems to describe food choices.

Probably the most obvious candidate from the primary emotional systems to be linked to the vegan/vegetarian diet is CARE. People with a highly active CARE system can be described as strongly feeling empathy and liking to care for others, including pets and children (Davis et al., 2003). Given this definition and the overlap between CARE and empathy, it is proposed that CARE might explain some of the variance in vegetarian food choices. In line with this idea, the vegan/vegetarian diet has been linked to higher empathy compared to the omnivorous diet in numerous studies (e.g., Preylo and Arikawa, 2008; Filippi et al., 2010; Rothgerber, 2015). Of note, vegans were shown to report even higher levels in empathy than vegetarians (Kessler et al., 2016). High CARE (together with low ANGER) might represent the evolutionary basis for agreeableness (Montag and Davis, 2018). Despite mixed results reported on the link between the vegetarian diet and agreeableness, the investigation of CARE is of high relevance in the context of eating behavior.

As openness to experiences has often been linked to both a plant-based diet and SEEKING (being curious, being drawn

[1]The capitalizations are used to specify the primary emotional systems as compared to other commonly used psychological terms (Davis and Panksepp, 2011).

toward new experiences; Davis et al., 2003; Davis and Panksepp, 2011), it is likely that individual differences in SEEKING might play an important role in the context of food choices, too. The associations between dietary choices and FEAR, SADNESS and ANGER as well as spirituality will be examined exploratory, since the existing literature does not allow for more specific hypotheses at this point. In general, the negative emotional systems FEAR, SADNESS, and ANGER are known to be tightly linked to high neuroticism, and the latter has been associated with vegetarianism (see Davis and Panksepp, 2011; Forestell and Nezlek, 2018). However, since neuroticism is a rather widely defined concept, compared to the more narrowly defined emotional systems of FEAR, SADNESS and ANGER, it is not clear what associations could be expected with food choices. For example, ANGER, which is related to aggression, might be linked to an omnivorous diet rather than a vegan/vegetarian diet (see Davis et al., 2003; Jain et al., 2018). Last but not least, spirituality, described as searching for the meaning in life and feeling connected to the world and creation as a whole (Davis et al., 2003; Davis and Panksepp, 2011), per definition might be rather linked to the vegan/vegetarian diet.

On another note, associations between beliefs in human's supremacy (Leite et al., 2018) or hierarchical domination (in specific right-wing authoritarianism and social dominance orientations) (Allen et al., 2000) and the omnivorous diet draw the attention toward another personality model, which has not been investigated in the context of dietary choices so far: The Dark Triad of personality. Here, the traits Machiavellianism, non-pathological narcissism and non-pathological psychopathy have been put forward (Paulhus and Williams, 2002). Machiavellianism describes a manipulative personality which lacks morality, and has a focus on self-interest. Narcissism includes grandiosity, entitlement, dominance and superiority. Lastly, psychopathy in terms of the Dark Triad includes high impulsivity, thrill-seeking going along with low empathy, and with antisocial behavior (Paulhus and Williams, 2002; Jones and Paulhus, 2014). The Dark Triad traits are intercorrelated and are assumed to constitute the basis of a higher-order trait. However, each of the traits also exhibits its own unique features (Rauthmann, 2012; Muris et al., 2017). Common correlates of the Dark Triad traits are low agreeableness, low honesty-humility (HEXACO), low empathy and high alexithymia (Furnham et al., 2013; Schimmenti et al., 2019). With respect to the link with empathy, differences between the Dark Triad traits were demonstrated, where psychopathy was negatively linked to perspective taking, fantasy and empathic concern, whereas narcissism was positively associated with fantasy and personal distress (Jonason and Kroll, 2015). Those positive associations between narcissism and empathy imply that understanding the thoughts and feelings of others might be crucial for narcissists in order to receive validation for their ego-needs (Jonason and Kroll, 2015). A recent meta-analysis demonstrated that the Dark Triad traits, and especially Machiavellianism and psychopathy, are linked to aggression, interpersonal problems and antisocial strategies (Muris et al., 2017). In this context, psychopathy and Machiavellianism are described as more negative traits, whereas the behavior of people high in narcissism has been rated by others as rather neutral (Rauthmann, 2012). From an evolutionary perspective, mating issues have been linked to the Dark Triad traits. Here, studies have demonstrated that the Dark Triad traits are linked to a fast-life history strategy, thus, accentuating mating compared to parenting. This strategy is associated with short-term mating, antisocial behavior and low self-control (Jonason et al., 2009; Furnham et al., 2013).

The link between high empathy and the vegetarian diet, reported above indicates a possible positive association between the omnivorous diet and the Dark Triad traits, the latter being associated with lower empathy. Additionally, an association between hierarchical justification for meat eating (e.g., "Humans are at the top of the food chain and meant to eat animals.," Rothgerber, 2013, p. 13) and higher meat consumption and lower consumption of vegetarian dishes points toward a possible link between narcissism and omnivorous dietary choices. Recent research also demonstrated an association between aggression and the omnivorous diet (Jain et al., 2018). With respect to the link between the Dark Triad traits and antisocial behavior reported above, as well as the link between the Dark Triad traits and schadenfreude (experiencing pleasure, when others are suffering or are misfortunate), and dispositional aggression (James et al., 2014; Jones and Neria, 2015), those associations give an additional hint toward the potential relationship between the Dark Triad traits and an omnivorous diet. Last but not least, the Dark Triad traits were associated with more negative attitudes toward animals, and psychopathy was additionally linked to behaviors demonstrating animal cruelty (Kavanagh et al., 2013). This last finding demonstrates that callous behavior and attitudes linked to the Dark Triad traits are not limited to human-to-human interactions, but are also relevant with regard to human-to-animal interactions (Kavanagh et al., 2013). Moreover, the Dark Triad traits are suggested to foster survival from an evolutionary point of view (Furnham et al., 2013). The negative attitudes and behavior toward animals, expressed by people scoring high on the Dark Triad traits, might result in meat consumption, which on the other hand will foster survival. This is another argument for the positive association between the Dark Triad traits and the omnivorous diet.

It is important to note at this point that empirical evidence on sex differences regarding the Dark Triad traits exists. Here, males usually score higher on all Dark Triad traits than females (Muris et al., 2017). The same is true for dietary choices, where more females than males chose a vegan/vegetarian diet (Ruby, 2012). Thus, particular attention will be paid on possible interactions between sex, diet and the Dark Triad traits.

The aim of the present study is to investigate individual differences in primary emotional systems, the three Dark Triad traits and their potential role for dietary choices. The focus of the two studies, described in detail further below, lies on differentiating between vegans/vegetarians (combined to one group) and omnivores with respect to the Affective Neuroscience Personality Framework and the Dark Triad of personality. To the authors' knowledge these associations have not been investigated before.

MATERIALS AND METHODS

Participants

In Study 1, in total N = 1255 volunteers, part of the Ulm Gene Brain Behavior Project, participated. Of note some participants were also included with a totally different focus, namely the Dark Triad traits and Internet Use Disorders in another sample (Sindermann et al., 2018b). Among others, articles have been published with a smaller subsample using the ANPS on revengefulness (Sindermann et al., 2018a) and Internet Use Disorder (Montag et al., 2016). After missing data in all questionnaires, inconsistent responses on the Eating Behavior Questionnaire (EBQ), the pescatarian group and minors (participants under the age of 18) were excluded, the final data set consisted of N = 1140 participants (783 females). Participants' average age was 23.54 (SD = 7.06, range 18–82). In total, 0.2% of participants reported having no degree, 0.4% secondary modern school qualification, 3.6% O-level, 2.7% vocational baccalaureate diploma, 72.5% A-levels, 2.8% polytechnic degree, and 17.7% university degree (numbers do not sum up to exactly 100% due to inaccuracies when rounding). Here, 131 (11.5%) participants reported being vegan or vegetarian and 1009 (88.5%) being omnivore (please see the following section for detailed information about data cleaning and assignment to groups). The percentage of vegans and vegetarians in the group of females (14.0%) was higher than in males (5.9%). Additionally, 94.1% of male participants reported being omnivores, compared to 86.0% of female participants. In total, the most common reasons for avoiding meat consumption reported by vegans and vegetarians were ethical reasons (71.8%), disgust (13.0%), and health (4.6%). The remaining participants reported weight reduction, religious reasons or other reasons for not consuming meat.

In total, N = 549 volunteers participated in Study 2. Part of this sample has been already used in a previous publication with another thematic focus, namely on the Dark Triad of personality and Internet Use Disorders, already reported above (see Sindermann et al., 2018b). After participants who already took part in Study 1, participants with missing values and those who gave inconsistent responses on the EBQ, pescatarians and minors were excluded, the final dataset resulted in N = 444 participants (312 females). The average age of participants was 30.12 (SD = 14.61, range 18–83) years. In total 0.2% reported having no degree, 3.4% secondary modern school qualification, 13.1% O-level, 5.6% vocational baccalaureate diploma, 55.2% A-levels, 4.1% polytechnic degree, and 18.5% university degree (numbers do not sum up to exactly 100% due to inaccuracies when rounding). Here, 55 (12.4%) participants reported being vegan or vegetarian and 389 (87.6%) being omnivore. The percentage of vegans and vegetarians in the group of females (16.0%) was higher than in males (3.8%). Additionally, 96.2% of male participants reported being omnivores, compared to 84.0% of female participants. Among the reasons reported by vegan and vegetarian participants for avoiding the consumption of meat, the most common were ethical reasons (78.2%), followed by disgust (10.9%) and health (7.3%). The remaining participants chose the answer "other reasons".

Materials

The (EBQ, developed based on Bilewicz et al., 2011, and translated into German) includes three questions, measuring the dietary habits of participants. The first question assesses the diet type. Here, participants can choose between vegan (following a strict plant-based diet, thus, refraining from consuming meat, fish, dairy products and eggs), ovo-lacto-vegetarian (not consuming fish and meat), pescatarian (not consuming meat) or omnivore (not limiting their diet with respect to animal products). The second question was answered only by vegans/vegetarians and pescatarians, and assessed the reasons for avoiding meat consumption (health, disgust, ethical reasons, weight loss, religious reasons, other reasons). Finally, the third question included a list of 10 different food categories (fruits, vegetables, honey, pasta/noodles, potatoes, eggs, fish/sea food, pork, poultry, and red meat) where participants were instructed to rate the frequency with which they consume those foods during a regular week (from 1 = "never" to 7 = "six times per week or more"). Before analyzing the data, it was examined if the reported type of diet according to the first question (e.g., following a vegan diet) corresponded to the responses regarding the frequency of consumption of different types of foods on the third question (e.g., never consuming meat, fish, eggs). Where inconsistencies were found, participants were excluded from the analyses.[2] Vegan and vegetarian participants were combined to one group to increase the statistical power, because both groups were rather small. For the present study, the pescatarian group was not analyzed as there is a discourse in the literature if pescatarians are better described as vegetarians or omnivores. As mentioned in the section "Participants", pescatarians were excluded before running the statistical analyses.

Affective Neuroscience Personality Scales [ANPS; Davis et al., 2003; German version by Reuter et al. (2017)] consist of 110 questions, rated on a scale from 1 = "strongly disagree" to 4 = "strongly agree". Six primary emotions can be assessed using this questionnaire: SEEKING, PLAY, CARE, FEAR, ANGER, SADNESS, together with the dimension of spirituality. The possible range for every scale except for spirituality is 14–56. The possible range for the scale spirituality is 12–48. The reliabilities for Study 1 were as follows: SEEKING α = 0.71, FEAR α = 0.87, CARE α = 0.80, ANGER α = 0.84, PLAY α = 0.79, SADNESS α = 0.75, spirituality α = 0.85. The ANPS questionnaire was only filled in by the participants of Study 1.

The Short Dark Triad [SD3; Jones and Paulhus (2014)] was developed to assess the traits Machiavellianism, non-pathological narcissism and non-pathological psychopathy. A German translation of this questionnaire was used in the present study. The German version was already applied in a study by Sindermann et al. (2018b), where also the factor structure

[2]Such inconsistencies were tested for vegans/vegetarians and pescatarians. For participants, reporting to not restrict their diet with respect to animal products on question 1 (omnivores), such inconsistency checks were not conducted, because 1) omnivores do not have to consume meat with every meal/every week, 2) people usually recall their behavior during the last couple of weeks (thus, they might report to not consume meat in a regular week, because they have not eaten meat for a couple of weeks), 3) we assume that people, who chose this answer, consciously decide to not restrict their diet with respect to animal products.

was assessed. It includes 27 items (nine items per scale), which are rated on a scale from 1 = "disagree strongly" to 5 = "agree strongly." The possible range for every scale varies between 9 and 45. Even though the SD3 is a short measure of the Dark Triad traits, its validity and reliability has been demonstrated in many studies already (Jones and Paulhus, 2014). The reliabilities of the three scales for the current samples were as follows: Machiavellianism $\alpha = 0.78$, narcissism $\alpha = 0.64$, psychopathy $\alpha = 0.73$ in Study 1, and Machiavellianism $\alpha = 0.71$, narcissism $\alpha = 0.62$, psychopathy $\alpha = 0.71$ in Study 2. In Study 1, SD3-data from 508 participants was available.

Procedure

Participants were mostly recruited in classes of Psychology at Ulm University, Ulm, Germany. Participants were then contacted via e-mail which included the link to the online-questionnaire. In both studies, participants had the opportunity to save the questionnaire and fill it in later, by using the link sent them per e-mail. In both studies participants were informed about the aim of the study and gave digital informed consent prior to their participation. Both studies were approved by the local ethic committee of Ulm University, Ulm, Germany.

Statistical Analyses

First, the distribution of variables was tested by assessing the skewness and kurtosis of the variables, where values < 2 were considered as normally distributed (Miles and Shevlin, 2001). Second, associations with age and sex were assessed using Pearson or Spearman correlations, and *t*-test or Mann–Whitney *U* test depending on the distribution of the variables. For non-normally distributed variables, where necessary a Blom rank-based transformation was used for normalization purposes. A MANOVA was conducted to assess the associations between dietary habits and the ANPS, and SD3 scales. Where significant associations between age, sex and the remaining variables were demonstrated, age was added as a control variable into the analyses, while sex was entered as a second independent variable next to the variable diet. This way, it was possible to examine potential interactions between sex and diet on the ANPS and Dark Triad traits. Finally, using Pearson correlation analyses with the Bootstrap BCa 95% CI, the relationship between the frequency of consuming different foods and the ANPS, and SD3 scales was tested (the results of the correlation analyses are presented in the **Supplementary Material**). These results are also presented separately for male and female participants.

RESULTS

Study 1

In the following, first the descriptive statistics of the sample in Study 1 are presented, split in vegans/vegetarians vs. omnivores (see **Tables 1**, **2**). The overall and by sex descriptive statistics are presented in **Supplementary Tables S1, S2**. After that, the associations between age, sex and the remaining variables was assessed (see section "Associations With Age and Sex") and the effect of diet on the ANPS and Dark Triad traits was examined (see section "Differences Between Vegans/Vegetarians and Omnivores With Respect to Personality").

Associations With Age and Sex

All ANPS and SD3 Scales were normally distributed. Age was non-normally distributed (Miles and Shevlin, 2001). Spearman correlations revealed that age was significantly associated with FEAR ($\rho = -0.11$, $p < 0.01$), CARE ($\rho = -0.09$, $p < 0.01$), PLAY ($\rho = -0.13$, $p < 0.01$), SADNESS ($\rho = -0.10$, $p < 0.01$), Machiavellianism ($\rho = -0.19$, $p < 0.01$), and narcissism ($\rho = -0.16$, $p < 0.01$). *T*-tests revealed significant sex differences regarding the ANPS and SD3 scales. Here, female

TABLE 1 | Descriptive statistics for age and the ANPS variables, split in vegan/vegetarian vs. omnivore (Study 1).

		Age	SEEKING	FEAR	CARE	ANGER	PLAY	SADNESS	Spirituality
Vegan/vegetarian	*N*	131	131	131	131	131	131	131	131
	Mean	22.54	40.23	37.68	43.58	35.44	41.17	36.23	27.46
	Median	21	40	37	44	36	41	36	27
	SD	6.14	5.09	7.25	5.60	6.53	5.86	5.95	7.18
	Skewness	3.95	−0.05	0.13	−0.65	0.14	−0.54	0.22	0.16
	Kurtosis	17.99	−0.39	−0.41	0.76	0.30	0.93	0.61	−0.71
	Min.	18	25	19	24	21	19	20	16
	Max.	57	51	54	55	56	54	54	45
Omnivore	*N*	1009	1009	1009	1009	1009	1009	1009	1009
	Mean	23.67	39.64	36.63	41.05	35.92	42.23	34.59	25.24
	Median	22	40	36	41	36	42	34	25
	SD	7.17	4.36	6.58	5.86	6.14	5.52	5.23	6.32
	Skewness	3.55	−0.07	−0.00	−0.34	0.07	−0.30	0.18	0.26
	Kurtosis	14.72	0.73	−0.30	0.18	0.13	0.23	−0.04	−0.13
	Min.	18	20	17	16	17	21	22	12
	Max.	82	53	54	56	55	56	52	47

SD = standard deviation, N = number of participants.

TABLE 2 | Descriptive statistics for age and the SD3 variables, split in vegan/vegetarian vs. omnivore (Study 1).

	Vegan/vegetarian				Omnivore			
	Age	**Machiavellianism**	**Narcissism**	**Psychopathy**	**Age**	**Machiavellianism**	**Narcissism**	**Psychopathy**
N	70	70	70	70	438	438	438	438
Mean	23.37	24.94	22.49	17.74	23.48	26.65	23.57	18.75
Median	21	25	23	17	21	27	23	19
SD	8.00	5.69	4.65	5.06	8.62	5.70	4.24	5.12
Skewness	3.10	0.18	−0.36	0.61	3.39	0.05	0.11	0.53
Kurtosis	9.76	−0.29	−0.50	0.22	12.27	0.06	0.02	0.41
Min.	18	13	12	9	18	12	11	9
Max.	57	39	31	34	82	44	38	38

SD = standard deviation, N = number of participants.

participants scored higher on FEAR, CARE, ANGER, SADNESS, and spirituality ($p < 0.01$; see **Supplementary Table S1**). Moreover, male participants scored higher than females on Machiavellianism, narcissism, and psychopathy ($p < 0.01$; see **Supplementary Table S2**). Vegans/vegetarians and omnivores significantly differed in age in the complete sample ($Z = -2.723$, $p < 0.01$; see **Table 1** for the means of both groups), and dietary habits were significantly linked to sex [$X^2(1) = 16.077$, $p < 0.01$]. Thus, sex and age were considered in the following analyses.

Differences Between Vegans/Vegetarians and Omnivores With Respect to Personality

A MANOVA revealed significant differences between vegans/vegetarians and omnivores with respect to the ANPS scales [Pillai's Trace: $F(7, 1132) = 6.950$, $p < 0.001$, $\eta_p^2 = 0.04$]. Here, the scales CARE [$F(1, 1138) = 21.761$, $p < 0.001$, $\eta_p^2 = 0.02$], SADNESS [$F(1, 1138) = 11.037$, $p = 0.001$, $\eta_p^2 = 0.01$], spirituality [$F(1, 1138) = 13.855$, $p < 0.001$, $\eta_p^2 = 0.01$], and PLAY [$F(1, 1138) = 4.202$, $p = 0.041$, $\eta_p^2 = 0.004$] reached significance in the univariate tests. Higher scores in CARE, SADNESS, spirituality and lower scores in PLAY were observed in vegans/vegetarians compared to omnivores (see **Table 1** for the means of the variables). After a Bonferroni correction for multiple testing was applied ($p = 0.05/7 = 0.007$), all associations except the one with PLAY remained significant. After entering "age" (Blom transformed) as a covariate in the analysis, the results did not change, thus, significant results from the previous analysis remained significant. In the next step, the sex of participants was entered as a second independent variable in order to test for interactions between the dietary style and sex (here age was not included as a covariate because it did not change the associations between dietary style and the primary emotional systems as demonstrated in the previous analysis). The multivariate test for the interaction effects did not reach significance [Pillai's Trace: $F(7, 1130) = 1.412$, $p = 0.197$]. Regarding the univariate tests, only the interaction between sex and dietary style on SADNESS reached significance [$F(1, 1136) = 6.382$, $p = 0.012$, $\eta_p^2 = 0.01$], however, this effect would not remain significant after a Bonferroni correction is applied ($p = 0.05/7 = 0.007$). Moreover, please note that the subsample of vegan/vegetarian male participants included only 21 people, thus, limiting the power for this type of analyses. The univariate tests for the main effects of sex were significant for FEAR ($p = 0.008$, $\eta_p^2 = 0.01$), CARE ($p < 0.001$, $\eta_p^2 = 0.06$) and SADNESS ($p = 0.003$, $\eta_p^2 = 0.01$) before a Bonferroni correction. Regarding diet, the univariate tests after including sex as a second independent variable remained significant for CARE ($p = 0.048$, $\eta_p^2 = 0.003$), PLAY ($p = 0.027$, $\eta_p^2 = 0.004$), SADNESS ($p = 0.001$, $\eta_p^2 = 0.01$), and spirituality ($p = 0.005$, $\eta_p^2 = 0.01$) before a Bonferroni correction (see group means in **Table 1**).

Another MANOVA was conducted to compare the SD3 scores among the investigated groups. Here, although descriptively the scores on all three scales were higher in omnivores, results did not reach significance [Pillai's Trace: $F(3, 504) = 2.324$, $p = 0.074$). On an univariate level omnivores and vegans/vegetarians differed in Machiavellianism [$F(1, 506) = 5.439$, $p = 0.020$, $\eta_p^2 = 0.01$]. However, this result would not hold a correction for multiple testing ($p = 0.05/3 = 0.017$). The results slightly changed after "age" (Blom transformed) was added as a covariate in the analyses. On a univariate level, Machiavellianism ($p = 0.017$, $\eta_p^2 = 0.01$) and narcissism ($p = 0.046$, $\eta_p^2 = 0.01$) reached significance before a Bonferroni correction (see **Table 2** for means in both groups). After sex was added as a second independent variable into the analysis (without age as a covariate), no significant multivariate effect for the interaction between sex and the dietary style could be observed [Pillai's Trace: $F(3, 502) = 1.166$, $p = 0.322$]. The same was true for the univariate effects regarding this interaction. The univariate main effects of dietary style for the Dark Triad traits did not reach significance, whereas sex had a significant effect on the Dark Triad traits Machiavellianism ($p = 0.001$, $\eta_p^2 = 0.02$), narcissism ($p = 0.038$, $\eta_p^2 = 0.01$) and psychopathy ($p < 0.001$, $\eta_p^2 = 0.05$) before a Bonferroni correction. Please note that the male vegan/vegetarian group included only 10 participants.

Next, the Bootstrap BCa 95% CI Pearson correlations between the frequency of consumption of different foods and the ANPS and Dark Triad traits were calculated (see **Supplementary Tables S3, S5**). Because the variables "honey," "red meat" and "fish/seafood" deviated from the normal distribution (Miles and Shevlin, 2001), we also report the Spearman

TABLE 3 | Pearson's correlations for the associations between the ANPS scales and the Dark Triad traits (Study 1).

	SEEKING	FEAR	CARE	ANGER	PLAY	SADNESS	Spirituality
Machiavellianism	0.03	0.12**	−0.26**	0.28**	−0.05	0.09	−0.12**
Narcissism	0.26**	−0.29**	−0.09*	0.07	0.20**	−0.24**	0.21**
Psychopathy	0.05	−0.03	−0.31**	0.39**	−0.04	0.05	−0.02

*N = 508, *p < 0.05, **p < 0.01, two–tailed tests.*

correlations for these variables in the **Supplementary Material** (**Supplementary Table S7**).

The results of the correlation analysis revealed some positive correlations between SEEKING, CARE, spirituality and the frequency of consumption of fruits and vegetables. CARE, SADNESS, FEAR, and spirituality were negatively associated with the consumption of red meat and pork (see **Supplementary Table S3**). Machiavellianism, narcissism and psychopathy were positively linked to the consumption of poultry and red meat. Additionally, narcissism was positively linked to the consumption of fish/seafood and eggs, while Machiavellianism and psychopathy were positively linked to the consumption of pork (see **Supplementary Table S5**). As the sex of participants was linked to the ANPS and Dark Triad traits, we report the correlation analyses separately for male and female participants in the **Supplementary Material** (**Supplementary Tables S4, S6**). Interestingly, only the correlation between psychopathy and poultry consumption remained significant in the male subsample, whereas most of the reported associations between the Dark Triad traits and the frequency of consumption of different foods for the complete sample remained significant in the female subsample.

To our knowledge the ANPS has never been investigated in the context of the Dark Triad personality before. For future research and for the reasons of completeness, we also provide the correlations between these inventories in **Table 3**. The results of this analysis demonstrated a significant negative link between CARE and all three Dark Triad traits. However, please note that the correlation between CARE and narcissism was rather weak. Moreover, ANGER was positively linked to Machiavellianism and psychopathy. Thus, CARE and ANGER showed the most consistent associations with the Dark Triad traits.

Study 2

In the following, the results from Study 2 will be reported, starting with the descriptive statistics (**Table 4** and **Supplementary Table S8**) and after that assessing the relationship between diet, the SD3 scales, age and sex (see section "Associations With Age and Sex" and "Differences With Respect to Personality").

Associations With Age and Sex

Machiavellianism, narcissism and psychopathy were normally distributed. Age was non-normally distributed only in the group of vegans/vegetarians (Miles and Shevlin, 2001). The group of vegans/vegetarians was significantly younger than the group of omnivores ($Z = -3.794$, $p < 0.001$, means for each group are depicted in **Table 4**). Age was not correlated with the SD3 scales ($p > 0.05$). The sex of participants was linked to their dietary style [$X^2(1) = 12.800$, $p < 0.001$] and to the SD3 scales, where male participants reported higher values in Machiavellianism, narcissism and psychopathy than female participants ($p < 0.01$; see **Supplementary Table S8**). As only sex was associated with both the EBQ and the SD3 scales, only sex was entered as a second independent variable next to diet in the following analyses.

Differences With Respect to Personality

The results of a MANOVA revealed significant mean differences between vegans/vegetarians and omnivores with respect to the SD3 scales [Pillai's Trace: $F(3, 440) = 9.931$, $p < 0.001$, $\eta_p^2 = 0.06$]. The univariate tests demonstrated that omnivores scored higher on all three scales: Machiavellianism [$F(1, 442) = 15.241$, $p < 0.001$, $\eta_p^2 = 0.03$], narcissism [$F(1, 442) = 22.736$, $p < 0.001$, $\eta_p^2 = 0.05$] and psychopathy [$F(1, 442) = 7.245$, $p = 0.007$, $\eta_p^2 = 0.02$]. Thus, these results would remain significant after a Bonferroni correction is applied ($p = 0.05/3 = 0.017$). In a next step, we added sex as a second independent variable in the MANOVA. The multivariate effect for the interaction between sex and diet did not reach significance [Pillai's Trace: $F(3, 438) = 0.824$, $p = 0.481$]. The same was true for the univariate effects for these interactions. However, please note that the number of male vegans/vegetarians was 5, thus, reducing the power of the analysis. Regarding the univariate main effects, sex was linked to narcissism ($p = 0.037$, $\eta_p^2 = 0.01$) and psychopathy ($p = 0.030$, $\eta_p^2 = 0.01$) before a Bonferroni correction, whereas diet showed an effect on Machiavellianism ($p = 0.010$, $\eta_p^2 = 0.02$) and narcissism ($p = 0.029$, $\eta_p^2 = 0.01$) also before a Bonferroni correction.

Furthermore, Pearson correlations with the Bootstrap BCa 95% CI were used to test the link between the frequency of consumption of different foods and the SD3 scales (see **Supplementary Table S9**). Here, significant positive correlations were observed between all SD3 scales and the consumption of pork, eggs, red meat, fish/sea food and poultry. Negative correlations were observed with fruits and vegetables (here only the correlation between narcissism and vegetable consumption did not reach significance). Since the variable "frequency of consumption of red meat" deviated from the normal distribution (Miles and Shevlin, 2001), here we report the Spearman correlations for Machiavellianism $\rho = 0.20$, $p < 0.001$, narcissism $\rho = 0.21$, $p < 0.001$ and psychopathy $\rho = 0.20$, $p < 0.001$.

Next, we split the analysis by considering the sex of participants (see **Supplementary Table S10**). Here, also the Pearson correlations with the Bootstrap BCa 95% CI are reported. Interestingly, in the group of males only the positive correlations between psychopathy and the consumption of red meat and

TABLE 4 | Descriptive statistics for age and the SD3 scales, split in vegan/vegetarian vs. omnivore (Study 2).

	Vegan/vegetarian				Omnivore			
	Age	**Machiavellianism**	**Narcissism**	**Psychopathy**	**Age**	**Machiavellianism**	**Narcissism**	**Psychopathy**
N	55	55	55	55	389	389	389	389
Mean	23.93	21.55	20.38	15.44	31.00	24.40	23.25	17.35
Median	21	21	20	15	23	24	23	16
SD	9.09	5.09	4.18	4.34	15.04	5.07	4.17	5.00
Skewness	2.61	0.20	0.54	1.17	1.26	0.05	0.18	0.65
Kurtosis	5.90	−0.03	0.08	1.35	0.44	−0.05	0.03	−0.18
Min.	18	10	13	9	18	10	12	9
Max.	57	33	33	28	83	41	37	32

*The raw data is available as a **Supplementary Material** ("Raw data Study 2"). SD = standard deviation, N = number of participants.*

poultry remained significant. Compared to that, in the female subsample, narcissism and psychopathy were negatively linked to the consumption of fruits. Most of the positive correlations between the SD3 scales and the consumption of red meat, fish/sea food and poultry remained significant when only the female subsample was investigated.

DISCUSSION

The present study was the first to investigate the link between dietary choices and primary emotional systems, and the Dark Triad of personality. Results of Study 1 demonstrated that the vegan/vegetarian diet is associated with higher scores in the primary emotional systems of CARE, SADNESS and spirituality, and lower scores in PLAY. However, please note that the link with CARE got weaker after the sex of participants was considered. There were no significant mean differences between vegans/vegetarians and omnivores on Machiavellianism, narcissism and psychopathy after age and sex were taken into consideration. Moreover, correlation analysis demonstrated that CARE, SADNESS and spirituality were negatively linked to meat consumption. Additionally, high Machiavellianism, narcissism and psychopathy were associated with more frequent meat consumption. These last associations remained significant only in the subsample of female participants after the analyses were split by the sex of participants.

Opposite to the results from Study 1, findings from Study 2 revealed that omnivores reported significantly higher scores on all three Dark Triad scales, compared to participants with a vegan/vegetarian diet. However, after the sex of participants was considered, only the differences with respect to Machiavellianism and narcissism remained significant. Most of the significant positive correlations between the frequency of meat consumption and the scores on the Dark Triad traits, found in Study 1, were replicated in Study 2. Those associations were again found primarily in the subsample of female participants.

As suggested in the introductory part of this article, high CARE scores were associated with having vegan/vegetarian diet, as well as higher consumption of fruits and vegetables and lower consumption of meat (as demonstrated by the correlation analysis). These results support findings on the link between higher empathy and a plant-based diet (Preylo and Arikawa, 2008; Filippi et al., 2010). However, per definition next to feeling empathy, CARE encompasses the actual behavior of taking care of others (including children and animals) (Davis et al., 2003). Moreover, some of the brain regions reported to show higher activation in vegans/vegetarians during the presentation of animal negative valence scenes in an fMRI study (Filippi et al., 2010), were also suggested to serve as a biological foundation for the CARE system (Montag and Panksepp, 2016). However, please note that the differences between vegans/vegetarians and omnivores with respect to CARE got weaker after the sex of participants was considered. Additionally, the negative correlations between CARE and meat consumption remained significant only in the female subsample. Thus, the more active CARE system in females might exert a larger effect on food choices (especially regarding meat eating) in females compared to males.

Vegans/vegetarians demonstrated higher SADNESS scores than omnivores. This result supports findings with respect to the link between high neuroticism and depression, and a vegetarian diet (Forestell and Nezlek, 2018). The present study adds to those findings as it was demonstrated that not negative affect as a whole, but only the SADNESS system was linked to dietary choices. On the other hand, neuroticism is correlated with all three negative emotional systems (SADNESS, FEAR and ANGER; Davis and Panksepp, 2011), making it a less specific personality trait. Please refer to the correlation analysis where ANGER was even positively associated with meat eating. This might also help to explain inconsistent findings with respect to negative emotionality (e.g., Beezhold et al., 2015, reported lower anxiety in male vegetarians as compared to omnivores). Thus, replication of findings in needed. Also, please note that the reported effect for SADNESS was small ($\eta_p^2 = 0.01$), thus demonstrating that many additional factors also play a role in choosing a particular diet.

With respect to spirituality, the results of the present study supported our hypothesis on a positive relation with the vegan/vegetarian diet (here the reported effect was also small: $\eta_p^2 = 0.01$). This result was supported also in the correlation analysis where spirituality demonstrated positive associations with fruit and vegetable consumption, and negative associations

with meat consumption. Spirituality was defined as seeking harmony and feeling as one with the universe, and was linked to agreeableness and openness to experiences (Davis et al., 2003). However, interestingly no significant association between SEEKING and the vegetarian diet could be found when comparing the group of vegans/vegetarians with the group of omnivores, although openness to experiences (a rather robust predictor of vegetarian food choices) was reported to be most strongly related to SEEKING among the primary emotional systems (Davis et al., 2003). Please note that some positive associations between SEEKING and the consumption of fruits and vegetables were found in the correlation analysis. Future studies need to further explore this link.

Lastly, the effect of diet on PLAY did not remain significant in the MANOVA after a Bonferroni correction. Also, no significant associations between PLAY and meat consumption could be demonstrated in the correlation analysis. However, descriptively the omnivorous group exhibited higher PLAY scores than the vegan/vegetarian group. Given the positive association between PLAY and extraversion, and the link between high extraversion and high meat consumption (e.g., Pfeiler and Egloff, 2018c), the association between PLAY and dietary choices should be further investigated in future studies.

The Dark Triad of personality was also examined for the first time in the context of food choices. Significant mean differences between vegans/vegetarians and omnivores with respect to the Dark Triad traits were found in Study 1, with omnivores reporting higher Machiavellianism scores (before Bonferroni correction) than vegans/vegetarians, and in Study 2, where omnivores scored higher on all three Dark Triad scales compared to vegans/vegetarians. However, after considering the sex of the participants, only the association between Machiavellianism ($\eta_p^2 = 0.02$), narcissism ($\eta_p^2 = 0.01$ before Bonferroni correction) and diet in Study 2 remained significant. This finding adds to studies reporting a link between beliefs in humans' supremacy and the omnivorous diet (Leite et al., 2018), as well as associations between the Dark Triad traits and negative attitudes and cruelty toward animals (Kavanagh et al., 2013).

On the other hand, the correlation patterns between the Dark Triad traits and the frequency of consumption of meat were similar in both studies. Interestingly, the positive correlations between the Dark Triad traits and the frequency of meat consumption remained significant only in the subsample of female participants with only a few exceptions (e.g. positive correlation between psychopathy and frequency of poultry consumption in the male subsample) (please note that the correlation coefficients were rather low). This is an important observation as sex differences with respect to both, the Dark Triad traits and dietary choices, were demonstrated in numerous studies, with males consistently reporting higher scores on the Dark Triad traits and female vegetarians, outnumbering male vegetarians (Ruby, 2012; Muris et al., 2017). Thus, it is important that future studies employ the same number of male and female participants to further examine those effects. The low number of male vegan/vegetarian participants in the present study hampers the examination of interaction effects between diet and sex.

Even though the results of the MANOVA did not deliver significant mean differences with respect to psychopathy after sex was accounted for, the correlation analysis demonstrated positive correlations between all Dark Triad variables and the consumption of meat. Thus, the question arises if a continuous variable (frequency of consumption of different foods; or least strict – to – most strict vegetarian) is a better measure of dietary choices than a dichotomous variable (vegan/vegetarian vs. omnivorous diet).

It needs to be mentioned that the SD3 scales measure Machiavellianism, non-pathological narcissism and non-pathological psychopathy, thus, these constructs need to be understood as personality traits rather than pathological behaviors. The aim of this study is not to pathologize or put a stigma on particular food/dietary choices. Instead, this research project aimed to investigate additional personality traits next to the often examined Five-factor model to help explain additional variance in dietary choices and, thus, better understand the factors, which might shape our food choices. Since the Dark Triad of personality and the Big Five traits overlap to a certain extent (O'Boyle et al., 2015), future studies, aiming at a direct comparison between the predictive abilities of both models with respect to dietary choices need to be conducted.

Moreover, with respect to the associations found between the primary emotional systems and the Dark Triad traits, future studies might consider examining those associations within a mediation model to predict dietary preferences. In such a complex model, also the role of sex as a moderator in this relationship might be considered. However, due to missing theoretical and empirical evidence regarding the direction of those associations (to the authors' knowledge this is the first study to examine the link between the primary emotional systems, Dark Triad traits and dietary preferences), we refrain from testing such a model in the present study.

In the following, some of the limitations of the study will be discussed. Even though sex was considered as a potential moderating variable, the number of male participants was much lower than the number of female participants as already discussed earlier in the text. With respect to sex differences, being linked to personality as well as eating style, it is of high importance that future studies employ the same number of male and female participants per group to further examine these relationships (see Ruby and Heine, 2011). Moreover, the subsample of vegans/vegetarians in the present study was rather small. Hence, in future studies the same number of participants per groups should be recruited and samples should be paralleled in order to eliminate possible sociocultural and demographic influences. Additionally, other possible alignments of groups such as the investigation of health-oriented versus ethically oriented vegans and vegetarians might be considered. Furthermore, the importance of investigating vegans and vegetarians separately has been highlighted in previous studies. For example, empirical research revealed higher openness and lower neuroticism scores in vegans compared to vegetarians (Kessler et al., 2016). Last but not least, in the current study the group of pescatarians was not examined for reasons named earlier in the text, however, future studies might consider comparing

pescatarians with vegans, vegetarians and omnivores to further disentangle individual differences in personality between these groups.

Lastly, as already mentioned earlier, the assignment of participants to two groups (vegans/vegetarians vs. omnivores) and, thus, the use of a dichotomous variable to test the hypotheses of the study, might be seen as another limitation of the present research project. First, in the present study a rather strict definition of diet was used, since some vegetarians might occasionally consume fish or meat. Thus, future studies might consider assessing dietary choices as a continuous variable, ranging from very strict to least strict vegetarian in order to depict a wider spectrum of dietary styles.

Despite the limitations listed above, the present research project recruited two large samples in order to examine (for the first time) the link between dietary choices and primary emotional systems and the Dark Triad traits. Moreover, Study 2 aimed at the replication of results from Study 1.

CONCLUSION

The present study for the first time examined the relationship between dietary choices (vegan/vegetarian vs. omnivorous diet) and the primary emotional systems, and the Dark Triad of personality. High CARE, SADNESS, spirituality and low PLAY were linked to following a vegan/vegetarian diet (Study 1) (please note that some associations got weaker after the sex of participants was considered in the analyses). Additionally, Machiavellianism (Study 1 and 2), narcissism (Study 2) and psychopathy (Study 2) were positively associated with following an omnivorous diet. However, those results got weaker or disappeared after the sex of participants was considered as a second independent variable. The findings of this study add to the literature because until now the focus lied mainly on the Five-factor model of personality. Lastly, the results of this study might help reconsider existing, rather negative stereotypes linked to the choice of a vegan or a vegetarian diet.

DATA AVAILABILITY STATEMENT

The raw data from Study 1, supporting the conclusion of this manuscript will be made available by the authors, only upon a reasonable request. The raw data from Study 2 is available as a **Supplementary Material** ("Raw Data Study 2").

AUTHOR CONTRIBUTIONS

RS, BL, and CM designed the study and recruited the participants for the current study. SM contributed protocols and advise. RS conducted the statistical analyses and drafted the first version of the manuscript. All authors worked over the manuscript again and approved its final draft.

FUNDING

The position of CM was supported by a Heisenberg grant awarded to him by the German Research Foundation (DFG, MO 2363/3-2).

ACKNOWLEDGMENTS

We would like to thank Nana Löchner and Jennifer Wernicke for taking the time to re-check all analyses applied in the present study.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2019.02591/full#supplementary-material

REFERENCES

Allen, M. W., Wilson, M., Ng, S. H., and Dunne, M. (2000). Values and beliefs of vegetarians and omnivores. *J. Soc. Psychol.* 140, 405–422. doi: 10.1080/00224540009600481

Beardsworth, A., and Keil, T. (1992). The vegetarian option: varieties, conversions, motives and careers. *Soc. Rev.* 40, 253–293. doi: 10.1111/j.1467-954X.1992.tb00889.x

Beezhold, B., Radnitz, C., Rinne, A., and DiMatteo, J. (2015). Vegans report less stress and anxiety than omnivores. *Nutr. Neurosci.* 18, 289–296. doi: 10.1179/1476830514Y.0000000164

Bilewicz, M., Imhoff, R., and Drogosz, M. (2011). The humanity of what we eat: conceptions of human uniqueness among vegetarians and omnivores. *Eur. J. Soc. Psychol.* 41, 201–209. doi: 10.1002/ejsp.766

Davis, K. L., and Montag, C. (2018). Selected principles of panksepian affective neuroscience. *Front. Neurosci.* 12:1025. doi: 10.3389/fnins.2018.01025

Davis, K. L., and Panksepp, J. (2011). The brain's emotional foundations of human personality and the affective neuroscience personality scales. *Neurosci. Biobehav. Rev.* 35, 1946–1958. doi: 10.1016/j.neubiorev.2011.04.004

Davis, K. L., Panksepp, J., and Normansell, L. (2003). The affective neuroscience personality scales: normative data and implications. *Neuropsychoanalysis* 5, 57–69. doi: 10.1080/15294145.2003.10773410

Filippi, M., Riccitelli, G., Falini, A., Di Salle, F., Vuilleumier, P., Comi, G., et al. (2010). The brain functional networks associated to human and animal suffering differ among omnivores, vegetarians and vegans. *PLoS One* 5:e10847. doi: 10.1371/journal.pone.0010847

Forestell, C. A., and Nezlek, J. B. (2018). Vegetarianism, depression, and the five factor model of personality. *Ecol. Food Nutr.* 57, 246–259. doi: 10.1080/03670244.2018.1455675

Furnham, A., Richards, S. C., and Paulhus, D. L. (2013). The dark triad of personality: a 10 year review. *Soc. Pers. Psychol. Compass* 7, 199–216. doi: 10.1111/spc3.12018

Hodson, G., and Earle, M. (2018). Conservatism predicts lapses from vegetarian/vegan diets to meat consumption (through lower social justice concerns and social support). *Appetite* 120, 75–81. doi: 10.1016/j.appet.2017.08.027

Jain, K., Sharma, S., Prajna, S. C., and Jain, V. (2018). Influences of gender, religion, dietary patterns, and mixed-sex education on aggressiveness in children: a

sociodemographic study in municipal primary schools of South Delhi. *Indian J. Public Health* 62, 21–26. doi: 10.4103/ijph.IJPH_346_16

James, S., Kavanagh, P. S., Jonason, P. K., Chonody, J. M., and Scrutton, H. E. (2014). The dark triad, schadenfreude, and sensational interests: dark personalities, dark emotions, and dark behaviors. *Pers. Individ. Diff.* 68, 211–216. doi: 10.1016/j.paid.2014.04.020

Janssen, M., Busch, C., Rödiger, M., and Hamm, U. (2016). Motives of consumers following a vegan diet and their attitudes towards animal agriculture. *Appetite* 105, 643–651. doi: 10.1016/j.appet.2016.06.039

Jonason, P. K., and Kroll, C. H. (2015). A multidimensional view of the relationship between empathy and the dark triad. *J. Individ. Diff.* 36, 150–156. doi: 10.1027/1614-0001/a000166

Jonason, P. K., Li, N. P., Webster, G. D., and Schmitt, D. P. (2009). The dark triad: facilitating a short-term mating strategy in men. *Eur. J. Pers.* 23, 5–18. doi: 10.1002/per.698

Jones, D. N., and Neria, A. L. (2015). The dark triad and dispositional aggression. *Pers. Individ. Diff.* 86, 360–364. doi: 10.1016/j.paid.2015.06.021

Jones, D. N., and Paulhus, D. L. (2014). Introducing the short dark triad (SD3) a brief measure of dark personality traits. *Assessment* 21, 28–41. doi: 10.1177/1073191113514105

Kavanagh, P. S., Signal, T. D., and Taylor, N. (2013). The Dark triad and animal cruelty: dark personalities, dark attitudes, and dark behaviors. *Pers. Individ. Diff.* 55, 666–670. doi: 10.1016/j.paid.2013.05.019

Kessler, C. S., Holler, S., Joy, S., Dhruva, A., Michalsen, A., Dobos, G., et al. (2016). Personality profiles, values and empathy: differences between lacto-ovo-vegetarians and vegans. *Forsch. Komplementarmed.* 23, 95–102. doi: 10.1159/000445369

Kessler, C. S., Michalsen, A., Holler, S., Murthy, V. S., and Cramer, H. (2018). How empathic are vegan medical professionals compared to others? leads from a paper–pencil-survey. *Eur. J. Clin. Nutr.* 72, 780–784. doi: 10.1038/s41430-017-0007-8

Leite, A. C., Dhont, K., and Hodson, G. (2018). Longitudinal effects of human supremacy beliefs and vegetarianism threat on moral exclusion (vs. inclusion) of animals. *Eur. J. Soc. Psychol.* 49, 179–189. doi: 10.1002/ejsp.2497

Miles, J., and Shevlin, M. (2001). *Applying Regression and Correlation: A Guide for Students and Researchers*. Newcastle upon Tyne: Sage.

Montag, C., and Davis, K. L. (2018). Affective neuroscience theory and personality: an update. *Personal. Neurosci.* 1, 1–12. doi: 10.1017/pen.2018.10

Montag, C., and Panksepp, J. (2016). Primal emotional-affective expressive foundations of human facial expression. *Motiv. Emot.* 40, 760–766. doi: 10.1007/s11031-016-9570-x

Montag, C., and Panksepp, J. (2017). Primary emotional systems and personality: an evolutionary perspective. *Front. Psychol.* 8:464. doi: 10.3389/fpsyg.2017.00464

Montag, C., Sindermann, C., Becker, B., and Panksepp, J. (2016). An affective neuroscience framework for the molecular study of internet addiction. *Front. Psychol.* 7:1906. doi: 10.3389/fpsyg.2016.01906

Muris, P., Merckelbach, H., Otgaar, H., and Meijer, E. (2017). The malevolent side of human nature: a meta-analysis and critical review of the literature on the dark triad (Narcissism, Machiavellianism, and Psychopathy). *Perspect. Psychol. Sci.* 12, 183–204. doi: 10.1177/1745691616666070

O'Boyle, E. H., Forsyth, D. R., Banks, G. C., Story, P. A., and White, C. D. (2015). A meta−analytic test of redundancy and relative importance of the dark triad and five−factor model of personality. *J. Pers.* 83, 644–664. doi: 10.1111/jopy.12126

Panksepp, J. (2004). *Affective Neuroscience: the Foundations of Human and Animal Emotions*. New York, NY: Oxford University Press.

Panksepp, J. (2005). Affective consciousness: core emotional feelings in animals and humans. *Conscious. Cogn.* 14, 30–80. doi: 10.1016/j.concog.2004.10.004

Paulhus, D. L., and Williams, K. M. (2002). The dark triad of personality: narcissism, machiavellianism, and psychopathy. *J. Res. Pers.* 36, 556–563. doi: 10.1016/S0092-6566(02)00505-6

Pfeiler, T. M., and Egloff, B. (2018a). Examining the "Veggie" personality: results from a representative German sample. *Appetite* 120, 246–255. doi: 10.1016/j.appet.2017.09.005

Pfeiler, T. M., and Egloff, B. (2018b). Personality and attitudinal correlates of meat consumption: results of two representative German samples. *Appetite* 121, 294–301. doi: 10.1016/j.appet.2017.11.098

Pfeiler, T. M., and Egloff, B. (2018c). Personality and meat consumption: the importance of differentiating between type of meat. *Appetite* 130, 11–19. doi: 10.1016/j.appet.2018.07.007

Preylo, B. D., and Arikawa, H. (2008). Comparison of vegetarians and non-vegetarians on pet attitude and empathy. *Anthrozoös* 21, 387–395. doi: 10.2752/175303708X371654

Rauthmann, J. F. (2012). The dark triad and interpersonal perception: similarities and differences in the social consequences of narcissism. *Soc. Psychol. Pers. Sci.* 3, 487–496. doi: 10.1177/1948550611427608

Reuter, M., Panksepp, J., Davis, K., and Montag, C. (2017). *Affective Neuroscience Personality Scales (ANPS)–Deutsche Version*. Göttingen: Hogrefe-Verlag.

Rothgerber, H. (2013). Real men don't eat (vegetable) quiche: masculinity and the justification of meat consumption. *Psychol. Men Masc.* 14, 363–375. doi: 10.1037/a0030379

Rothgerber, H. (2015). Underlying differences between conscientious omnivores and vegetarians in the evaluation of meat and animals. *Appetite* 87, 251–258. doi: 10.1016/j.appet.2014.12.206

Ruby, M. B. (2012). Vegetarianism. a blossoming field of study. *Appetite* 58, 141–150. doi: 10.1016/j.appet.2011.09.019

Ruby, M. B., and Heine, S. J. (2011). Meat, morals, and masculinity. *Appetite* 56, 447–450. doi: 10.1016/j.appet.2011.01.018

Schimmenti, A., Jonason, P. K., Passanisi, A., Marca, L. L., Dio, N. D., and Gervasi, A. M. (2019). Exploring the dark side of personality: emotional awareness, empathy, and the dark triad traits in an italian sample. *Curr. Psychol.* 38, 100–109. doi: 10.1007/s12144-017-9588-6

Sindermann, C., Luo, R., Zhao, Z., Li, Q., Li, M., Kendrick, K. M., et al. (2018a). High ANGER and low agreeableness predict vengefulness in German and Chinese participants. *Pers. Individ. Diff.* 121, 184–192. doi: 10.1016/j.paid.2017.09.004

Sindermann, C., Sariyska, R., Lachmann, B., Brand, M., and Montag, C. (2018b). Associations between the dark triad of personality and unspecified/specific forms of internet-use disorder. *J. Behav. Addict.* 7, 985–992. doi: 10.1556/2006.7.2018.114

The Guardian, (2018). *The Unstoppable Rise of Veganism: How a Fringe Movement Went Mainstream*. Available at: https://www.theguardian.com/lifeandstyle/2018/apr/01/vegans-are-coming-millennials-health-climate-change-animal-welfare (accessed March 1, 2019).

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 26 November 2020
doi: 10.3389/fpsyg.2020.597671

Authoritarianism, Conspiracy Beliefs, Gender and COVID-19: Links Between Individual Differences and Concern About COVID-19, Mask Wearing Behaviors, and the Tendency to Blame China for the Virus

Eric C. Prichard[1]* *and Stephen D. Christman*[2]

[1] School of Social and Behavioral Sciences, University of Arkansas at Monticello, Monticello, AR, United States,
[2] Department of Psychology, University of Toledo, Toledo, OH, United States

OPEN ACCESS

Edited by:
Severi Luoto,
The University of Auckland,
New Zealand

Reviewed by:
Aaron L. Wichman,
Western Kentucky University,
United States
Marius Hans Raab,
University of Bamberg, Germany

***Correspondence:**
Eric C. Prichard
prichard@uamont.edu

Specialty section:
This article was submitted to Personality and Social Psychology, a section of the journal Frontiers in Psychology

Received: 21 August 2020
Accepted: 21 October 2020
Published: 26 November 2020

Citation:
Prichard EC and Christman SD (2020) Authoritarianism, Conspiracy Beliefs, Gender and COVID-19: Links Between Individual Differences and Concern About COVID-19, Mask Wearing Behaviors, and the Tendency to Blame China for the Virus. Front. Psychol. 11:597671. doi: 10.3389/fpsyg.2020.597671

The present study investigated variables potentially associated with a lack of concern about COVID-19 and belief in the conspiracy theory that China is responsible for the virus. In particular, the study looked at Authoritarianism, Conspiracy Beliefs, gender, and consistency of handedness as predictors of nine Likert-type items gauging attitudes, behavior, and beliefs regarding the virus. Initial analyses showed that Authoritarianism predicted less concern about the impact of the virus on health, less mask wearing, and a stronger belief in China's responsibility for the illness. Conspiracy Beliefs were associated with a stronger belief in China's responsibility. Women expressed greater degrees of concern about their own and others' health and about the financial wellbeing of others. In order to reduce the number of dimensions, and thus the number of tests that could yield a type one error, the nine items were then submitted to a principal components analysis which yielded a "Concern about COVID" factor and a "Blame for China" factor. Authoritarianism is generally associated with less concern about the virus. In addition, men showed less concern about the virus overall than women. Both Authoritarianism and Conspiracy Beliefs accounted for unique variance in blame on China for the virus.

Keywords: authoritarianism, conspiracy beliefs, handedness, gender, COVID-19

INTRODUCTION

The COVID-19 public health crisis is arguably being driven as much by behavior as by germs. A recent Pew Research Center reported the effect of increasing polarization of attitudes toward the pandemic (Mitchell et al., 2020). Among the findings reported in the study, 38% of respondents believe the seriousness of COVID-19 is being exaggerated, and 36% of all respondents across the study reported believing that it is definitely or probably true that the outbreak was a planned

conspiracy. In addition, Mitchell et al. (2020) reported that Americans who rely on Trump and Republican-leaning media outlets for news about the outbreak were more likely to believe the disease is exaggerated, and people who get a lot of their news from social media were more likely to believe that the outbreak was a planned conspiracy.

The last finding is alarming in light of evidence that social media bots are actively being used to spread misinformation about the virus (Ferrara, 2020). Recent investigative journalism has revealed how the collection of social media data can be effectively used by political organizations to target propaganda to specific audiences based on personality and behavioral data collected online (Cadwalladr and Graham-Harrison, 2018). Public knowledge about the type of personality variables that can be targeted may give individual citizens and public policy makers some means of defending themselves against this kind of manipulation. Forewarned is forearmed. Psychological scientists could play an important role in understanding which personality factors contribute to negative health behaviors during the outbreak. If policy makers are going to craft effective messages that encourage people to wear masks and take virus science seriously, they must have an idea of which personality types are more susceptible to ignoring the recommendations of experts and believing in conspiracies.

The present paper focuses on two personality variables and two individual variables that the authors suspect may be related to how seriously people respond to the virus threat. The first is Authoritarianism. Evidence shows that Trump support is associated with Authoritarianism (Choma and Hanoch, 2017), and the Pew Study showed that, among Americans, Trump supporters were more likely to doubt virus science (Mitchell et al., 2020). This raises the possibility that Authoritarianism may be one of the personality traits targeted by the bots investigated by Ferrara (2020). Another potential personality variable of interest is the tendency to endorse Conspiracy Beliefs, a trait that can now be measured using instruments such as that created by Brotherton et al. (2013). As the Pew Study showed, over a third of Americans believe that the virus was planned. It only takes a small number of people who doubt virus science in order to make containment difficult.

The first individual variable investigated in this paper is consistency of handedness. Consistency of handedness has been linked to a number of variables related to gullibility, such as magical ideation and paranormal beliefs (Barnett and Corballis, 2002; Prichard and Christman, 2016). Consistency of handedness has also been linked to Authoritarianism (Christman, 2014; Lyle and Grillo, 2020). Interestingly, it is difficult to predict in which direction handedness might be related to disregard for COVID-19 science. Magical ideation and paranormal beliefs have been linked to inconsistent handedness and left handedness (Barnett and Corballis, 2002; Prichard and Christman, 2016). If consistent handers show less regard for virus science, then it is possible that this relationship is mediated by Authoritarianism. If inconsistent handers show less regard for virus science, then it might be related to gullibility and the tendency to believe conspiracy theories. If there is no handedness effect, these two competing handedness effects may cancel each other out and result in handedness not being of use in predicting COVID-19-specific behavior.

Finally, we included gender as a variable. There is already evidence that men are less likely than women to wear masks (Capraro and Barcelo, 2020), which is notable given evidence that males are more likely to die from COVID-19 than females (Jin et al., 2020). It is worth investigating whether there are other gender differences in behavior and attitudes toward COVID-19.

The present study is empirical and exploratory. It focuses on these four predictors and nine statements regarding attitudes and behaviors related to COVID-19. The first approach was to simply look at the raw correlations between predictors and attitudes and behaviors to the virus. The second approach was to perform an exploratory factor analysis on the items and reduce the total number of factors investigated. This was done in order to reduce the number of tests performed and get an idea of the total contribution of each predictor to the variance in COVID-19-related attitudes and behaviors.

METHODS AND PARTICIPANTS

Participants

Participants were 200 MTurk (M_{Age} = 41.58) workers recruited using Amazon MTurk service. Although not a purely representative sample, evidence shows that MTurk can be a reliable source of data when used appropriately (Buhrmester et al., 2011). It also has the advantage of providing a sample that differs from traditional university students. Participants are referred to as workers because they are paid on per survey basis to participate in research. Ninety-one participants were women and 109 were men. Using MTurk's screening options, we required that all participants report being U.S. High School graduates. This was done to ensure a basic level of English literacy and in part to increase the proportion of participants who are aware of American politics. While political orientation was not measured, Americans have shown a unique link between party affiliation and belief in the seriousness of COVID-19 (Mitchell et al., 2020). Furthermore, Authoritarianism has been associated with support for Donald Trump (Choma and Hanoch, 2017). Thus, among a sample of participants who have an awareness of American politics, we would expect a link between Authoritarianism and a lack of concern about COVID-19. As a secondary screening process, we looked at the reported state of residence for each respondent. Of the participants, 189 reported currently residing in the United States and 11 reported residing in a foreign country. These 11 participants were excluded.

Procedure

Participants were recruited using MTurk. Participants saw a study titled "Attitudes, Personality, and COVID-19." The description of the study included a statement saying that the study had been approved by an institutional review board and that by clicking on the link, participants agreed to take on any risks associated with the study. Participants then saw a series of instruments presented through Google Forms. Participants completed all instruments in the same order, which is detailed in

the instrument section below. Google Forms allows researchers to make questions required. As a result, we had no missing data. The instruments detailed below were the only ones administered. Upon completion of the survey, participants received a "hit code," which was a number they were instructed to copy and paste into a field provided on the MTurk webpage. This code was used as verification that the study had been completed. Participants were paid $1 within 72 h of completing the study.

Instruments

Dependent variables. The dependent measures were created by the authors. After asking participants to report their age, U.S. state of residence, and gender, participants were presented with a series of nine questions broken up into two sections. The first section was titled "Concern About COVID-19" and consisted of five items. There first four items were:

- "How worried and concerned are you about your personal health?"
- "How worried and concerned are you about your financial situation?"
- "How worried and concerned are you about the personal health of your fellow citizens?"
- "How worried and concerned are you about the financial situation of your fellow citizens?"

These items were scored on a seven-point scale from 1 (Not at all concerned) to 7 (Very concerned). The fifth item was "How often do you wear a mask when going out in public?" This item was scored on a seven-point scale from 1 (Always) to 7 (Never). Before analysis, this item was reverse scored.

The second section was titled "Expert Response to COVID-19." It consisted of the following three items:

- "It is important to listen to and heed the advice given by experts and scientists."
- "It is important to listen to and heed the advice given by politicians and public figures."
- "China is directly responsible for the infection rates and death toll in the United States."

These items were scored on a seven-point scale from 1 (Strongly Disagree) to 7 (Strongly Agree). For the initial analysis, all DVs were treated separately. Later, in order to reduce the number of tests, exploratory factor analysis reduced the dimensions from seven to two. This process will be discussed in the analysis and results section.

Conspiracy beliefs. The Generic Conspiracist Belief Scale (Brotherton et al., 2013) is a fifteen-item scale which measures degree of belief in conspiracies, which the authors define believing in conspiracies when more prosaic explanations are more likely. Example items include: "The government is involved in the murder of innocent citizens and/or well-known public figures, and keeps this a secret," "Secret organizations communicate with extraterrestrials, but keep this fact from the public," and "Technology with mind-control capacities is used on people without their knowledge." The scales consist of 5 point Likert-type items (1—"definitely not true," 2—"probably not true," 3—"not sure/cannot decide," 4—"probably true," and 5—"definitely true"). For the purposes of making the items more continuous, we changed the five-point scale into a seven-point scale anchored from 1 (Strongly Disagree) to 7 (Strongly Agree). The questions remained the same.

Authoritarianism. Participants were given a ten-item scale intended to assess Authoritarianism. The first part of the scale consisted of the 7-item Authoritarianism subscale of the short version of the Right-Wing Authoritarianism Scale (Rattazzi et al., 2007). The scale consists of items believed to measure the construct of political Authoritarianism (e.g., "Our country desperately needs a mighty leader who will do what has to be done to destroy the radical new ways and sinfulness that are ruining us"). The scale consisted of six-point response scale: Strongly Disagree, Disagree Somewhat, Slightly Disagree, Slightly Agree, Agree Somewhat, Strongly Agree. In the presentation, we made a slight modification. We presented the items as 7-point item anchored from 1 (Strongly Agree) to 7 (Strongly Disagree). In other words, we added an extra level and reversed the polarity of the anchors. In addition to the 7-items they suggested for their Authoritarianism and Submission Subscale (Chronbach's coefficient = 0.72) we also included the last three Authoritarianism and submission items listed in the appendix. These items were "The only way our country can get through the crisis ahead is to get back to our traditional values, put some tough leader in power, and silence the troublemakers spreading bad ideas," "Once our government leaders give us the 'go ahead', it will be the duty of every patriotic citizen to help stomp out the rot that is poisoning our country from within," and "What our country really needs is a strong, determined leader who will crush evil, and take us back to our true path." Once the scale was completed, we reverse scored the items so that a higher score indicated greater Authoritarianism.

Handedness. In order to measure handedness, we used the modified version of the Edinburgh Handedness Inventory (Oldfield, 1971) which was factor analyzed by Christman et al. (2015). It is a 10-item scale which asks participants which hand they prefer, and how strongly they prefer it, for each one of 10 tasks. There are five response options: "Always Right," "Usually Right," "No Preference," "Usually Left," and "Always Left." During scoring, "Always Right" and "Always Left" are assigned scores of +10 and −10 respectively. "Usually Right" and "Usually Left" are assigned scores of +5 and −5. No preference is assigned a score of zero. Participants can be divided into "Consistent" and "Inconsistent" groups by summing each person's score, taking the absolute value of the summed scores, and dividing participants via the median split method. Alternatively, the absolute value of the summed scores, which may range from 0 to 100, can also serve as a continuous measure of consistency of handedness. A score of zero is ambidexterity. A score of 100 is a strong preference for one's dominant hand. For the analyses below, we used consistency of handedness as a continuous variable.

In **Table 1**, we list descriptive statistics for all of the variables as well as Cronbach's alpha for each independent variable. Where a measure of reliability is not applicable, because the variable is a one-item scale, the table says N/A under "Cronbach's alpha."

TABLE 1 | Descriptive statistics for all continuous variables.

Variable	Mean	*SD*	Cronbach's alpha
Consistency of handedness	80.83	11.17	0.964
Authoritarianism	31.6	20.17	0.976
Conspiracy beliefs	44.53	23.34	0.96
How worried and concerned are you about your personal health?	4.45	1.84	N/A
How worried and concerned are you about your financial situation?	4.26	1.86	N/A
How worried and concerned are you about the personal health of your fellow citizens?	4.90	1.63	N/A
How worried and concerned are you about the financial situation of your fellow citizens?	4.82	1.60	N/A
How often do you wear a mask when going out in public?	5.19	2.08	N/A
It is important to listen to and heed the advice given by experts and scientists	6.12	1.25	N/A
It is important to listen to and heed the advice given by politicians and public figures	3.98	1.66	N/A
China is directly responsible for the infection rates and death toll in the United States	3.33	2.10	N/A

ANALYSIS AND RESULTS

Factor Reduction and Raw Correlations

The four predictor variables of interest were Conspiracy Beliefs, Authoritarianism, Handedness, and Gender. The first part of the analysis investigated the raw correlations between the predictor variables and the dependent variables. Because the research was exploratory, we did not correct for family-wise error initially. However, after investigating the raw correlation coefficients, we factor analyzed the nine dependent variables and reduced the number of dimensions from nine to two. We also included two of our predictor variables in a set of two regression models. This reduced the number of comparisons to two. Conclusions take both sets of analyses into consideration.

Tables 2, **3** show correlations between predictors and the outcome variables. **Table 2** shows correlations between the first three predictor variables and the items from the "Concern About COVID-19" section of the survey. Authoritarianism was significantly negatively associated with concern for others' health and with self-reported frequency of wearing a mask at the 0.01 level. Authoritarianism was negatively associated with concern for one's personal health at the 0.05 level. Conspiracy Beliefs were positively associated with concern with one's personal health at the 0.05 level. During coding, women were given a score of one and men were given a score of two. A negative correlation coefficient means that women show a trait to a greater degree. Women expressed a greater degree of concern about personal health, a greater degree of concern about the health of fellow citizens, a greater degree of concern about the financial well-being of other citizens.

Table 3 shows correlations between the predictors and items under the "Expert Response to COVID-19" section. Authoritarianism was negatively associated with the belief that it is important to listen to scientists and experts during the crisis, and positively associated with the belief that China is responsible for the outbreak. Conspiracy beliefs showed the same pattern, albeit the correlations were only significant at the 0.05 level. Handedness showed no positive associations with any of the dependent variables. None of the first three predictor variables were correlated in this dataset. Handedness and gender were modestly related, with women reporting a slight tendency toward more consistent handedness, $r = 0.144$, $p = 0.042$.

The general pattern from the correlation matrix suggests that people with more authoritarian tendencies are less concerned about the virus's impact on their and others' health, are less inclined to wear masks, are less inclined to listen to experts, and are more likely to believe China is directly responsible for the virus. People high in Conspiracy Beliefs are more inclined to be concerned about their own health, but also express less trust in experts and greater beliefs in Chinese responsibility for the virus. Women seemed to be more concerned about the impact of the virus on themselves and others, but did not report a greater likelihood of wearing a mask. However, we did nothing to correct for family-wise error rates. In order to reduce the number of comparisons, we engaged in a two-step process. The first step was to perform a principal components analysis of the nine items using SPSS version 25. The analysis offered three dimensions with eigenvalues of greater than one, however, we initially accepted a two-factor solution that clustered the nine items into two dimensions. The reason we accepted the two-factor solution is that the third factor consisted of one item, concern about one's personal financial situation, which also loaded onto factor one. As will be shown below, when this item

TABLE 2 | Correlations between predictor variables and "concern about COVID-19" items.

	How worried and concerned are you about your personal health?	How worried and concerned are you about your financial situation?	How worried and concerned are you about the personal health of your fellow citizens?	How worried and concerned are you about the financial situation of your fellow citizens?	How often do you wear a mask when going out in public?
Authoritarian	−0.177*	0.025	−0.227**	−0.113	−0.228**
AbsHand	0.019	−0.025	−0.012	0.041	0.061
Conspiracy	0.162*	0.091	−0.032	−0.002	−0.13
Gender	−0.156*	0.001	−0.155*	−0.150*	−0.73

***Correlation is significant at the 0.01 level (2-tailed).*
**Correlation is significant at the 0.05 level (2-tailed).*

TABLE 3 | Correlations between predictor variables and "expert response to COVID-19" items.

	It is important to listen to and heed the advice given by experts and scientists.	It is important to listen to and heed the advice given by politicians and public figures.	China is directly responsible for the infection rates and death toll in the United States.
Authoritarian	−0.261**	0.044	0.349**
AbsHand	0.062	0.03	−0.045
Conspiracy	−0.179*	−0.075	0.282**
Gender	−0.85	−0.002	0.003

***Correlation is significant at the 0.01 level (2-tailed).*
**Correlation is significant at the 0.05 level (2-tailed).*

is included in factor one, it gives factor one sufficient internal reliability, which is to say a Chronbach's alpha of greater than 0.70. For that reason, the item was included in factor one. The factor matrix is shown in **Table 4**. The first factor consists of the items "How worried and concerned are you about your personal health," "How worried and concerned are you about your financial situation," "How worried and concerned are you about the personal health of your fellow citizens," "How worried and concerned are you about the financial situation of your fellow citizens," "How often do you wear a mask when going out in public," and "It is important to listen to and heed the advice given by experts and scientists." A reliability check showed that Cronbach's alpha = 0.73. This factor was called "Concern about COVID-19." The second factor consisted of the items "It is important to heed and listen to the advice given by politicians and public figures" and "China is directly responsible for the infection rates and death toll in the United States." However, a reliability check indicated that Cronbach's alpha = 0.326, an unacceptable level of reliability. Upon investigation of the initial correlation matrix, we found that blame for China, but not trust of public figures, was related to both Authoritarianism and Conspiracy Beliefs. For that reason, we dropped the item "It is important to heed and listen to the advice given by politicians and public figures" and chose "Blame for China" as factor two.

Regression Models

Once we reduced our dependent variables to two factors, we ran two regression models. Each model included Authoritarianism, Conspiracy Beliefs, and gender as predictors. Since the initial correlation matrix found no effect of handedness, it was left out of the final two models. **Table 5** shows both regression models. For the first model, the "Concern about COVID-19" factor is the outcome variable. The overall model is significant. Authoritarianism had a significant negative relationship with concern. The more authoritarian attitudes that were endorsed, the less concerned participants were about COVID-19. Gender was also related to concern. Women showed more concern than men. Because both Gender and Authoritarianism were related to concern, we added the interaction term between Gender and Authoritarianism as part of a second step. The interaction term explained little additional variance and did not improve model fit.

The second model, also displayed in **Table 5**, used blame of China for COVID-19 as the dependent variable. The overall model was significant. Furthermore, both Authoritarianism and Conspiracy Beliefs uniquely predicted the tendency to give China more blame for the illness. Because both Conspiracy Beliefs and Authoritarianism were related to blame for China, we added the interaction term between Conspiracy Beliefs and Authoritarianism as part of a second step. The interaction term explained little additional variance and did not improve model fit.

TABLE 4 | Factor loading matrix.

	1	2
How worried and concerned are you about your personal health?	0.724	0.233
How worried and concerned are you about your financial situation?	0.402	0.261
How worried and concerned are you about the personal health of your fellow citizens?	0.853	0.000
How worried and concerned are you about the financial situation of your fellow citizens?	0.563	−0.072
How often do you wear a mask when going out in public?	0.615	−0.289
It is important to listen to and heed the advice given by experts and scientists	0.760	−0.116
It is important to listen to and heed the advice given by politicians and public figures	0.352	0.619
China is directly responsible for the infection rates and death toll in the United States	−0.229	0.812

Extraction method: principal component analysis.

TABLE 5 | Regression models.

	R	R^2	*b*	*SE*	β	*T*	*p*
DV one: concern about COVID-19	0.287	0.082					0.001
Authoritarianism			−0.079	0.023	−0.241	−3.516	0.001
Conspiracy belief			0.007	0.020	0.025	0.360	0.719
Gender			−2.009	0.915	−0.152	−2.196	0.029
DV two: blame on China for COVID-19	0.455	0.207					<0.001
Authoritarianism			0.029	0.007	0.277	4.325	<0.001
Conspiracy belief			0.031	0.006	0.347	5.423	<0.001
Gender			0.141	0.270	0.033	0.524	0.601

DISCUSSION

Before attempting any interpretation, it is important to note that the present study is exploratory and should serve as a hypothesis-generating study. It should not be considered a set of hypothetico-deductive tests of *a priori* hypotheses. Some researchers even caution that the use of *p*-values in exploratory research is potentially misleading (e.g., Nosek et al., 2018). While we have elected to keep the *p*-values in the paper, we caution readers to focus primarily on the direction and the size of the effects. The effect sizes should be used to estimate future sample sizes. Finally, the reader should keep in mind that our explanations for the findings are tentative. This must be kept in mind because of both the exploratory and correlational nature of the study.

Among a sample of American high school graduates, Authoritarianism was associated with less overall concern about the virus. Authoritarianism in this context can be defined as feelings of aggression toward people who violate their social norms and unthinking submission to authority. In a recently published paper, Prichard and Christman (2020) used the exact scale which was used in the present study and found that, among Republican primary voters, Authoritarianism was associated with support for Donald Trump. This might explain an odd aspect of the findings. Authoritarianism was also associated with a reduced likelihood of wearing a mask and a greater tendency to blame the virus on China. Conspiracy Beliefs are also related to a greater tendency to blame the virus on China. Interestingly, there was not a significant correlation between Conspiracy Beliefs and Authoritarianism. One potential explanation is that Authoritarianism among American high school graduates is associated with support for Donald Trump, as has been suggested by other studies (Choma and Hanoch, 2017; Prichard and Christman, 2020). Donald Trump has blamed China for the virus (McNeil and Jacobs, 2020) and refused to wear a mask (Blake, 2020). Hence, the trend for authoritarians to be mistrustful of scientists and experts and to refuse to wear a mask might reflect political views as opposed to a general tendency to believe in conspiracy theories. Related recent research offers further reason to suspect that political beliefs may be confounding the negative relationship between Authoritarianism and mask wearing. In a study of the relationships between Life History Orientation and COVID-19-related precautions, Corpuz et al. (2020) reported evidence that political conservatism (which included both social and economic factors) was associated with less endorsement of virus-related precautions and mandatory vaccination. Manson (2020) found that as of April, both Left-wing Authoritarianism and Right-wing Authoritarianism were associated with endorsement of stringent methods to prevent the spread of COVID-19. Our findings would seem to be contradictory, unless enough individuals who score high in authoritarian traits are following the lead of politicians who downplay the virus, such as Donald Trump (Blake, 2020). This raises the question of whether politics have led people who endorse authoritarian views, in particular Right-wing Authoritarians, to shift away from being concerned about the virus. According to this hypothesis, people who score high in Left-wing Authoritarianism would still support stringent anti-virus measures, but Right-wing Authoritarians will have shifted their views. This is a hypothesis that can be tested empirically, and should be of interest to researchers.

In the present study, Authoritarianism and Conspiracy Beliefs each made a separate contribution to explaining the variance associated with the belief that China is responsible for the virus. As stated above, Authoritarians and Conspiracists are not necessarily the same people. Conspiracy Beliefs were not related to the tendency to wear a mask, which might be explained by the fact that Conspiracy Beliefs were positively associated with concern for one's personal health. Authoritarianism was associated with a lower likelihood of wearing a mask. As such, the effects of inaccurate messaging about the virus may play differently with different people. A conspiracist who believes that China released the virus as part of a plot may be ill informed, but still worried enough to take preventative measures. An authoritarian who admires Donald Trump may blame China because Trump has openly blamed China for the virus (McNeil and Jacobs, 2020), but may also follow Trump's lead in refusing to wear a mask (Blake, 2020). Future research should replicate the same findings using the measures reported in the present paper. However, we recommend future studies take two additional steps. The first is to measure political orientation. We did not do so in this study, but it would help clarify the link between Trump support, Authoritarianism, and Conspiracy theories. In addition, it would be helpful to have samples which are predominantly from outside of America. The patterns may differ in countries that had different styles of leadership in response to the pandemic. For example, China may also be considered an authoritarian country, but China was able to use this to enforce strict lockdowns (Volpicelli, 2020). In that context, mask wearing and Authoritarianism may be positively related.

Our results did not exactly replicate the findings of Capraro and Barcelo (2020) insofar as men did not express a significantly lower tendency to wear masks. However, men expressed less concern overall regarding COVID-19.

Handedness did not predict any of the outcome variables. There are several possible explanations. One is that, as mentioned earlier, there may be a tendency of inconsistent handers to believe in conspiracies because of gullibility and for consistent handers to believe in conspiracies because of authoritarian tendencies. Another possibility is these particular nine COVID-19-related outcome variables are just not related to handedness and, despite handedness's usefulness as a predictor of other psychological variables (Prichard et al., 2013), it is not a particularly important variable for the study of these outcomes.

Psychologists have a potentially useful role to play in combating the misinformation that is worsening the impact of the virus. Part of the way to do this is to understand the personality variables and individual differences that predict COVID-19-related behaviors and sensitivities to anti-science messaging. Private firms have long been studying personality for their own purposes (Cadwalladr and Graham-Harrison, 2018). Bots are already targeting people with various kinds of misinformation with the help of data mining (Ferrara, 2020). At a time when COVID-19 is causing harm to peoples' health, the multiple

studies of relationships between personality and COVID-19-related behaviors have the potential to serve as an important firewall against those who would use personality-driven findings to spread misinformation about COVID-19.

DATA AVAILABILITY STATEMENT

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found below: https://osf.io/qjsr2/?view_only=404917253d4240ed9564ed24b8af6021.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by University of Arkansas at Monticello Human Subjects IRB. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

EP collected and analyzed the data. Both authors wrote approximately 50% of the manuscript.

REFERENCES

Barnett, K. J., and Corballis, M. C. (2002). Ambidexterity and magical ideation. *Laterality* 7, 75–84. doi: 10.1080/13576500143000131

Blake, A. (2020). *Republicans are Practically Begging Trump to Tell People to Wear a Mask. He Still Won't Listen*. Washington, DC: Washington Post.

Brotherton, R., French, C. C., and Pickering, A. D. (2013). Measuring belief in conspiracy theories: the generic conspiracist beliefs scale. *Front. Psychol.* 4:279. doi: 10.3389/fpsyg.2013.00279

Buhrmester, M., Kwang, T., and Gosling, S. D. (2011). Amazon;s mechanical turk: a new source of inexpensive, yet high-quality, data? *Perspect. Psychol. Sci.* 6, 3–5.

Cadwalladr, C., and Graham-Harrison, E. (2018). Revealed: 50 million Facebook profiles harvested for Cambridge Analytica in major data breach. *Guardian* 17:22.

Capraro, V., and Barcelo, H. (2020). The effect of messaging and gender on intentions to wear a face covering to slow down COVID-19 transmission. *arXiv* [preprint]. doi: 10.31234/osf.io/tg7vz

Choma, B. L., and Hanoch, Y. (2017). Cognitive ability and authoritarianism: understanding support for trump and clinton. *Personal. Individ. Differ.* 106, 287–291. doi: 10.1016/j.paid.2016.10.054

Christman, S. (2014). Individual differences in personality as a function of degree of handedness: consistent-handers are less sensation seeking, more authoritarian, and more sensitive to disgust. *Laterality: Asymmetries of Body, Brain and Cognition*, 19, 354–367. doi: 10.1080/1357650X.2013.838962

Christman, S. D., Prichard, E. C., and Corser, R. (2015). Factor analysis of the edinburgh handedness inventory: inconsistent handedness yields a two-factor solution. *Brain Cogn.* 98, 82–86. doi: 10.1016/j.bandc.2015.06.005

Corpuz, R., D'Alessandro, S., Adeyemo, J., Jankowski, N., and Kandalaft, K. (2020). Life history orientation predicts COVID-19 precautions and projected behaviors. *Front. Psychol.* 11:1857. doi: 10.3389/fpsyg.2020.01857

Ferrara, E. (2020). # covid-19 on twitter: bots, conspiracies, and social media activism. *arXiv* [preprint], Available at: https://arxiv.org/abs/2004.09531 (accessed July 8, 2020).

Jin, J.-M., Bai, P., He, W., Wu, F., Liu, X.-F., Han, D.-M., et al. (2020). Gender differences in patients with COVID-19: focus on severity and mortality. *Front. Public Health* 8:152. doi: 10.3389/fpubh.2020.00152

Lyle, K. B., and Grillo, M. C. (2020). Why are consistently-handed individuals more authoritarian? The role of need for cognitive closure, *Laterality,* 25, 490–510. doi: 10.1080/1357650X.2020.1765791

Manson, J. H. (2020). Right-wing authoritarianism, left-wing authoritarianism, and pandemic-mitigation authoritarianism. *Personal. Individ. Differ.* 167:110251. doi: 10.1016/j.paid.2020.110251

McNeil, D. G., and Jacobs, A. (2020). *Blaming China for the Pandemic, Trump Says U.S. Will Leave the W.H.O*. New York, NY: The New York Times.

Mitchell, A., Jurkowitz, M., Oliphant, J. B., and Shearer, E. (2020). *Three Months In, Many Americans See Exaggeration, Conspiracy Theories and Partisanship in COVID-19 News*. Washington, DC: Pew Research Center.

Nosek, B. A., Ebersole, C. R., DeHaven, A. C., and Mellor, D. T. (2018). The preregistration revolution. *Proc. Natl. Acad. Sci. U.S.A.* 115, 2600–2606. doi: 10.1073/pnas.1708274114

Oldfield, R. C. (1971). The assessment and analysis of handedness: the Edinburgh inventory. *Neuropsychologia* 9, 97–113. doi: 10.1016/0028-3932(71)90067-4

Prichard, E., Propper, R. E., and Christman, S. D. (2013). Degree of handedness, but not direction, is a systematic predictor of cognitive performance. *Front. Psychol.* 4:9. doi: 10.3389/fpsyg.2013.00009

Prichard, E. C., and Christman, S. D. (2016). Need for cognition moderates paranormal beliefs and magical ideation in inconsistent-handers. *Laterality* 21, 228–242. doi: 10.1080/1357650x.2015.1125914

Prichard, E. C., and Christman, S. D. (2020). Handedness and the 2016 US Primaries: consistent handedness predicts support for Donald Trump among republicans, but gender predicts support for hillary clinton among democrats. *Laterality* 1–13. doi: 10.1080/1357650X.2020.1810061

Rattazzi, A. M. M., Bobbio, A., and Canova, L. (2007). A short version of the right-wing authoritariaNism (RWA) Scale. *Personal. Individ. Differ.* 43, 1223–1234. doi: 10.1016/j.paid.2007.03.013

Volpicelli, G. (2020). *China has Almost Eliminated Covid-19. What can the World Learn?*. London: Wired UK.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 17 June 2021
doi: 10.3389/fpsyg.2021.658919

Conspiracy Mentality Predicts Public Opposition to Foreign Trade

*Alexander Jedinger**

GESIS – Leibniz Institute for the Social Sciences, Cologne, Germany

The proliferation of protectionist sentiments and policies has raised questions about the psychological sources of trade openness among the public. The current research investigated the effects of a previously neglected factor on attitudes toward international trade: conspiracy mentality. Conspiracy mentality describes the generalized belief that political and economic events are controlled by powerful malevolent forces acting in secret. Using data from a cross-sectional survey of German adults (N = 391), I hypothesized and found that conspiracy mentality is uniquely associated with the perceived threat posed by foreign trade and opposition to international trade. These findings suggest that individual differences in conspiracy mentality make an important contribution to understanding the fears associated with economic globalization.

Keywords: conspiracy mentality, policy attitudes, foreign trade, protectionism, economic globalization

OPEN ACCESS

Edited by:
Mark Hallahan,
College of the Holy Cross,
United States

Reviewed by:
Asheley R. Landrum,
Texas Tech University, United States
Sinan Alper,
Yaşar University, Turkey

***Correspondence:**
Alexander Jedinger
alexander.jedinger@gesis.org

Specialty section:
This article was submitted to Personality and Social Psychology, a section of the journal Frontiers in Psychology

Received: *26 January 2021*
Accepted: *10 May 2021*
Published: *17 June 2021*

Citation:
Jedinger A (2021) Conspiracy Mentality Predicts Public Opposition to Foreign Trade. Front. Psychol. 12:658919. doi: 10.3389/fpsyg.2021.658919

INTRODUCTION

In recent years, there has been heated public debate about the political, social, and economic consequences of international trade (Blendon et al., 2017). Although general support for foreign trade remains high in most Western industrialized nations, free trade agreements such as the Transatlantic Trade and Investment Partnership (TTIP) have witnessed growing skepticism among the public (Bluth, 2016; White, 2017; Steiner, 2018; Eliasson and Huet, 2019). In addition, many countries adopted protectionist policies after the global financial crisis to shield their domestic economy against foreign imports (Evenett and Fritz, 2019; World Trade Organization, 2019). This development recently peaked under former U.S. President Donald Trump when he withdrew the United States from key international trade agreements (e.g., the Trans-Pacific Partnership; TPP) and enacted several increases in tariffs and other trade barriers that culminated in an ongoing trade conflict with Europe and China (Chong and Li, 2019; Fajgelbaum et al., 2020). Against this background, understanding the psychological determinants of trade openness has become an important task for scholars from various disciplines because protectionist attitudes have been linked to rising levels of support for right- and left-wing populist candidates and parties that use anti-globalization rhetoric to rally against immigrants and financial elites (Rodrik, 2018; van der Waal and de Koster, 2018; van Bohemen et al., 2019).

Protectionist attitudes entail support for policies that restrict international trade to protect the domestic economy from foreign competition (e.g., import tariffs or non-tariff trade barriers; see Rodrik, 1995). Previous research has largely attributed protectionist sentiments to economic insecurity among low-skilled individuals in export-oriented industries who feel threatened by foreign competition (e.g., O'Rourke and Sinnott, 2001; Scheve and Slaughter, 2001; Kaltenthaler et al., 2004; Mayda and Rodrik, 2005). Notably, however, the material advantages and disadvantages of global trade are of little importance in predicting attitudes toward foreign trade (e.g., Johnston, 2013; Rho and Tomz, 2017). Over and above material self-interest, recent work has argued that

views on global trade are driven by generalized political attitudes, including nationalism (O'Rourke and Sinnott, 2001; Rankin, 2001), ethnocentrism (Mansfield and Mutz, 2009; Mansfield et al., 2019), authoritarianism and social dominance orientation (Johnston, 2013; Satherley and Sibley, 2016; Mutz and Kim, 2017; Jedinger and Burger, 2020). In the present study, I contribute to the growing research on the psychological basis of trade attitudes by exploring the potential role of conspiracy mentality in understanding the psychological differences between supporters and opponents of free trade.

CONSPIRACY MENTALITY AND ATTITUDES TOWARD FOREIGN TRADE

Conspiracy theories have long been a pervasive feature of societal discourses, especially in times of social and economic crises (van Prooijen and Douglas, 2017). Conspiracy theories are defined as attempts to explain important societal events by the planned actions of sinister and powerful forces, which act in the hidden (van Prooijen, 2018; Douglas et al., 2019). For example, during the Great Recession of 2008/2009, a popular conspiracy theory proposed that the financial crisis was deliberately caused by Wall Street bankers to expand the power of the American Federal Reserve System (Oliver and Wood, 2014).

Empirical research consistently finds that beliefs in specific kinds of conspiracy theories are strongly intercorrelated, which suggests an underlying predisposition for conspiracy explanations (e.g., Goertzel, 1994). This is true for conspiracy theories that are relatively independent, fictitious, or even contradictory (Swami et al., 2011; Wood et al., 2012; Brotherton et al., 2013). Accordingly, several scholars have proposed the existence of a conspiratorial mindset or conspiracy mentality. Conspiracy mentality refers to a general propensity to view societal events as the result of the secret plans of powerful individuals and groups that pursue their own unlawful or malicious goals (Moscovici, 1987; Brotherton et al., 2013; Imhoff and Bruder, 2014).

During the last decade, scholars have begun to systematically investigate the real-world consequences of conspiracy beliefs, covering a wide range of issues from the environment to public health and immigration, just to name a few (for an overview, see Douglas et al., 2015). However, there has been a scarcity of research that explored how endorsements of conspiracy narratives are related to economic attitudes and behavior.

The idea that a clandestine group of powerful people controls important economic and financial events is very popular, and a malicious plot to rig the economy is part of many conspiracy narratives (Uscinski, 2020). For instance, a common theme within the so-called New World Order conspiracy is that a global elite who secretly controls international organizations such as the World Bank, the International Monetary Fund (IMF), and the World Trade Organization (WTO) is pursuing the worldwide dismantling of trade barriers to establish an authoritarian world government (Spark, 2000).

Economic phenomena such as globalization and international trade provide fertile ground for conspiratorial thinking because rapid economic changes elicit feelings of material insecurity such as those associated with technological progress, offshoring, and automation (van Prooijen and Douglas, 2017). Additionally, economic issues are often complex and difficult for citizens to comprehend, which in turn attracts people to simplistic explanations to gain a sense of control (Baron and Kemp, 2004; Leiser et al., 2017). Finally, public distrust in key actors of the free market economy, such as major corporations and banks, is widespread and fuels conspiratorial suspicion (Smallpage et al., 2017; Gallup, 2020).

The uncertainties and complexity surrounding foreign trade raise the possibility that conspiracy mentality may be an important and previously overlooked explanatory factor for protectionist attitudes. According to Imhoff and Bruder (2014), conspiracy mentality is a belief system that entails a heightened sensitivity to cues that signal power asymmetries in intergroup relations. More specifically, the extent to which people subscribe to a conspiracy mentality is associated with hostility toward powerful groups that are held responsible for undesirable developments in society. The concept of conspiracy mentality can be situated within a larger theoretical framework of ideology as motivated social cognition (Jost et al., 2003). Jost et al. (2003) identified two core elements underlying ideological belief systems: advocating vs. resisting social change and opposing vs. accepting social inequality. These core elements are linked to basic epistemic, existential and relational needs. In other words, all individuals fundamentally strive for epistemic certainty, physical security and positive feelings associated with belonging to important social in-groups. The theory posits that those higher in need of managing uncertainty and threats are more likely to adapt conservative system-justifying belief systems because they provide a functional match to their basic psychological needs.

Resistance to change is most often measured by right-wing authoritarianism (Altemeyer, 1996), which predicts negative attitudes toward groups perceived as culturally deviant and threatening to the norms and values of in-groups (Shaffer and Duckitt, 2013). Acceptance of inequality is often related to individual differences in social dominance orientation (Pratto et al., 1994) that give rise to negative attitudes toward groups of low socioeconomic status (Asbrock et al., 2010). In contrast, conspiracy mentality has been conceived as a system-challenging belief system because it entails an aversion toward those in power (Imhoff and Bruder, 2014). However, recent work argued that a conspiratorial worldview is a means to bolster the societal status quo by attributing negative developments in society to small groups of powerful but evil-minded conspirators rather than to deficits of the social system as a whole (Douglas and Sutton, 2018). Consistent with this reasoning, several studies have indicated that threats to the legitimacy of the social system actually lead to greater endorsements of conspiracy beliefs (Federico et al., 2018; Jolley et al., 2018).

Conspiracy mentality also shares some conceptual similarities with populist attitudes. Populism is defined as a generalized attitude in which society is perceived as an antagonism between the "pure people" and a corrupt political elite (Mudde, 2004). The elite is assumed to act only for its material benefit and against the interests of the people, while the people are assumed

to have higher moral qualities. The skepticism toward power elites and the Manichean view of the world are shared by people high in conspiracy mentality and populist attitudes (Castanho Silva et al., 2017). However, conspiracy beliefs aim more at reducing epistemic uncertainty and the associated loss of control by offering explanations for specific events that differ from official accounts (Swami et al., 2010; Imhoff and Bruder, 2014). Furthermore, populist beliefs are primarily focused on the role of the political establishment, whose actions are not necessarily conspiratorial. Finally, an essential component of populism is the alignment of political decision-making with the "will of the people." People with a pronounced conspiracy mentality, on the other hand, see themselves as superior to their fellow citizens because they feel "enlightened" and have seen through the supposed conspiratorial machinations (Imhoff and Lamberty, 2017). Thus, although conspiracy mentality and populist attitudes have conceptual similarities, they indicate different patterns of generalized attitudes.

Another line of inquiry focuses more on the consequences of a conspiratorial mindset. Past research has shown that people high in conspiracy mentality are more likely to express prejudice toward powerful outgroups (e.g., managers and capitalists), distrust the government, and tend to attribute less credibility to experts (Imhoff and Bruder, 2014; Einstein and Glick, 2015; Imhoff and Lamberty, 2018; Imhoff et al., 2018). Furthermore, they are less likely to engage in conventional forms of political participation (e.g., voting), which are deemed ineffective in challenging existing political and economic power structures; however, they are more prone to rely on alternative forms of political participation, such as violent protests (Jolley and Douglas, 2014; Uscinski et al., 2016; Ardèvol-Abreu et al., 2020; Imhoff et al., 2021).

More directly relevant for the current investigation, past research suggests that people who endorse a conspiratorial worldview are more likely to oppose policies promoted by powerful agents (e.g., major corporations or national governments) because they are supposed of serving the sinister interests of clandestine elites (Imhoff et al., 2018; Lamberty and Imhoff, 2018). For instance, Lamberty and Imhoff (2018) demonstrated that individuals high in conspiracy mentality evaluated a fictitious drug more positively if its approval was advocated by a low-power group (an interest group of patients) than if the drug was supported by a high-power group (a pharmaceutical consortium).

In the context of the current investigation, trade negotiations often involve asymmetrical power relations between citizens, on the one hand, and major corporations, international financial institutions, and national authorities, on the other hand. Consequently, the social, economic, and cultural consequences of foreign trade will be perceived as a threat to the well-being of citizens among those higher in conspiracy mentality. Furthermore, any policy that promotes the dismantling of trade restrictions will be seen as a malicious plot to the detriment of the interests of citizens and therefore opposed by those high in this predisposition.

THE PRESENT RESEARCH

Although previous research has examined the impact of generalized political attitudes on protectionist sentiments, we know relatively little about how a conspiratorial worldview predicts aversion to economic openness. To address this gap, the current study examines the extent to which conspiracy mentality affects public opposition to free trade using data from a cross-sectional survey among German Internet users. According to the theoretical framework presented above, individuals high in conspiracy mentality will perceive policies proposed by high-power agents as suspicious. Free trade agreements and the dismantling of regulatory barriers to trade have long been promoted by the German government and influential business associations, as the German export-oriented economy is highly integrated into global trade (Federal Ministry for Economic Affairs Energy, 2020). Thus, I hypothesize that conspiracy mentality will be positively associated with the endorsement of protectionist attitudes (Hypothesis 1) and should increase perceptions of the economic, social, and cultural threat posed by international trade (Hypothesis 2).

I also control for several established covariates that are related to trade preferences, such as resistance to change, acceptance of social inequality, labor market skills, demographics, as well as populist attitudes.

METHOD

Participants and Procedure

The sample for the present study is a subsample ($N = 391$) of a larger survey ($N = 1,000$) on the consequences of conspiracy beliefs among German citizens. A national quota sample of adult German citizens was drawn from an opt-in online panel maintained by a commercial survey agency (Respondi). The quotas were set up to represent the German population with internet access in terms of age, gender, education, and region of residence. The survey was administered online between March 9 and 16, 2020. The participants received a small financial reward from the survey agency in exchange for their participation. In total, $N = 1{,}000$ participants completed the survey, and a randomly chosen subsample of $N = 500$ answered questions about their trade policy preferences. Of these participants, 109 were excluded after listwise deletion of missing data[1]. A sensitivity power analysis ($\alpha = 0.05$, two-tailed) indicated that a sample size of 391 allows the detection of a relatively small effect ($f^2 = 0.02$) with 80% power. The age of the remaining participants varied between 19 and 76 years ($M = 50.4$, $SD = 15.1$), and about half of the participants were

[1]The percentage of missing values was relatively low (≤6.2%), except for self-reported household income (10.2%) and attitudes toward trade agreements (11.2%). However, Little's (1988) test indicated that the data were missing completely at random, $\chi^2_{(148)} = 160.83$, $p = 0.22$. Thus, listwise deletion was considered unproblematic. Nevertheless, missing values for household income were imputed using predictive mean matching to avoid losing too many observations. All variables from the analytical model were included in the imputation model as well as employment status as auxiliary variable. As suggested by the literature attitudes toward trade agreements as a dependent variable were not imputed (Little, 1992).

male (51.7%). Regarding their formal level of education, 20.7% reported having a lower secondary qualification (after 9 years of schooling) or no degree, 43.5% reported having an intermediary secondary qualification (after 10 years of schooling), and 35.8% reported having a higher secondary qualification (technical college or University entrance qualification, after 11 or 12 years of schooling). The median monthly household income category was 2,500 to <3,000 euros. The distribution of age and gender in the sample largely corresponds to the German population, even after respondents with missing data were excluded. Participants with a lower education level were underrepresented, while participants with a medium level of education were slightly overrepresented (a detailed comparison can be found in **Supplementary Table 2.1**).

After providing informed consent, the participants completed a questionnaire including measures of economic attitudes, conspiracy beliefs, political attitudes, and a host of other items unrelated to the present research. The exact wording of all measures can be found in **Supplementary Material**, Section 1. Ethical approval was obtained from the local institutional research and ethics committee.

Measures

Conspiracy Mentality

Conspiracy mentality was measured with a shortened five-item version of the original Conspiracy Mentality Scale proposed by Imhoff and Bruder (2014). All items were presented in randomized order and scored on five-point scales ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The descriptive statistics and corrected item-total correlations of the items are shown in **Table 1**. The items were averaged to produce a composite score (Cronbach's $\alpha = 0.82$; McDonald's $\omega = 0.84$).

Attitudes Toward International Trade

General opposition to international trade was measured by one item "(What do you think about the growing trade relations between Germany and other countries—do you think it is a good thing, or a bad thing for Germany?") adapted from Bluth (2016). The participants were asked to rate their attitude toward growing trade ties with other countries on a seven-point scale (1 = *very bad*; 7 = *very good*). Furthermore, they were asked to indicate their support for free trade agreements between the European Union (EU) and other countries using a self-developed item ("Currently, there is much discussion about the adoption of free trade agreements. Do you favor or oppose that the European Union (EU) enters free trade agreements with other countries?"). Responses were given on a seven-point scale (1 = *completely support*; 7 = *completely oppose*).

Perceived Threats Posed by International Trade

To assess perceived threats associated with international trade, the participants were asked to indicate whether growing global trade had positive or negative consequences for Germany in 10 different areas using items adapted from Bluth (2016): economic growth; employment and the labor market situation; the consumer prices of goods and services; international competitiveness; consumer protection standards (e.g., for agricultural products); environmental standards; workers' rights and social standards; cultural life; state regulatory jurisdiction; and cultural values and traditions. These areas were selected because they constitute the main lines of public dissent on the anticipated positive and negative consequences of international trade. The participants responded to these items, which were presented in a randomized order, on scales ranging from 1 (*very positive*) to 7 (*very negative*).

To examine the factorial structure of the 10-item scale, a principal axis factor analysis was conducted. The initial eigenvalues and visual inspection of the scree plot suggested that a single factor should be extracted. The first unrotated factor (eigenvalue = 5.24) accounted for 94.3% of the total variance, with factor loadings ranging between 0.66 and 0.76. A parallel analysis, according to Horn (1965), suggests the extraction of three factors. After oblique rotation (promax), which takes into account that the factors are correlated, the three-factorial solution could be clearly interpreted. The first factor describes the perceived economic threats posed by foreign trade (four items). The second factor refers to the undermining of environmental, social, and product-related standards (four items). The third factor refers to the negative consequences of foreign trade for cultural values (two items). All factors were strongly correlated ($r \geq 0.57$). The following results, however, do not differ substantively by specific facets of trade threats (see **Supplementary Materials**, **Supplementary Table 3-1**)[2]. Therefore, I use a composite scale of perceived threat in the remaining analyses (Cronbach's $\alpha = 0.91$; McDonald's $\omega = 0.92$).

Resistance to Change and Acceptance of Inequality

Generalized political attitudes indicating a tendency to derogate out-groups and favor in-groups emerged as robust predictors of trade attitudes, often rivaling the effects of more tangible consequences of foreign trade (e.g., Mansfield and Mutz, 2009; Johnston, 2013). According to Jost et al. (2003), generalized political attitudes are based on individual differences in the propensity to tolerate social changes and hierarchies. Resistance to social change was captured by two items adapted from the Moral Traditionalism Scale (Conover and Feldman, 1986). The items include "The world is constantly changing, and we should adapt our understanding of moral behavior to these changes" and "We should be more tolerant of people who choose to live according to their own moral standards, even if they are very different from our own" (both are reverse coded). Acceptance of social inequality was measured with three items taken from the Social Inequality Scale (Mayer et al., 2014) with statements such as "The differences in rank between people are acceptable because they essentially express what you did with the opportunities you had." Participants responded on five-point Likert scales (1 = *strongly disagree*; 5 = *strongly agree*), and an average score was computed for resistance to change (Cronbach's $\alpha = 0.45$; McDonald's $\omega = 0.67$) and acceptance of inequality (Cronbach's $\alpha = 0.68$; McDonald's $\omega = 0.68$).

[2] An exception to this pattern is that conspiracy mentality is mainly associated with economic and symbolic threat (see **Supplementary Table 3-1**).

TABLE 1 | Descriptive item statistics for the conspiracy mentality scale.

Items		*M*	*SD*	r_{it}
1.	Most people do not recognize the extent to which our lives are determined by conspiracies that are concocted in secret.	2.77	1.32	0.72
2.	There are secret organizations that have great influence on political decisions.	3.13	1.28	0.73
3.	Politicians and other leaders are nothing but the puppets of powers operating in the background.	3.30	1.21	0.70
4.	I think that the various conspiracy theories circulating in the media are absolute nonsense.*	3.52	1.17	0.50
5.	There is no good reason to distrust governments, intelligence agencies, or the media.*	2.47	1.14	0.41

*The entries are the means, standard deviations, and corrected item-total correlations. The items marked with an asterisk * are reverse coded. Response scale: 1, strongly disagree, 2, disagree, 3, neither agree nor disagree, 4, agree, and 5, strongly agree. N = min. 367.*

Populism

Populism is a generalized attitude that divides society into deceitful elites and the "true people" and demands that political decision-making should be the expression of a homogeneous "popular will" (Mudde, 2004). While populist attitudes are essentially content-free because they refer to the inherent dualism between political elites and ordinary people, the anti-elitist component and distrust in political authorities could possibly influence attitudes toward foreign trade. Therefore, populist attitudes are included as a covariate in the following analyses. Participant completed a six item populism scale (Akkerman et al., 2014) that included statement such as "The political differences between the elite and the people are larger than the differences among the people" (1 = *strongly disagree*; 5 = *strongly agree*). The scale exhibited very good reliability (Cronbach's $\alpha = 0.86$; McDonald's $\omega = 0.87$).

Labor Market Skills

According to classical trade theory, individuals with higher levels of labor market skills and those working in export-oriented sectors of employment are more supportive of trade openness (Rodrik, 1995). Unfortunately, the survey does not include questions about the respondents' occupational industry. However, I will use educational attainment, task autonomy, and income as established indicators of individuals' objective skill level (Scheve and Slaughter, 2001; Blonigen, 2011; Blonigen and McGrew, 2014). First, the participants were asked to report their level of formal education and vocational qualifications, which were combined to produce an overall measure of educational attainment, as outlined by Hoffmeyer-Zlotnik and Warner (2005) (1 = *no professional qualification*; 5 = *University degree*). Second, the participants indicated their occupational category (manual laborer, clerk, civil servant, self-employed worker, or farmer), followed by their level of professional activity (e.g., frontline or managerial employee). The professional activity was then categorized based on the degree of task autonomy (Hoffmeyer-Zlotnik and Geis, 2003), with higher values indicating increasing responsibility and leadership skills and lower task routineness, resulting in a five-point scale ranging from 1 (*low autonomy*) to 5 (*high autonomy*). Finally, the participants reported their monthly household income using 12 categories that were recoded to income quintiles (1 = *<1.500 euro*; 5 = *4,000 euro or more*).

Demographics

The following demographic controls were included: age (in years), gender (1 = *male,* 0 = *female*), and region (1 = *East Germany*, 0 = *West Germany*).

RESULTS

The descriptive statistics and bivariate correlations among the main study variables are displayed in **Table 2**. Consistent with the hypotheses formulated above, conspiracy mentality is positively correlated with opposition to free trade in general and free trade agreements between the EU and other states. Furthermore, a conspiratorial worldview is positively correlated with increased levels of perceived threat posed by international trade. In turn, perceived threat strongly correlates with opposition to trade openness and trade agreements. Resistance to social change was positively related to trade protectionism in general and perceived trade threats but unrelated to attitudes toward trade agreements. Conversely, the acceptance of social hierarchies was negatively associated with the disapproval of trade negotiations and beliefs about trade threats but unrelated to general protectionism. As expected, the correlation analysis revealed significant positive associations between populism and all three indicators of protectionism. There was also a strong positive correlation between populist attitudes and conspiracy mentality. In line with previous research, individuals with higher levels of educational attainment, task autonomy and income are less likely to oppose trade openness, but only individuals who score higher on task autonomy endorse the negotiation of free trade agreements.

A series of hierarchical (OLS) regression analyses were carried out to examine whether conspiracy mentality explains any additional variance in trade perceptions and attitudes, taking several covariates into account. Regressions diagnostics indicated no violations of model assumptions. Although several multivariate outliers were detected by means of Cook's distance (Cohen et al., 2003), excluding these cases does not substantially change the results. In the first step, generalized political attitudes, labor market skills and demographic characteristics were included in the regression model. In the second step, conspiracy mentality was added to the model. All continuous variables were converted to range from 0 to 1 to facilitate the

TABLE 2 | Descriptive statistics and correlations among the main study variables.

	M	*SD*	1	2	3	4	5	6	7	8	9
1. Conspiracy mentality	3.06	0.95									
2. Opposition to free trade	2.90	1.18	0.29***								
3. Opposition to free trade agreements	3.26	1.32	0.22***	0.29***							
4. Perceived trade threat	3.71	0.99	0.28***	0.44***	0.52***						
5. Resistance to social change	2.69	0.83	0.09	0.18***	0.09	0.26***					
6. Acceptance of social inequality	2.61	0.87	−0.02	−0.04	−0.19***	−0.14**	−0.14**				
7. Populism	3.70	0.86	0.64***	0.26***	0.11*	0.25***	0.10*	−0.08			
8. Educational attainment	3.57	0.97	−0.16**	−0.16**	−0.07	−0.05	−0.02	0.03	−0.16**		
9. Task autonomy	3.03	0.93	−0.20***	−0.15**	−0.15**	−0.07	0.05	0.06	−0.18***	0.45***	
10. Household income	2.89	1.46	−0.22***	−0.12*	−0.07	−0.01	−0.02	0.12*	−0.19***	0.26***	0.24***

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$; $N = 391$.

interpretation of unstandardized regression coefficients[3]. The results are shown in **Table 3**.

In the first step, generalized political attitudes, labor market skills, and demographic characteristics accounted for 14.4% of the variance in perceived trade threats, $\Delta R^2 = 0.144$, $F_{(9, 381)} = 7.10$, $p < 0.001$, 14.7% of the variance in trade hostility, $\Delta R^2 = 0.147$, $F_{(9, 381)} = 7.32$, $p < 0.001$, and 9.6% of the variance in opposition to trade agreements, $\Delta R^2 = 0.096$, $F_{(9, 381)} = 4.48$, $p < 0.001$. The R^2 change statistic between Step 1 and Step 2 indicated that an additional 2.1% of variance in perceived threat was explained by adding conspiracy mentality to the model, $\Delta R^2 = 0.021$, $F_{(1, 380)} = 9.65$, $p = 0.002$. The incremental increases in explained variance for disapproval of foreign trade and trade agreements were 1.5% [$\Delta R^2 = 0.015$, $F_{(1, 380)} = 6.81$, $p = 0.009$] and 2.6%, [$\Delta R^2 = 0.026$, $F_{(1, 380)} = 11.44$, $p < 0.001$], respectively.

Mirroring the findings of the correlation analysis, conspiracy mentality significantly predicted increased perceptions of threats associated with the global exchange of goods and services, heightened hostility toward free trade, and stronger opposition to trade agreements. As can be seen from the regression coefficients in **Table 3**, moving from the minimum to the maximum score for conspiracy mentality increases the perceived threats from trade and general trade hostility by 14 percentage points ($b = 0.14$, $SE = 0.04$, $\beta = 0.19$, $t = 3.11$, $p = 0.002$, and $b = 0.14$, $SE = 0.05$, $\beta = 0.16$, $t = 2.61$, $p = 0.009$, respectively). Regarding opposition to trade agreements, changing from the lowest to the highest level of conspiracy mentality leads to a shift of 20 percentage points of the range of the dependent variable ($b = 0.20$, $SE = 0.06$, $\beta = 0.22$, $t = 3.38$, $p = 0.001$).

None of the other explanatory factors showed a comparable consistent and substantial effect on anti-trade attitudes and beliefs in the final step of the regression analysis. With regard to the other predictors in the final model, only generalized political attitudes had considerable effects on protectionism. As shown in **Table 3**, there was again a significant positive relationship between resistance to change and the perceived threats of trade relations as well as general animosity toward trade. Acceptance of inequality was a significant negative predictor of trade agreements between the EU and other countries. After adjusting for other predictors in the model, populist attitudes and individual differences in labor market skills did not make a noteworthy contribution to predicting foreign trade attitudes.

DISCUSSION

Opponents of foreign trade from both the left and the right of the political spectrum often argue that global trade serves the economic interests of powerful corporate capitalism, which tries to control national authorities and to undermine the liberal and social rights of ordinary people (Spark, 2000). In the present study, I examined whether a generalized belief that our society is controlled by the activities of conspiratorial powers influences attitudes toward free trade. Although the magnitude of effects are in the low to medium range, the results show that conspiracy mentality predicts unique variance in opposition to trade openness, even controlling for several drivers of protectionist attitudes such as generalized political attitudes and individuals' labor market skills. Furthermore, individuals who are more prone to a conspiratorial worldview feel more threatened by the economic, political, and social consequences of international trade. The results also show that resistance to social change makes an important contribution to explaining economic protectionism, which is in line with previous studies that found strong negative effects of related constructs such as authoritarianism on trade openness. By contrast, acceptance of social inequality was negatively associated with animosity toward trade agreements. While populist attitudes were positively associated with protectionism in the bivariate analysis, they did not contribute to the explanation of protectionist sentiments after adjusting for general beliefs in conspiracies. This lends further support to the discriminant validity of conspiracy mentality. The results also confirm once again that material interests do not play a major role in explaining trade attitudes compared to intergroup attitudes.

[3]The conversion was done using the following formula: (observed–min)/(max–min), with observed indicating the observed score for a given variable, and min and max denoting the minimum and maximum possible score on the scale, respectively (see Cohen et al., 2003).

TABLE 3 | Hierarchical regression predicting anti-trade perceptions and attitudes.

	Perceived trade threat		Opposition to free trade		Opposition to free trade agreements	
Predictor	**B (SE)**	**Beta**	**B (SE)**	**Beta**	**B (SE)**	**Beta**
Step 1: ΔR^2	0.144***		0.147***		0.096***	
Resistance to social change	0.18***	0.22	0.15**	0.16	0.07	0.06
	(0.04)		(0.05)		(0.05)	
Acceptance of social inequality	−0.07	−0.09	0.01	0.01	−0.17***	−0.17
	(0.04)		(0.04)		(0.05)	
Populism	0.07	0.10	0.11	0.12	−0.06	−0.06
	(0.05)		(0.06)		(0.07)	
Educational attainment	−0.01	−0.02	−0.09*	−0.11	−0.02	−0.02
	(0.04)		(0.04)		(0.05)	
Task autonomy	−0.02	−0.03	−0.02	−0.02	−0.07	−0.07
	(0.04)		(0.05)		(0.05)	
Household income	0.04	0.09	−0.01	−0.02	0.01	0.01
	(0.02)		(0.03)		(0.03)	
Age	−0.02	−0.03	−0.09*	−0.10	−0.10*	−0.10
	(0.04)		(0.04)		(0.05)	
Male	−0.03	−0.09	−0.05**	−0.13	−0.05*	−0.11
	(0.02)		(0.02)		(0.02)	
East Germany	0.03	0.08	0.03	0.06	0.04	0.07
	(0.02)		(0.02)		(0.03)	
Step 2: ΔR^2	0.021**		0.015**		0.026***	
Conspiracy mentality	0.14**	0.19	0.14**	0.16	0.20***	0.22
	(0.04)		(0.05)		(0.06)	
Constant	0.30***		0.25***		0.46***	
	(0.05)		(0.05)		(0.06)	
Total R^2	0.165***		0.162***		0.122***	

The entries are unstandardized OLS regression coefficients, standard errors in parentheses, and standardized coefficients in the final step. All continuous variables ranged from 0 to 1; N = 391.

$^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

From a theoretical point of view, the results imply that a new dimension of intergroup attitudes should be taken into account in the psychological explanation of foreign trade preferences. Previous studies suggest that people reject free trade because they perceive trade relations as a zero-sum game (ethnocentrism), associate the exchange of goods with a negative influence of foreign ideas on their own culture (authoritarianism), or are afraid of losing their own status in competition with supposedly inferior nations (social dominance orientation). However, thinking in conspiracy categories makes not inferior but powerful groups responsible for the negative effects of economic globalization. This makes conspiracy theories particularly attractive to powerless groups in society who see themselves on the economic losing side.

The results also have practical implications for policies addressing concerns about economic globalization. Thus far, labor market and social policy measures have mainly been designed to compensate the so-called "losers of globalization" only materially by expanding welfare services (see Marcal, 2001; Hays et al., 2005). However, the reported findings make it clear that political countermeasures to economic nationalism should also leverage economic education and debunking techniques (van der Linden and Roozenbeek, 2021) to help people better understand global economic processes and to avoid the pitfalls of conspiratorial thinking.

The strengths of the present study are that the analyses are based on a diverse sample and, unlike other studies, rely on a relatively large number of items to measure foreign trade perceptions and attitudes. In addition, the scale used to measure conspiracy mentality is relatively abstract and is not, like other scales, based on a selection of beliefs in specific conspiracy theories (e.g., Brotherton et al., 2013). Thus, the scale is not contaminated with political and economic positions that one might want to explain.

Naturally, however, the conclusions are also subject to some limitations. The present sample is restricted to German citizens with Internet access drawn from an opt-in online panel. While Internet penetration in Germany is quite high, future studies should strive to replicate the results using probability samples that include the off-line population as well. Another limitation is that the cross-sectional and observational design of the study

does not allow for any statements on the causal relationship between conspiracy mentality and protectionism. There is evidence that experimental exposure to political conspiracy theories increases distrust in governmental institutions (Einstein and Glick, 2015; Kim and Cao, 2016), and it could be worthwhile to manipulate the salience of conspiratorial thinking to investigate the effects on economic attitudes and behavior. The reliabilities of the scales measuring resistance to change and acceptance of inequality were far from optimal, and future studies should strive to assess the incremental validity of conspiracy mentality using more established scales such as right-wing authoritarianism (Altemeyer, 1996). Likewise, future research could profit from including measures of nationalism to prove the robustness of the findings (e.g., Rankin, 2001). Moreover, it would be desirable to consider a more extensive number of covariates for material interests to account for the potentially confounding effects of the sector of employment, automation, or offshorability (e.g., Owen and Johnston, 2017).

CONCLUSION

The evidence presented here contributes to the growing research on trade attitudes by showing that conspiracy mentality is an important factor in forming trade policy preferences. Economic globalization is associated not only with subjective fears of material losses but also with irrational ideas about being controlled by the invisible hand of dark forces. To be sure, not all criticisms of globalization are based on conspiratorial thinking, but people high in this trait are more likely to link trade issues with the supposed actions of sinister groups that pull the strings of international financial capitalism, thus creating a breeding ground for populist reactions to international trade.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available from PsychArchives at: http://dx.doi.org/10.23668/psycharchives.4840.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics Committee at GESIS—Leibniz-Institute for the Social Sciences (Application 2020-2). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

FUNDING

The publication of this article was funded by the Open Access Fund of the Leibniz Association.

ACKNOWLEDGMENTS

I would like to thank Sofie Jedinger and the two reviewers for their helpful comments on earlier versions of the article.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2021.658919/full#supplementary-material

REFERENCES

Akkerman, A., Mudde, C., and Zaslove, A. (2014). How populist are the people? Measuring populist attitudes in voters. *Compar. Polit. Stud.* 47, 1324–1353. doi: 10.1177/0010414013512600

Altemeyer, B. (1996). *The Authoritarian Specter*. Cambridge, MA: Harvard University Press.

Ardèvol-Abreu, A., Gil de Zúñiga, H., and Gámez, E. (2020). The influence of conspiracy beliefs on conventional and unconventional forms of political participation: the mediating role of political efficacy. *Br. J. Soc. Psychol.* 59, 549–569. doi: 10.1111/bjso.12366

Asbrock, F., Sibley, C. G., and Duckitt, J. (2010). Right-wing authoritarianism and social dominance orientation and the dimensions of generalized prejudice: a longitudinal test. *Eur. J. Pers.* 24, 324–340. doi: 10.1002/per.746

Baron, J., and Kemp, S. (2004). Support for trade restrictions, attitudes, and understanding of comparative advantage. *J. Econ. Psychol.* 25, 565–580. doi: 10.1016/S0167-4870(03)00064-3

Blendon, R. J., Casey, L. S., and Benson, J. M. (2017). Public opinion and trump's jobs and trade policies. *Challenge* 60, 228–244. doi: 10.1080/05775132.2017.1308763

Blonigen, B. A. (2011). Revisiting the evidence on trade policy preferences. *J. Int. Econ.* 85, 129–135. doi: 10.1016/j.jinteco.2011.05.010

Blonigen, B. A., and McGrew, J. (2014). Task routineness and trade policy preferences. *Econ. Polit.* 26, 505–518. doi: 10.1111/ecpo.12046

Bluth, C. (2016). *Attitudes to Global Trade and TTIP in Germany and the United States [Global Economic Dynamics Study]*. Gütersloh: Bertelsmann Foundation.

Brotherton, R., French, C., and Pickering, A. (2013). Measuring belief in conspiracy theories: the generic conspiracist beliefs scale. *Front. Psychol.* 4:279. doi: 10.3389/fpsyg.2013.00279

Castanho Silva, B., Vegetti, F., and Littvay, L. (2017). The elite is up to something: exploring the relation between populism and belief in conspiracy theories. *Swiss Polit. Sci. Rev.* 23, 423–443. doi: 10.1111/spsr.12270

Chong, T. T. L., and Li, X. (2019). Understanding the China-US trade war: causes, economic impact, and the worst-case scenario. *Econ. Polit. Stud.* 7, 185–202. doi: 10.1080/20954816.2019.1595328

Cohen, J., Cohen, P., West, S. G., and Aiken, L. S. (2003). *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences,3rd Edn.* Mahwah, NJ: Lawrence Erlbaum Associates Publishers.

Conover, P. J., and Feldman, S. (1986). *Morality Items on the 1985 Pilot Study (ANES Pilot Study Report No. nes002251).*

Douglas, K. M., and Sutton, R. M. (2018). Why conspiracy theories matter: a social psychological analysis. *Eur. Rev. Soc. Psychol.* 29, 256–298. doi: 10.1080/10463283.2018.1537428

Douglas, K. M., Sutton, R. M., Jolley, D., and Wood, M. J. (2015). "The social, political, environmental, and health-related consequences of conspiracy theories: problems and potential solutions," in *The Psychology of Conspiracy*, eds M. Bilewicz, A. Cichocka, and W. Soral (New York, NY: Routledge, 183–200.

Douglas, K. M., Uscinski, J. E., Sutton, R. M., Cichocka, A., Nefes, T., Ang, C. S., et al. (2019). Understanding conspiracy theories. *Polit. Psychol.* 40, 3–35. doi: 10.1111/pops.12568

Einstein, K. L., and Glick, D. M. (2015). Do i think BLS data are BS? The consequences of conspiracy theories. *Polit. Behav.* 37, 679–701. doi: 10.1007/s11109-014-9287-z

Eliasson, L. J., and Huet, P. G.-D. (2019). *Civil Society, Rhetoric of Resistance, and Transatlantic Trade.* Cham: Palgrave Pivot. doi: 10.1007/978-3-030-13366-5

Evenett, S. J., and Fritz, J. (2019). *Going It Alone? Trade Policy After Three Years of Populism: The 25th Global Trade Alert Report*. London: CEPR Press. Retrieved from: https://www.globaltradealert.org/reports/download/48

Fajgelbaum, P. D., Goldberg, P. K., Kennedy, P. J., and Khandelwal, A. K. (2020). The return to protectionism. *Q. J. Econ.* 135, 1–55. doi: 10.1093/qje/qjz036

Federal Ministry for Economic Affairs and Energy (2020). *Facts About German Foreign Trade*. Berlin: Federal Ministry for Economic Affairs and Energy.

Federico, C. M., Williams, A. L., and Vitriol, J. A. (2018). The role of system identity threat in conspiracy theory endorsement. *Eur. J. Soc. Psychol.* 48, 927–938. doi: 10.1002/ejsp.2495

Gallup (2020). *Big Business.* Retrieved from: https://news.gallup.com/poll/5248/big-business.aspx (accessed June 8, 2020).

Goertzel, T. (1994). Belief in conspiracy theories. *Polit. Psychol.* 15, 731–742. doi: 10.2307/3791630

Hays, J. C., Ehrlich, S. D., and Peinhardt, C. (2005). Government spending and public support for trade in the OECD: an empirical test of the embedded liberalism thesis. *Int. Organ.* 59, 473–494. doi: 10.1017/S0020818305050150

Hoffmeyer-Zlotnik, J. H. P., and Geis, A. J. (2003). Occupational classification and measurement of occupational status/prestige. *ZUMA News* 27, 125–138.

Hoffmeyer-Zlotnik, J. H. P., and Warner, U. (2005). "How to measure education in cross-national comparison: HoffmeyerZlotnik/Warner-Matrix of Education as a new instrument," in *Methodological Aspects in Cross-National Research* (Mannheim: GESIS), 223–240.

Horn, J. L. (1965). A rationale and test for the number of factors in factor analysis. *Psychometrika* 30, 179–185. doi: 10.1007/BF02289447

Imhoff, R., and Bruder, M. (2014). Speaking (un-)truth to power: conspiracy mentality as a generalised political attitude. *Eur. J. Pers.* 28, 25–43. doi: 10.1002/per.1930

Imhoff, R., Dieterle, L., and Lamberty, P. (2021). Resolving the puzzle of conspiracy worldview and political activism: belief in secret plots decreases normative but increases nonnormative political engagement. *Soc. Psychol. Pers. Sci.* 12, 71–79. doi: 10.1177/1948550619896491

Imhoff, R., and Lamberty, P. (2018). How paranoid are conspiracy believers? Toward a more fine-grained understanding of the connect and disconnect between paranoia and belief in conspiracy theories. *Eur. J. Soc. Psychol.* 48, 909–926. doi: 10.1002/ejsp.2494

Imhoff, R., Lamberty, P., and Klein, O. (2018). Using power as a negative cue: how conspiracy mentality affects epistemic trust in sources of historical knowledge. *Pers. Soc. Psychol. Bull.* 44, 1364–1379. doi: 10.1177/0146167218768779

Imhoff, R., and Lamberty, P. K. (2017). Too special to be duped: need for uniqueness motivates conspiracy beliefs. *Eur. J. Soc. Psychol.* 47, 724–734. doi: 10.1002/ejsp.2265

Jedinger, A., and Burger, A. M. (2020). The ideological foundations of economic protectionism: authoritarianism, social dominance orientation, and the moderating role of political involvement. *Polit. Psychol.* 41, 403–424. doi: 10.1111/pops.12627

Johnston, C. D. (2013). Dispositional sources of economic protectionism. *Publ. Opin. Q.* 77, 574–585. doi: 10.1093/poq/nft004

Jolley, D., and Douglas, K. M. (2014). The social consequences of conspiracism: exposure to conspiracy theories decreases intentions to engage in politics and to reduce one's carbon footprint. *Br. J. Psychol.* 105, 35–56. doi: 10.1111/bjop.12018

Jolley, D., Douglas, K. M., and Sutton, R. M. (2018). Blaming a few bad apples to save a threatened barrel: the system-justifying function of conspiracy theories. *Polit. Psychol.* 39, 465–478. doi: 10.1111/pops.12404

Jost, J. T., Glaser, J., Kruglanski, A. W., and Sulloway, F. J. (2003). Political conservatism as motivated social cognition. *Psychol. Bull.* 129, 339–375. doi: 10.1037/0033-2909.129.3.339

Kaltenthaler, K. C., Gelleny, R. D., and Ceccoli, S. J. (2004). Explaining citizen support for trade liberalization. *Int. Stud. Q.* 48, 829–851. doi: 10.1111/j.0020-8833.2004.00327.x

Kim, M., and Cao, X. (2016). The impact of exposure to media messages promoting government conspiracy theories on distrust in the government: evidence from a two-stage randomized experiment. *Int. J. Commun.* 10, 3808–3827.

Lamberty, P., and Imhoff, R. (2018). Powerful pharma and its marginalized alternatives? Effects of individual differences in conspiracy mentality on attitudes toward medical approaches. *Soc. Psychol.* 49, 255–270. doi: 10.1027/1864-9335/a000347

Leiser, D., Duani, N., and Wagner-Egger, P. (2017). The conspiratorial style in lay economic thinking. *PLoS ONE* 12:e0171238. doi: 10.1371/journal.pone.0171238

Little, R. J. A. (1988). A test of missing completely at random for multivariate data with missing values. *J. Am. Stat. Assoc.* 83, 1198–1202. doi: 10.1080/01621459.1988.10478722

Little, R. J. A. (1992). Regression with missing X's: a review. *J. Am. Stat. Assoc.* 87, 1227–1237. doi: 10.2307/2290664

Mansfield, E. D., and Mutz, D. C. (2009). Support for free trade: self-interest, sociotropic politics, and out-group anxiety. *Int. Organ.* 63, 425–457. doi: 10.1017/S0020818309090158

Mansfield, E. D., Mutz, D. C., and Brackbill, D. (2019). Effects of the great recession on American attitudes toward trade. *Br. J. Polit. Sci.* 49, 37–58. doi: 10.1017/S0007123416000405

Marcal, L. E. (2001). Does trade adjustment assistance help trade-displaced workers? *Contemp. Econ. Policy* 19, 59–72. doi: 10.1111/j.1465-7287.2001.tb00050.x

Mayda, A. M., and Rodrik, D. (2005). Why are some people (and countries) more protectionist than others? *Eur. Econ. Rev.* 49, 1393–1430. doi: 10.1016/j.euroecorev.2004.01.002

Mayer, K. U., Kraus, V., and Schmidt, P. (2014). "Social inequality," in *CIS: Collection of Items and Scales for the Social Sciences* (Mannheim: GESIS - Leibniz-Institute for the Social Sciences).

Moscovici, S. (1987). "The conspiracy mentality," in *Changing Conceptions of Conspiracy*, eds C. F. Graumann and S. Moscovici (New York, NY: Springer), 151–169. Retrieved from: https://link.springer.com/book/10.1007/978-1-4612-4618-3

Mudde, C. (2004). The populist zeitgeist. *Govern. Oppos.* 39, 541–563. doi: 10.1111/j.1477-7053.2004.00135.x

Mutz, D. C., and Kim, E. (2017). The impact of in-group favoritism on trade preferences. *Int. Organ.* 71, 827–850. doi: 10.1017/S0020818317000327

Oliver, J. E., and Wood, T. J. (2014). Conspiracy theories and the paranoid style(s) of mass opinion. *Am. J. Polit. Sci.* 58, 952–966. doi: 10.1111/ajps.12084

O'Rourke, K. H., and Sinnott, R. (2001). The determinants of individual trade policy preferences: international survey evidence. *Brook. Trade Forum* 2001, 157–206. doi: 10.1353/btf.2001.0011

Owen, E., and Johnston, N. P. (2017). Occupation and the political economy of trade: job routineness, offshorability, and protectionist sentiment. *Int. Organ.* 71, 665–699. doi: 10.1017/S0020818317000339

Pratto, F., Sidanius, J., Stallworth, L. M., and Malle, B. F. (1994). Social dominance orientation: a personality variable predicting social and political attitudes. *J. Pers. Soc. Psychol.* 67, 741–763. doi: 10.1037/0022-3514.67.4.741

Rankin, D. M. (2001). Identities, interests, and imports. *Polit. Behav.* 23, 351–376. doi: 10.1023/A:1015413506599

Rho, S., and Tomz, M. (2017). Why don't trade preferences reflect economic self-interest? *Int. Organ.* 71, S85–S108. doi: 10.1017/S0020818316000394

Rodrik, D. (1995). "Political economy of trade policy," in *Handbook of International Economics Vol. 3,* eds G. M. Grossman and K. Rogoff (Amsterdam: Elsevier), 1457–1494. doi: 10.1016/S1573-4404(05)80008-5

Rodrik, D. (2018). Populism and the economics of globalization. *J. Int. Bus. Policy* 1, 12–33. doi: 10.1057/s42214-018-0001-4

Satherley, N., and Sibley, C. G. (2016). A Dual Process Model of attitudes toward immigration: predicting intergroup and international relations with China. *Int. J. Intercult. Relat.* 53, 72–82. doi: 10.1016/j.ijintrel.2016.05.008

Scheve, K. F., and Slaughter, M. J. (2001). What determines individual trade-policy preferences? *J. Int. Econ.* 54, 267–292. doi: 10.1016/S0022-1996(00)00094-5

Shaffer, B., and Duckitt, J. (2013). The dimensional structure of people's fears, threats, and concerns and their relationship with right-wing

authoritarianism and social dominance orientation. *Int. J. Psychol.* 48, 6–17. doi: 10.1080/00207594.2012.696651

Smallpage, S. M., Enders, A. M., and Uscinski, J. E. (2017). The partisan contours of conspiracy theory beliefs. *Res. Polit.* 4:205316801774655. doi: 10.1177/2053168017746554

Spark, A. (2000). Conjuring order: the new world order and conspiracy theories of globalization. *Sociol. Rev.* 48, 46–62. doi: 10.1111/j.1467-954X.2000.tb03520.x

Steiner, N. D. (2018). Attitudes towards the transatlantic trade and investment partnership in the European Union: the treaty partner heuristic and issue attention. *Eur. Union Polit.* 19, 255–277. doi: 10.1177/1465116518755953

Swami, V., Chamorro-Premuzic, T., and Furnham, A. (2010). Unanswered questions: a preliminary investigation of personality and individual difference predictors of 9/11 conspiracist beliefs. *Appl. Cogn. Psychol.* 24, 749–761. doi: 10.1002/acp.1583

Swami, V., Coles, R., Stieger, S., Pietschnig, J., Furnham, A., Rehim, S., et al. (2011). Conspiracist ideation in Britain and Austria: evidence of a monological belief system and associations between individual psychological differences and real-world and fictitious conspiracy theories. *Br. J. Psychol.* 102, 443–463. doi: 10.1111/j.2044-8295.2010.02004.x

Uscinski, J. E. (2020). *Conspiracy Theories: A Primer*. Lanham, MD: Rowman and Littlefield.

Uscinski, J. E., Klofstad, C., and Atkinson, M. D. (2016). What drives conspiratorial beliefs? The role of informational cues and predispositions. *Polit. Res. Q.* 69, 57–71. doi: 10.1177/1065912915621621

van Bohemen, S., de Koster, W., and van der Waal, J. (2019). Euroscepticism among Dutch leftist and rightist populist constituencies: how can the U-curve be understood? *J. Common Market Stud.* 57, 371–387. doi: 10.1111/jcms.12806

van der Linden, S., and Roozenbeek, J. (2021). "Psychological inoculation against fake news," in *The Psychology of Fake News: Accepting, Sharing, and Correcting Misinformation*, eds R. Greifeneder, M. E. Jaffé, E. J. Newman, and N. Schwarz (Abingdon: Routledge), 147–169. doi: 10.4324/9780429295379-11

van der Waal, J., and de Koster, W. (2018). Populism and support for protectionism: the relevance of opposition to trade openness for leftist and rightist populist voting in the Netherlands. *Polit. Stud.* 66, 560–576. doi: 10.1177/0032321717723505

van Prooijen, J.-W. (2018). *The Psychology of Conspiracy Theories.* Abingdon: Routledge. doi: 10.4324/9781315525419

van Prooijen, J.-W., and Douglas, K. M. (2017). Conspiracy theories as part of history: the role of societal crisis situations. *Mem. Stud.* 10, 323–333. doi: 10.1177/1750698017701615

White, R. (2017). *Public Opinion on Economic Globalization: Considering Immigration, International Trade, and Foreign Direct Investment*. Cham: Palgrave Macmillan. doi: 10.1007/978-3-319-58103-3

Wood, M. J., Douglas, K. M., and Sutton, R. M. (2012). Dead and alive: beliefs in contradictory conspiracy theories. *Soc. Psychol. Pers. Sci.* 3, 767–773. doi: 10.1177/1948550611434786

World Trade Organization (2019). *Report on G20 Trade Measures*. Geneva: World Trade Organization. Retrieved from: https://www.wto.org/english/news_e/news19_e/report_trdev_21nov19_e.pdf doi: 10.30875/f134601b-en

Conflict of Interest: The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 28 January 2022
doi: 10.3389/fpsyg.2021.799802

Effects of Low-Calorie Nutrition Claim on Consumption of Packaged Food in China: An Application of the Model of Consumer Behavior

*Zeying Huang[1], Haijun Li[2], Pei Wang[3] and Jiazhang Huang[1]**

[1] Institute of Food and Nutrition Development, Ministry of Agriculture and Rural Affairs, Beijing, China, [2] School of Information & Intelligence Engineering, University of Sanya, Sanya, China, [3] School of Public Health, Southeast University, Nanjing, China

More and more packaged products in China have been labeled as low-calorie products since the official implementation of nutrition claims in 2007. But little was known about the impact of such claims on the Chinese consumption of low-calorie food on the background of increasing rates of obesity among the Chinese population. This study sought to fill the gap by applying a consumer behavior model to a nationally representative online survey by means of structural equation modeling. The findings revealed that nutrition claims significantly affect the consumption of low-calorie products. Specifically, marketing stimulus on low-calorie products first affected consumer psychology, then consumer decision-making, and finally consumer responses. Despite the significant role of consumer psychology and decision-making in consumption, consumers were susceptible to the influence of targeted marketing strategies for foods with a low-calorie claim. It is recommended that appropriate use of low-calorie nutrition claims by manufacturers and choices of low-calorie food by consumers according to their own needs should be encouraged.

Keywords: nutrition claim, low-calorie products, nutrition labeling, packaged food, model of consumer behavior

OPEN ACCESS

Edited by:
Dan-Cristian Dabija, Babeş-Bolyai University, Romania

Reviewed by:
Laura Stan, University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca, Romania
Marius Mircea Sabau, University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca, Romania
George Lazaroiu, Spiru Haret University, Romania

****Correspondence:***
Jiazhang Huang
huangjiazhang@caas.cn

Specialty section:
This article was submitted to Personality and Social Psychology, a section of the journal Frontiers in Psychology

Received: *06 November 2021*
Accepted: *28 December 2021*
Published: *28 January 2022*

Citation:
Huang Z, Li H, Wang P and Huang J (2022) Effects of Low-Calorie Nutrition Claim on Consumption of Packaged Food in China: An Application of the Model of Consumer Behavior. Front. Psychol. 12:799802. doi: 10.3389/fpsyg.2021.799802

INTRODUCTION

Overweight and obesity are growing problems in China and have been linked to a variety of adverse health outcomes (e.g., diabetes, heart disease, and certain cancers). Report on Nutrition and Chronic Diseases in China (2020) illustrated that over 50% of adults were overweight or obese in 2019, an increase of at least 8% from 2012 (Central People's Government of the People's Republic of China, 2020). Given that the calorie intake exceeding the calorie expenditure is a strong contributor to overweight or obesity (Blundell, 1975), consumers are increasingly concerned with the amount of calories from food (Zhang et al., 2008).

Nutrition claim, a nutrition labeling first advocated by the Codex Alimentarius Commission, refers to any representation which states, suggests, or implies that a food has particular nutritional properties (e.g., fat free, low in sugars, high protein, and source of calcium) (Codex Alimentarius Commission, 1985). Many countries have adopted Codex recommendations and regulated the use of nutrition claims (Franco-Arellano et al., 2018). For improvement in diet quality, China implemented *Food Nutrition Labeling Management Standards* in 2007, introducing voluntary nutrition claims to the country for the first time. The low-calorie claim, a form of nutrient

content claim, can be used on prepackaged food of China when calorie is less than 170 kJ/100 g for solids or 80 kJ/100 ml for liquids, according to *General Rules of National Prepackaged Food Nutrition Labels* (GB 28050-2011) (Ministry of Health of the PRC, 2011), thus some food or drink products (e.g., low-calorie bread, low-calorie soda water) have been labeled as "low in calorie" by manufacturers. Therefore, identifying the impact of such a claim on the consumption of low-calorie packaged products is of importance to understand whether this claim is helpful to reduce the calorie intake of consumers.

Previous studies on the nutrition claim mainly focused on the influence of regulation concerning nutrition claims on food choice of consumers (Mathios, 1998; Stranieri et al., 2010) and preference of consumers for food labeled with nutrition claims (Wezemael et al., 2014; Klopčič et al., 2019). It remained unknown whether and how nutrition claims and other key factors impact low-calorie food consumption of consumers, although a few studies assessed the impact of nutrition claims on perceptions (Benson et al., 2019), attitudes (Garretson and Burton, 2000), and food choices of consumers (Oostenbach et al., 2019). In China, some studies investigated the objective understanding of Chinese residents toward nutrition claims (Song et al., 2015) and nutrients displayed on nutrition claims in China (Wang et al., 2011), but few studies focused on the impact of nutrition claims.

This study aims to achieve a better understanding of how a low-calorie-related claim influences consumption of prepackaged food by Chinese residents. Structural equation modeling (SEM) was utilized to establish possible linkages by employing the model of consumer behavior as an analytical framework. To the best of our knowledge, it is the first study in China to empirically investigate the consumption of foods with a low-calorie claim from the perspective of consumers. The findings will assist policymakers in achieving the public health goal that increases healthier food consumption.

HYPOTHESES

The model of consumer behavior used in this work is proposed by Professor Philip Kotler (Kotler and Armstrong, 2011), stems from the stimulus-response (S-R) model, and is a commonly used theoretical model describing the real and reasonable consumption process.

In contrast to other theories, the model of consumer behavior takes marketing stimulus as the only external element and uses consumer psychology, consumer decision-making, and consumer responses as internal elements. In other words, the model emphasizes consumption behavior in the process of consumer psychology, consumer decision-making, and consumer responses under marketing stimuli. Generally, foods with specific nutrition claims provide opportunities for product differentiation based on a health-related positioning, as compared with those without such claims (Verbeke et al., 2009). Nutrition claim is known as a marketing tool to make the products appear healthier resulting from the halo effect (Story and French, 2004; Barreiro-Hurlé et al., 2009), so manufacturers attempt to increase the exposure of consumers to nutrition claims through marketing and advertising (Andrews et al., 2000). Thus, the model of consumer behavior can be applied to identify the relationships and pathways between nutrition claims and consumers' behavior.

The proposed conceptual model in **Figure 1** suggests that marketing stimuli first influence consumer psychology, then consumer decision-making, and finally consumer responses. Marketing stimuli consists of four P's, namely, product, price, place, and promotion, which, in this study, respectively, refer to the food labeled with a low-calorie claim, the amount of money customers must pay for such food, the channels through which consumers have access to such food, and the activities that advertise the merits of the claim to encourage consumer purchase.

Consumer psychology refers to the psychological activities of consumers when they seek, choose, purchase, use, evaluate, and dispose of products. The psychosocial-anthropological approach indicates that there are four types of physiological effects among consumers, namely, herd mentality, the mind of difference, the mind of rivalry, and the practical mind (Katona, 1967). Specifically, herd mentality refers to the phenomenon that an individual's ideas and behaviors involuntarily or unconsciously are consistent with those of the majority due to group guidance or pressure; the mind of difference means that individuals pursue originality and distinctness in consumption processes; the mind of rivalry is an individual's consumption desire beyond one's actual income level; the practical mind is primarily characterized by attention to the actual use value of goods. Most previous research on the effect of marketing- or advertising-driven strategies of manufacturers on consumer psychology concludes that marketing produces a positive influence (Foxall, 1986; Aaker et al., 2000). Hence, hypothesis 1 is proposed:

H1. Marketing of foods with a low-calorie nutrition claim has a positive effect on consumer psychology.

Consumer decision-making consists of cognition, experience, evaluation, and purchase (Kotler and Armstrong, 2011). Several empirical studies have found that consumer psychology could pose an influence on consumer decision-making (Foxall, 2016; Ebert, 2017). Hence, hypothesis 2 is proposed:

H2. Consumer psychology influences the decision-making process regarding foods with a low-calorie nutrition claim.

Consumer responses, generated after the process of decision-making, are composed of product selection, brand selection, purchase timing, and purchase quantity (Kotler and Armstrong, 2011). Specifically, product selection refers to the behavior of consumers in choosing a product; brand selection refers to the choice of consumers for the product brand; purchase timing refers to the time when consumers buy the product; and purchase quantity refers to how many/much products consumers buy. Prior studies have identified the links between consumer decision-making and consumer responses (Fan and Xiao, 1998; Loureiro and Mccluskey, 2000). Hence, hypothesis 3 is proposed:

H3. Consumer decision-making impacts consumer responses to foods with a low-calorie nutrition claim.

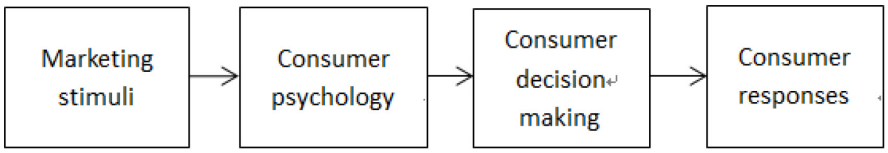


FIGURE 1 | Model of consumer behavior. Source: Kotler and Armstrong (2011).

MATERIALS AND METHODS

Participants and Procedure

With respect to the model of consumer behavior, the four latent variables, namely, marketing stimuli, consumer psychology, consumer decision-making, and consumer responses could be measured by scale items designed based on a review of previous literature (Priester, 2010; Devika et al., 2020). **Figure 2** illustrated the general experimental design process. The data were collected using a self-administered questionnaire consisting of socio-demographic information and 20 scale items (see "**Supplementary Material**"). Each item was answered on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree), and 80 residents were randomly selected in Beijing by a pretest on October 21, 2020. As a company specializing in data collection *via* online surveys, Wenjuanxing platform[1] has a sample pooling of 2.6 million potential respondents uniformly distributed by gender, age groups, and regions. Paid data collection service is provided by the Wenjuanxing platform for sending questionnaires to target samples and ensuring the validity of questionnaire information. From November 10, 2020, to December 28, 2020, the Wenjuanxing platform was commissioned to obtain 930 valid survey samples from the sample pooling. First of all, a stratified sampling approach was used to randomly select 45 individuals from each province (i.e., autonomous region, municipality) of China to fill out the online questionnaire, and then cross-checking was conducted to eliminate invalid questionnaires due to lack of information and implausible answers. Finally, a total of 930 valid samples (i.e., 30 samples × 31 provinces) were generated for analysis.

Measures

Propositions that connect endogenous variables with exogenous variables were analyzed using SEM, which provides a dependable framework for testing differences among groups on latent variables (i.e., constructs, factors) (Graham and Roberto, 2016). SEM allows the creation of observable variables per construct, which does not require the split analysis and yields valid and clear inferences (Lei and Wu, 2007), thus results of the relationships among variables were reliable and neutral (Neale et al., 2016). In addition, SEM is capable of scrutinizing complex correlations and a range of hypotheses by immediately incorporating mean structures and group estimation (Al-Gahtani, 2016). Therefore, the hypotheses proposed above were made out by the SEM. Specifically speaking, all data analyses were conducted in two steps. First, the reliability analysis was performed using the SPSS 25.0 software to evaluate the stability and consistency of measured items. Second, the evaluation of goodness-of-fit indices for the proposed SEM and tests of hypotheses was conducted by means of moment structure analysis using the AMOS 21.0 software.

[1]https://www.wjx.cn

RESULTS

The final sample is nationally representative of the Chinese population in terms of socio-demographic characteristics. **Table 1** below outlines the demographic features of 930 valid samples. More males were surveyed (56.77%), and respondents were mostly young adults, with those aged between 18 and 44 years comprising about 31.61% of the sample. The majority of respondents had high school education (31.29%) followed by junior high school degrees (30.43%). Among the respondents, most (27.31%) had an annual household income between ¥10,000 and 50,000 after tax, but the percentage was slightly higher than those with an income from ¥50,001 to 100,000.

Table 2 presents the reactions of respondents toward the marketing of products by manufacturers with a low-calorie nutrition claim, together with consumer psychology, decision-making, and responses. The marketing strategy of products with a low-calorie claim mainly played a role with respect to product and place. More than half of the respondents (55.81%) had seen products with a low-calorie nutrition claim on sales, and nearly 50% had seen these products in multiple places. The respondents paid attention to such a claim with the herd mentality and practical mind rather than the mind of difference and rivalry. Up to 60.53% of the respondents indicated that they would follow their friends and relatives who read nutrition claims related to low calories. Also, as many as 64% would pay attention to the practical benefits of food with such claims. Few respondents had experience in reading nutrition claims or purchasing food with nutrition claims, whereas approximately 66 and 65% of them believed that the low-calorie nutrition claim could help make a healthy food choice and understand nutritional properties, respectively. Regarding consumer responses, the low-calorie claim shaped the choices of respondents among different kinds of foods, among different brands of similar foods, among different food package sizes, and prompted impulse purchase of low-calorie foods.

Discriminant Validity Analysis

The interrelationships among constructs affecting the behavior of consumers were assessed using Pearson's correlation test,

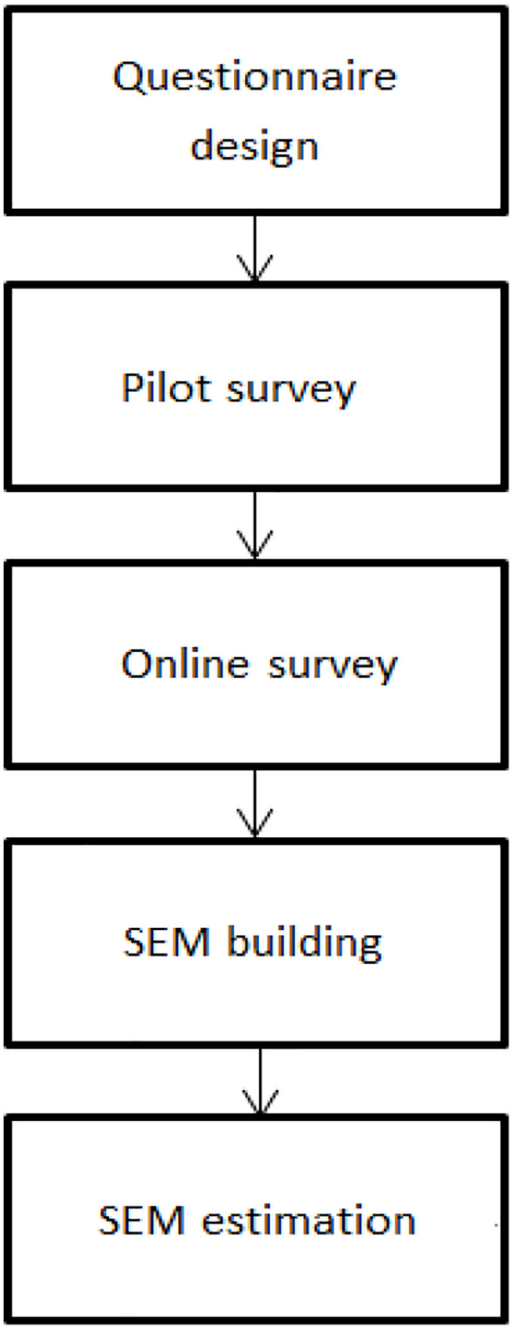


FIGURE 2 | The experimental design.

TABLE 1 | Socio-demographic characteristics of the sample (n = 930).

Sample characteristics	Option	Sample size	Percentage (%)
Gender	Male	528	56.77
	Female	402	43.23
Age	<18	168	18.06
	From 18 to 44	294	31.61
	From 45 to 59	275	29.57
	≥9.5	193	20.76
Education level	Primary school and below	127	13.66
	Junior high school	283	30.43
	High school	291	31.29
	College/Bachelor	198	21.29
	Postgraduate or above	31	3.33
Annual household income (after tax)	<10,000 Yuan	117	12.58
	From 10,000 Yuan to 50,000 Yuan	254	27.31
	From 50,001 Yuan to 100,000 Yuan	246	26.45
	From 100,001 Yuan to 150,000 Yuan	180	19.35
	From 150,001 Yuan to 200,000 Yuan	83	8.92
	>200,000 Yuan	50	5.38

One US dollar is equal to 6.524 Chinese Yuan and One Euro is equal to 7.960 Chinese Yuan from November 10 to December 28, 2020.

Testing the Fit of the Model

An exploratory factor analysis (EFA) was employed to examine the reliability and validity of the measurement model. The suitability of data was examined by using the Kaiser-Meyer-Olkin (KMO) sampling adequacy test and Bartlett's Test of Sphericity (BTS). As seen in **Table 4**, the sample is suitable to conduct EFA, owing to the statistically significant BTS value and KMO value (Kaiser, 1974). Also, the consistency of items of all constructs was examined by the composite reliability (CR) test. To evaluate the level to which the items were theoretically associated with each other, the convergent validity test was implemented by using AVE and item loadings (Anderson and Gerbing, 1988). Further empirical results revealed that all AVE values surpassed 0.50 for each construct, and this indicated that the latent constructs retained a minimum of 50% of the variance. The values of CR and Cronbach's α exceeded 0.70 in all four constructs through a reliability analysis test (Nunnally, 1978), indicating that the sample was valid and reliable.

and statistically significant ($p < 0.05$) positive correlations were reported (as described in **Table 3**). Discriminant validity was also assessed by examining the average variance extracted estimates (AVE). The discriminant validity analysis evaluates the extent to which the items are not theoretically correlated. The data did not have any problems of discriminant validity because the value of the square root of AVE was greater than its correlation with other constructs (Kline, 2005).

Structural Equation Modeling Estimation and Hypothesis Testing

All hypotheses proposed were examined after the validity and reliability of the measures were attained. **Figure 3** shows the estimation result, and **Table 5** displays the goodness-of-fit indices for the model. Each fitting index value [standard chi-square (SCS) = 2.199, comparative fit index (CFI) = 0.950, incremental fit index (IFI) = 0.951, goodness-of-fit index (GFI) = 0.987,

TABLE 2 | Description of latent variables and summary statistics.

Latent variables	Scale items	Strongly disagree		Disagree		Neither agree nor disagree		Agree		Strongly agree	
		N	%	N	%	N	%	N	%	N	%
Marketing stimuli	I have seen food with low-calorie nutrition claim on sales.	21	2.26	110	11.83	280	30.11	374	40.22	145	15.59
	I know that the price of food with low-calorie nutrition claim is affordable.	108	11.61	288	30.97	376	40.43	138	14.84	20	2.15
	I have seen food with low-calorie nutrition claim sold in many places.	31	3.33	153	16.45	300	32.26	336	36.13	110	11.83
	I have seen the food with low-calorie nutrition claim on promotion.	64	6.88	301	32.37	338	36.34	178	19.14	49	5.27
Consumer psychology	I would follow my friends and relatives' example if they all read low-calorie nutrition claim when shopping.	24	2.58	85	9.14	258	27.74	455	48.92	108	11.61
	I would read low-calorie nutrition claim even if none of my friends and relatives did it when shopping.	36	3.87	223	23.98	380	40.86	226	24.30	65	6.99
	I would buy the food with low-calorie nutrition claim which is beyond my factual income.	83	8.92	291	31.29	352	37.85	176	18.92	28	3.01
	I would pay attention to the actual benefits of food with low-calorie nutrition claim.	15	1.61	49	5.27	271	29.14	446	47.96	149	16.02
Consumer decision making	I believe low calorie nutrition claim helps make healthy food choice.	14	1.51	70	7.53	231	24.84	453	48.71	162	17.42
	I believe low calorie nutrition claim helps understand nutritional properties of food.	17	1.83	64	6.88	247	26.56	428	46.02	174	18.71
	I have read low calorie nutrition claim when shopping.	29	3.12	222	23.87	340	36.56	263	28.28	76	8.17
	I have bought foods with low calorie nutrition claim when shopping	14	1.51	135	14.52	397	42.69	289	31.08	95	10.22
Consumer responses	I have made choices among different kinds of foods through low-calorie nutrition claim.	31	3.33	210	22.58	334	35.91	283	30.43	72	7.74
	I have made choices among different brands of similar foods through low-calorie nutrition claim.	41	4.41	190	20.43	353	37.96	276	29.68	70	7.53
	I have seized the moment to buy foods with low-calorie nutrition claim.	42	4.52	232	24.95	376	40.43	228	24.52	52	5.59
	I have made choices among different amounts of food through low-calorie nutrition claim.	73	7.85	221	23.76	369	39.68	194	20.86	73	7.85

AGFI = 0.957, root mean square error of approximation (RMSEA) = 0.075, non-normalizing fitting index (NNFI) = 0.928, norm fitting index (NFI) = 0.927] outperformed the respective threshold value, signifying that the model was able to fit all data satisfactorily (Byrne, 1994; Thompson, 2004; Kline, 2005).

TABLE 3 | Factor correlations and discriminant validity.

Factors	Marketing stimuli	Consumer psychology	Consumer decision making	Consumer responses
Marketing stimuli	[0.792]			
Consumer psychology	0.494**	[0.787]		
Consumer decision making	0.451*	0.913***	[0.705]	
Consumer responses	0.333*	0.674*	0.739**	[0.733]

*Values in brackets [] indicate the square root of AVEs. A significance level is shown at ***p < 0.001, **p < 0.01, and *p < 0.05. Diagonals represent the square root of the average variance extracted, while the other entries represent the squared correlations.*

As expected, all null hypotheses were supported at the statistical significance level of 0.01 (**Table 6**). Marketing stimuli had significant effects on consumer psychology, and the path coefficient was 0.363. Likewise, consumer psychology posed a significant impact on consumer decision-making, with the largest coefficient (0.913) out of the three relationships, which was followed by the path coefficient of consumer decision-making on consumer responses.

DISCUSSION

The present study has demonstrated two key strengths. On one hand, the model of consumer behavior offered a conceptual framework for exploring how the marketing strategy of food by manufacturers with a low-calorie nutrition claim influenced consumption behavior. On the other hand, this study considered consumer behavior as a process of transformation from

TABLE 4 | Factor loadings and convergent validity results.

Variables	Scale items Code	Scale items	Standard Loadings	AVE	Composite reliability	Cronbach' s α
Marketing stimuli	X1	I have seen food with low-calorie nutrition claim on sales.	0.506	0.627	0.703	0.816
	X2	I know that the price of food with low-calorie nutrition claim is affordable.	0.641			
	X3	I have seen food with low-calorie nutrition claim sold in many places.	0.562			
	X4	I have seen the food with low-calorie nutrition claim on promotion.	0.554			
Consumer psychology	X5	I would follow my friends and relatives' example if they all read low-calorie nutrition claim when shopping.	0.588	0.619	0.734	0.853
	X6	I would read low-calorie nutrition claim even if none of my friends and relatives did it when shopping.	0.591			
	X7	I would buy the food with low-calorie nutrition claim which is beyond my factual income.	0.501			
	X8	I would pay attention to the actual benefits of food with low-calorie nutrition claim.	0.516			
Consumer decision making	X9	I believe low-calorie nutrition claim helps make healthy food choice.	0.661	0.597	0.769	0.826
	X10	I believe low-calorie nutrition claim helps understand nutritional properties of food.	0.635			
	X11	I have read low-calorie nutrition claim when shopping.	0.718			
	X12	I have bought foods with low-calorie nutrition claim when shopping.	0.643			
Consumer responses	X13	I have made choices among different kinds of foods through low-calorie nutrition claim.	0.729	0.537	0.792	0.899
	X14	I have made choices among different brands of similar foods through low-calorie nutrition claim.	0.755			
	X15	I have seized the moment to buy foods with low-calorie nutrition claim.	0.760			
	X16	I have made choices among different amounts of food through low-calorie nutrition claim.	0.752			

Rotation technique: Promax; extraction technique: maximum likelihood; total variance elucidated: 59.05%; Bartlett's test of sphericity: $\chi 2 = 5{,}901.666$, $p < 0.001$; *Kaiser-Meyer-Olkin measure of sampling adequacy: 0.884 (*$p < 0.001$*).*

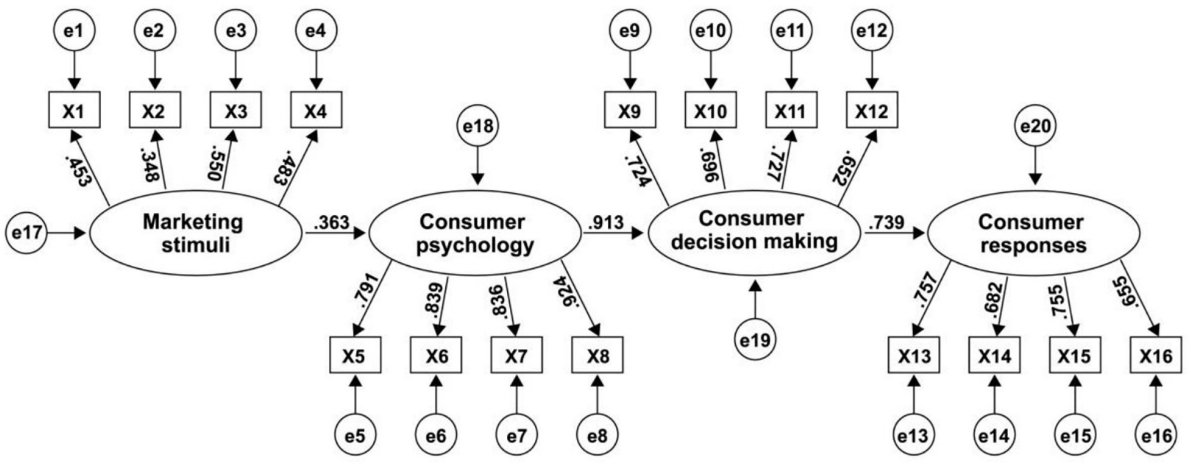


FIGURE 3 | Structural equation modeling results. Comparative fit index = 0.850; goodness-of-fit index = 0.887; root mean square error of approximation = 0.075; degrees of freedom = 136; chi-square = 1,029.143; X1–X16 is the scale items code and e1–e20 is statistical error of four latent variables and 16 scale items.

individual psychology to behavior, which could identify whether the behaviors of Chinese consumers were rational or not in the context of marketing. As for methodological strength, the application of SEM was helpful to reveal interrelationships among constructs affecting consumer behavior. However, several limitations need to be acknowledged and addressed in future studies. First, the intrinsic factors in the model of consumer behavior did not take into account the socio-demographic

TABLE 5 | Structural equation modeling fitting.

Goodness-of-fit indices	Fitting index values	Fitting
Standard chi – square (SCS)	2.199	<3, good
Comparative fit index (CFI)	0.950	>0.9, good
Incremental fit index (IFI)	0.951	>0.9, good
Goodness-of-fit Index (GFI)	0.987	>0.9, good
Adjusted goodness-of-fit index (AGFI)	0.957	>0.9, good
Root mean square error of approximation (RMSEA)	0.075	<0.08, good
Non-normalizing fitting index (NNFI)	0.928	>0.9, good
Norm fitting index (NFI)	0.927	>0.9, good

TABLE 6 | Test results of the hypothesis.

Hypothesized paths	Normalized path coefficient	*T*-value	*P*-value	Accepted
H1: Marketing stimuli→Consumer psychology	0.363	1.382	0.007	Yes
H2: Consumer psychology→Consumer decision making	0.913	3.411	0.005	Yes
H3: Consumer decision making→Consumer responses	0.739	3.835	0.008	Yes

characteristics of consumers, such as gender, age, occupation, and education level. Second, the model did not regard consumer cognition (Drugău-Constantin, 2019; Pocol et al., 2021), attitude (Graessley et al., 2019), and loyalty (Hollowell et al., 2019) as factors, despite the proven role of these factors in shaping the consumption behavior of individuals. Third, this study lacked an examination of satisfaction of consumers with consumption experience, which was yet proved an integral part of consumer behavior (Reibstein et al., 1975; Gounaris et al., 2007). Fourth, respondents may make wrong answers in the self-filled questionnaire concerning consumer psychology, and neuroscience techniques such as brain waves and eye movement tracking technologies, which have been thought to overcome such problems (Drugău-Constantin, 2019), should be considered to use in the future study. The last possible limitation is related to the small sample size analyzed in comparison with the Chinese large population, which hardly guaranteed that our findings above could be replicated within relevant studies, thus we call for a larger sample included.

Association Between Marketing Stimuli and Consumer Psychology

The research result coincided with the marketing theory of 4P's and findings of existing studies (Foxall, 1986; Aaker et al., 2000), which suggested that current marketing strategies of food with low-calorie nutrition claims on the Chinese market could somewhat exert influence on consumer psychology. To be specific, manufacturers focused on the development of food nutrition function, product pricing, sales channel establishment, and product publicity, all of which were able to cause the psychological reaction of consumers and to increase their desire for low-calorie food (Wing et al., 1991; O'Neil and Jarrell, 1992). However, the marketing of food products with low-calorie claims played a minor role, which may be due to the recent scandals of "low calorie" misrepresentation on food packages in China and the concern of consumers about being misled. Meanwhile, it reflected that consumers may know little about the principles of nutrition claim usage.

Association Between Consumer Psychology and Consumer Decision-Making

This study found convincing evidence of a statistically significant link between consumer psychology and consumer decision-making, consistent with the results of existing studies (Foxall, 2016; Ebert, 2017).

In detail, consumer psychology toward the food with low-calorie nutrition claims, such as herd mentality, the mind of difference, the mind of rivalry, and practical mind, was found to likely affect their trust and use of low-calorie nutrition claim. It implied that marketing stimuli of manufacturers were likely to exert an obvious effect on consumer decision-making through shaping consumer psychology. That is, the decision of consumers to purchase and consume low-calorie products with help of nutrition claims was significantly influenced by marketing stimuli and is also mediated by consumer psychology.

Association Between Consumer Decision-Making and Consumer Responses

The study confirmed previous findings that consumer responses could be influenced by how a consumer reaches a decision (Kim and John, 2008; Aggarwal and Agarwal, 2015). Although the influence was not the strongest, consumers' decision-making involving individuals' trust (Dabija et al., 2018; Meilhan, 2019; Popescu and Ciurlău, 2019) on low-calorie nutrition claims, reading the claim, and purchasing related products seemed to have a positive impact on consumers' product selection (Mirică, 2019), brand selection, purchase timing, and purchase quantity for products with low-calorie claims. This link was expected to increase the purchase and intake of healthy foods by consumers and eventually contribute to improved health status.

CONCLUSION

The study highlights the importance of understanding the effects of low-calorie nutrition claims on the consumption of packaged food in China. The model of consumer behavior, as a theoretical and empirical framework, was proved to be possibly suitable for explaining the use of nutrition claims by Chinese residents. The findings suggested that marketing of products by manufacturers with low-calorie claims first affects consumer psychology and then, exerts a positive impact upon consumer decision-making, which ultimately determines consumer responses. To sum up,

the application of low-calorie nutrition claims by manufacturers is positively associated with the increasing consumption rate of low-calorie food among the residents, which provides a theoretical basis for adult obesity intervention by using low-energy nutrition claim in China.

To increase the access to and the use of low-calorie nutrition claims, the following policy recommendations are offered: (1) manufacturers should be guided to adopt appropriate and reasonable marketing techniques to promote low-calorie foods; (2) public propaganda should be widely carried out to educate consumers to choose low-calorie food according to their physical conditions and occupational needs; and (3) the regulation and supervision of nutrition claim use by manufactures should be strengthened through authoritative nutritional guidelines and standards, resulting in social trust on nutrition claims.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding author.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent was obtained from all participants.

AUTHOR CONTRIBUTIONS

ZH contributed to conceptualization, original draft preparation, and methodology. HL conducted statistical analysis. PW performed data cleaning. JH carried out review and editing. All authors contributed to the article and approved the submitted version.

FUNDING

We acknowledge gratefully the financial support of the Central Public-interest Scientific Institution Basal Research (1610422022002) and Chinese Academy of Agricultural Sciences fund through the Science and Technology Innovation Engineering Project (CAAS-ASTIP-2022-IFND).

ACKNOWLEDGMENTS

We are grateful to all the enumerators for their help in data collection.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2021.799802/full#supplementary-material

REFERENCES

Aaker, J. L., Brumbaugh, A. M., and Grier, S. A. (2000). Nontarget markets and viewer distinctiveness: the impact of target marketing on advertising. *J. Consum. Psychol.* 9, 127–140. doi: 10.1207/S15327663JCP0903_1

Aggarwal, P., and Agarwal, M. (2015). Linear versus step-function decision making: the moderating role of relationship norms on consumer responses to brand transgressions. *Rev. Mark. Res.* 12, 207–232. doi: 10.1108/S1548-643520150000012008

Al-Gahtani, S. S. (2016). Empirical investigation of e-learning acceptance and assimilation: a structural equation model. *Appl. Comput. Inf.* 12, 27–50. doi: 10.1016/j.aci.2014.09.001

Anderson, J. C., and Gerbing, D. W. (1988). Structural equation modeling in practice: a review and recommended two-step approach. *Psychol. Bull.* 103, 411–423. doi: 10.1037/0033-2909.103.3.411

Andrews, J. C., Burton, S., and Netemeyer, R. G. (2000). Are some comparative nutrition claims misleading? The role of nutrition knowledge, ad claim type and disclosure conditions. *J. Advert.* 29, 29–42. doi: 10.1080/00913367.2000.10673615

Barreiro-Hurlé, J., Gracia, A., and de-Magistris, T. (2009). Market implications of new regulations: impact of health and nutrition information on consumer choice. *Span. J. Agric. Res.* 7, 257–268. doi: 10.5424/sjar/2009072-417

Benson, T., Lavelle, F., Mccloat, A., Mooney, E., Bucher, T., Egan, B., et al. (2019). Are the claims to blame? A qualitative study to understand the effects of nutrition and health claims on perceptions and consumption of food. *Nutrients* 11:2058. doi: 10.3390/nu11092058

Blundell, J. E. (1975). Anorexic drugs, food intake and the study of obesity. *Int. J. Food Sci. Nutr.* 29, 5–18. doi: 10.3109/09637487509143887

Byrne, B. M. (1994). *Structural Equation Modeling with EQS and EQS/Windows: Basic Concepts, Applications, and Programming*. Militas, CA: Sage.

Central People's Government of the People's Republic of China (2020). *Report on Nutrition and Chronic Diseases in China*. Available online at: http://www.gov.cn/xinwen/2020-12/24/content_5572983.htm (accessed October 1, 2021)

Codex Alimentarius Commission (1985). *Codex Guidelines on Nutrition Labeling*. CACGL 2-1985. Rome: Codex Alimentarius Commission.

Dabija, D.-C., Bejan, B. M., and Grant, D. (2018). The impact of consumer green behaviour on green loyalty among retail formats: a romanian case study. *Morav. Geogr. Rep.* 26, 173–185. doi: 10.2478/mgr-2018-0014

Devika, R., Harikrishna, M., and Anjaneyulu, M. V. L. R. (2020). Influence of psychological factors in mode choice decision making: a structural equation modeling approach. *Transp. Res. Proc.* 48, 2821–2830. doi: 10.1016/j.trpro.2020.08.236

Drugău-Constantin, A. (2019). Is consumer cognition reducible to neurophysiological functioning? *Econ. Manag. Financ. Mark.* 14, 9–15. doi: 10.22381/EMFM14120191

Ebert, S. (2017). Consumer psychology insights and their use for operational book marketing. *Exp. J. Bus. Manag.* 5, 91–97.

Fan, J. X., and Xiao, J. J. (1998). Consumer decision-making styles of young-adult Chinese. *J. Consum. Aff.* 32, 275–294. doi: 10.1111/j.1745-6606.1998.tb00410.x

Foxall, G. R. (1986). Theoretical progress in consumer psychology: the contribution of a behavioural analysis of choice. *J. Econ. Psychol.* 7, 393–414. doi: 10.1016/0167-4870(86)90030-9

Foxall, R. G. (2016). *Consumer Choice as Decision: Micro-Cognitive Psychology*. London: Palgrave Macmillan.

Franco-Arellano, B., Labonté, M., Bernstein, J. T., and L'Abbé, M. R. (2018). Examining the nutritional quality of Canadian packaged foods and beverages with and without nutrition claims. *Nutrients*. 10:832. doi: 10.3390/nu10070832

Garretson, J. A., and Burton, S. (2000). Effects of nutrition facts panel values, nutrition claims, and health claims on consumer attitudes, perceptions of

disease-related risks, and trust. *J. Public Policy Mark*. 19, 213–227. doi: 10.1509/jppm.19.2.213.17133

Gounaris, S. P., Tzempelikos, N. A., and Chatzipanagiotou, K. (2007). The relationships of customer-perceived value, satisfaction, loyalty and behavioral intentions. *J. Relatsh. Mark.* 6, 63–87. doi: 10.1300/J366v06n01_05

Graessley, S., Horak, J., Kovacova, M., Valaskova, K., and Poliak, M. (2019). Consumer attitudes and behaviors in the technology-driven sharing economy: motivations for participating in collaborative consumption. *J. Self-Gov. Manag. Econ.* 7, 25–30. doi: 10.22381/JSME7120194

Graham, D. J., and Roberto, C. A. (2016). Evaluating the impact of U.S. food and drug administration–proposed nutrition facts label changes on young adults' visual attention and purchase intentions. *Health Educ. Behav.* 43, 389–398. doi: 10.1177/1090198116651082

Hollowell, J. C., Rowland, Z., Kliestik, T., Kliestikova, J., and Dengov, V. V. (2019). Customer loyalty in the sharing economy platforms: how digital personal reputation and feedback systems facilitate interaction and trust between strangers. *J. Self-Gov. Manag. Econ.* 7, 13–18. doi: 10.22381/jsme7120192

Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika* 39, 31–36. doi: 10.1007/BF02291575

Katona, G. (1967). What is consumer psychology? *Am. Psychol*. 22, 219–226. doi: 10.1037/h0037767

Kim, H., and John, D. R. (2008). Consumer response to brand extensions: construal level as a moderator of the importance of perceived fit. *J. Consum.Psychol.* 18, 116–126. doi: 10.1016/j.jcps.2008.01.006

Kline, R. B. (2005). *Principles and Practice of Structural Equation Modeling*, 2nd Edn. New York, NY: Guilford Press.

Klopčič, M., Slokan, P., and Erjavec, K. (2019). Consumer preference for nutrition and health claims: a multi-methodological approach. *Food Qual. Prefer.* 82:103863. doi: 10.1016/j.foodqual.2019.103863

Kotler, P., and Armstrong, G. (2011). *Principle of Marketing*, 14th Edn. Hoboken, NJ: Prentice Hall.

Lei, P., and Wu, Q. (2007). Introduction to structural equation modeling: issues and practical considerations. *Educ. Meas. Issues Pract.* 26, 33–43. doi: 10.1111/j.1745-3992.2007.00099.x

Loureiro, M. L., and Mccluskey, J. J. (2000). Assessing consumer response to protected geographical identification labeling. *Agribusiness* 16, 309–320. doi: 10.1002/1520-6297(200022)16:3<309::AID-AGR4<3.0.CO;2-G

Mathios, A. D. (1998). The importance of nutrition labeling and health claim regulation on product choice: an analysis of the cooking oils market. *Agric. Res. Econ. Rev*. 27, 159–168. doi: 10.1017/S1068280500006481

Meilhan, D. (2019). Customer value co-creation behavior in the online platform economy. *J. Self-Gov. Manag. Econ.* 7, 19–24. doi: 10.22381/JSME7120193

Ministry of Health of the PRC (2011). *General Rules for Nutrition Labeling of Pre-Packaged Food*. GB28050-2011. Beijing: Ministry of Health of the PRC.

Mirică, C.-O. (2019). The behavioral economics of decision making: explaining consumer choice in terms of neural events. *Econ. Manag. Financ. Mark.* 14, 16–20. doi: 10.22381/EMFM14120192

Neale, M. C., Hunter, M. D., Pritikin, J. N., Zahery, M., Brick, T. R., Kirkpatrick, R. M., et al. (2016). OpenMx20: extended structural equation and statistical modeling. *Psychometrika* 81, 535–549.

Nunnally, J. C. (1978). *Psychometric Theory*. New York, NY: Mcgraw-Hill.

O'Neil, P. M., and Jarrell, M. P. (1992). Psychological aspects of obesity and very-low-calorie diets. *Am. J. Clin. Nutr.* 56, 185S–189S. doi: 10.1111/j.1747-0080.2009.01380.x

Oostenbach, L. H., Slits, E., Robinson, E., and Sacks, G. (2019). Systematic review of the impact of nutrition claims related to fat, sugar and energy content on food choices and energy intake. *BMC Public Health* 19:1296. doi: 10.1186/s12889-019-7622-3

Pocol, C. B., Marinescu, V., Dabija, D.-C., and Amuza, A. (2021). Clustering generation Z university students based on daily fruit and vegetable consumption: empirical research in an emerging market. *Br. Food J.* 4, 47–53. doi: 10.1108/BFJ-10-2020-0900

Popescu, G. H., and Ciurlău, F. C. (2019). Making decisions in collaborative consumption: digital trust and reputation systems in the sharing economy. *J. Self-Gov. Manag. Econ.* 7, 7–12. doi: 10.22381/JSME7120191

Priester, J. R. (2010). The use of structural equation models in consumer psychology: a methodological dialogue on its contributions, cautions, and concerns. *J. Consum. Psychol.* 20, 205–207. doi: 10.1016/j.jcps.2010.03.005

Reibstein, D. J., Youngblood, S. A., and Fromkin, H. L. (1975). Number of choices and perceived decision freedom as a determinant of satisfaction and consumer behavior. *J. Appl. Psychol.* 60, 434–437. doi: 10.1037/h0076906

Song, J., Huang, J., Chen, Y., Zhu, Y., Li, H., Wen, Y., et al. (2015). The understanding, attitude and use of nutrition label among consumers (China). *Nutr. Hosp*. 31, 2703–2710. doi: 10.3305/nh.2015.31.6.8791

Story, M., and French, S. (2004). Food advertising and marketing directed at children and adolescents in the US. *Int. J. Behav. Nutr. Phys. Act*. 1:3. doi: 10.1186/1479-5868-1-3

Stranieri, S., Baldi, L., and Banterle, A. (2010). Do nutrition claims matter to consumers? An empirical analysis considering European requirements. *J. Agric. Econ.* 61, 15–33. doi: 10.1111/j.1477-9552.2009.00223.x

Thompson, B. (2004). *Exploratory and Confirmatory Factor Analysis: Understanding Concepts and Applications*. Washington, DC: American Psychological Association.

Verbeke, W., Scholderer, J., and Lähteenmäki, L. (2009). Consumer appeal of nutrition and health claims in three existing product concepts. *Appetite* 52, 684–692. doi: 10.1016/j.appet.2009.03.007

Wang, S., Chen, Y., Liu, M., Hong, Z., Sun, D., Du, Y., et al. (2011). The changes of nutrition labeling of packaged food in Hangzhou in China during 2008˜2010. *PLoS One* 6:e28443. doi: 10.1371/journal.pone.0028443

Wezemael, L. V., Caputo, V., Nayga, R. M., Chryssochoidis, G., and Verbeke, W. (2014). European consumer preferences for beef with nutrition and health claims: a multi-country investigation using discrete choice experiments. *Food Policy* 44, 167–176. doi: 10.1016/j.foodpol.2013.11.006

Wing, R. R., Marcus, M. D., Blair, E. H., and Burton, L. R. (1991). Psychological responses of obese type II diabetic subjects to very-low-calorie diet. *Diabetes Care* 14, 596–599. doi: 10.2337/diacare.14.7.596

Zhang, X., Dagevos, H., He, Y., Lans, I. V. D., and Zhai, F. (2008). Consumption and corpulence in China: a consumer segmentation study based on the food perspective. *Food Policy* 33, 37–47.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's Note: All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

frontiers | Frontiers in Psychology

SYSTEMATIC REVIEW
published: 10 June 2022
doi: 10.3389/fpsyg.2022.848434

Beyond the Choice of What You Put in Your Mouth: A Systematic Mapping Review of Veganism and Vegan Identity

Sara Vestergren[1] *and Mete Sefa Uysal*[2]*

[1] School of Psychology, Keele University, Newcastle upon Tyne, United Kingdom, [2] Department of Social Psychology, Friedrich Schiller University Jena, Jena, Germany

In recent years, and in the current climate crisis, the interest in veganism and sustainable diet/lifestyle has increased. This growing interest can also be seen within academia. Therefore, we set out to systematically document and organize the social psychological literature on veganism and vegan identity to identify where the field currently is, and what we need to do next. Following PRISMA guidelines we identified a data set of 26 academic papers published between 2010 and 2021. Through a thematic analysis of the data, we created four categories of study focus and content: (1) vegans as a disadvantaged/stigmatized group, (2) the role of ideology in negative attitudes toward vegans, (3) the role of moral and ethical beliefs in changing or sustaining dietary preferences, and (4) veganism as a social movement and vegan activism. Our analysis emphasizes issues with merging all non-meat eaters, reduction of veganism into dietary or lifestyle choices neglecting the politicized content and movement, lack of processes underlying emergence and endurance of veganism, and decontextualization of vegan identity. What is needed is a more fine-grained exploration that addresses the identified issues to account for the content of vegan identity. This would expand, for example, the motives literature to include and emphasize intersectionality in a vegan identity context. Specifically, to facilitate a more sustainable lifestyle, the content of social dimensions needs to be qualitatively explored.

Keywords: vegan, veganism, identity, activism, social movement

OPEN ACCESS

Edited by:
Ana-Maria Bliuc,
University of Dundee, United Kingdom

Reviewed by:
Anna Dobai,
University of Dundee, United Kingdom
Anna Klas,
Deakin University, Australia

***Correspondence:**
Mete Sefa Uysal
mete.uysal@uni-jena.de

Specialty section:
This article was submitted to Personality and Social Psychology, a section of the journal Frontiers in Psychology

Received: *04 January 2022*
Accepted: *17 May 2022*
Published: *10 June 2022*

Citation:
Vestergren S and Uysal MS (2022) Beyond the Choice of What You Put in Your Mouth: A Systematic Mapping Review of Veganism and Vegan Identity. Front. Psychol. 13:848434. doi: 10.3389/fpsyg.2022.848434

INTRODUCTION

Veganism is described in various ways by non-vegans, often referring to what vegans do not eat. However, vegans generally refer to veganism as a political philosophy based on the rejection of the commodity status of animals (Pedersen and Staescu, 2014) or as part of an environmentally sustainable ideology (Buttny and Kinefuchi, 2020; Hudepohl, 2021). Although veganism is considered extreme by many people, veganism is gradually becoming a widespread phenomenon not only in western societies but across cultures around the world (Forgrieve, 2018; Jones, 2020). However, among scholars, there is sparse focus on the political, collective, and social movement aspects of veganism. Understanding the wider dimensions of veganism on an ideological and collective level is important in our understanding and application of an environmentally sustainable lifestyle.

Vegan identity can be understood as a shared social identity with rejection of the product-status of animals and the intersectional justice movement against animal exploitation and speciesism as part of identity content (e.g., Tajfel and Turner, 1979). The social identity approach suggests that our group memberships, the social categories we perceive to be part of, make significant contributions to how we see ourselves and our worldview (e.g., Turner et al., 1987). Some social categories and group memberships become salient in our daily lives as we perceive our worldview through that categorization (see Vestergren et al., 2018). Hence, our identification as part of the social category vegans will affect our values and behaviors in all social contexts where appropriate. Consequently, vegan identity and veganism goes beyond the choice of diet (plant-based) to incorporate veganism as an identity characteristic influencing actions and values derived from norms of the social identity. However, whether veganism is part of a social identity, or a social identity in itself is likely to depend on the social context. For example, veganism can be part of social identity content, you might be an animal-rights activist and reject harm to animals in all forms which makes veganism part of your animal-rights identity. Importantly, vegan identity includes social values and norms, and should thereby be seen as more than a dietary choice or identity. What veganism includes might depend on the salient social identity, such as values and behaviors tied to feminism, environmentalism, or animal-rights. Furthermore, veganism is often expressed through actions in relation to others, and not only oneself or one's own group. For example, Judge et al. (2022) emphasize in their Social Identity Model of Vegan Activism (SIMVA) that vegan identity also includes an active component of trying to promote vegan norms to others which goes beyond the food you put in your mouth.

Individuals can have various and diversified motives for becoming vegan including health-related, environmental, animal and social justice. Hence, a definition focused solely on diet does not capture the different levels of veganism (see North et al., 2021). With the transformative nature of vegan identity that goes beyond the vegan diet itself, the motives become converged to political and social justice-oriented aspects of veganism, which reflects the intersectional nature of the movement. It is also important to acknowledge that social identities can develop based on a perception of shared reactions or struggle to/in a situation (e.g., Thomas and McGarty, 2009; Thomas et al., 2012). Hence, the current climate crisis could provide a context where a shared identity around the climate emerges, which contains veganism as a shared value and behavioral norm. Hence, veganism can be part of an opinion-based identity, through people defining themselves as a group based on shared opinions (Bliuc et al., 2007).

In recent years, social psychologists have turned attention to the study of veganism and vegan identity. Recent theorizing has highlighted psychological similarities between human intergroup relations and human-animal relations (Dhont and Hodson, 2014; Dhont et al., 2014; Amiot and Bastian, 2015, 2017), and addressed human-animal relations in terms of intergroup interaction/relations (Haslam and Loughnan, 2014; Becker et al., 2019; Everett et al., 2019; Hoffarth et al., 2019; Leite et al., 2019). Previous studies mainly focus on the role of conservatism (e.g., Hodson and Earle, 2018), system justification (e.g., Caviola et al., 2019), or social dominance orientation (e.g., Dhont and Hodson, 2014), in relation to meat consumption, prejudice against vegan and vegetarians, speciesism, animal welfare concerns, and support for animal rights. However, veganism has been found to be an important part of some activist identities and social movements (e.g., Stuart et al., 2013; Vestergren et al., 2019; Judge et al., 2022). Although personality or ideology constructs such as Social Dominance Orientation (SDO), Right-Wing Authoritarianism (RWA) (see e.g., Dhont et al., 2016; Judge and Wilson, 2019), and conservatism can explain some behaviors or behavioral intentions such as meat-eating or not meat-eating that are considered as related to veganism or anti-veganism, these are not sufficient to explain veganism or vegan identity itself. An identity-focused approach, as outlined above, can offer a more comprehensive explanation in relation to becoming vegan as well as sustaining the vegan identity by going beyond the facilitators of veganism-related behaviors.

We believe that a systematic mapping review is needed to summarize the findings and identify the gaps in social psychological studies of veganism and vegan identity. These gaps are of importance to identify, not only for vegan activism and movement but also for sustainable living in relation to the environment and climate crisis.

METHOD

In accordance with PRISMA guidelines (Liberati et al., 2009) we conducted a systematic mapping review of social psychological factors related to veganism as a diet, social movement, lifestyle, or shared social identity. To be included in this review, studies had to meet the following inclusion criteria: (1) be indexed in Web of Science or PsycArticles, (2) written in English, (3) published after 2010, and (4) focused on veganism or topics related to veganism such as meat eating, speciesism, anthropocentrism, or animal right activism. The keywords used to compile the papers in our data set were "*vegan, veganism, vegetarian, vegetarianism, meat, omnivores, speciesism, animal rights, animal exploitation, animal welfare, human-animal relations*". We purposely added search terms such as vegetarian and vegetarianism for capturing social psychological studies that merged vegetarians and vegans in their sample. Initial database searches, conducted in February 2021, using these key terms in the social psychology category of databases yielded 66 articles, from which 4 duplicates were removed. Screening of titles and abstracts was conducted independently by authors to identify articles that were relevant to the scope of the review. Where the authors did not initially agree on the articles that should be discarded, conflicts were resolved via consensus. We include records that collected data from vegans; approach veganism as an environmental, social, activist, or political identity; frames vegans as an outgroup and measure anti or pro-vegan attitudes; address vegans as a subgroup of vegetarians; explain meat-eating behaviors using social psychological perspectives and approach them as behaviors committed by group members who see vegans/vegetarians as outgroup. Records were excluded

if they focus on meat-eating without emphasis on veganism-related social-psychological variables and processes such as identity, ideology (e.g., SDO, RWA, conservatism, speciesism, anthropocentrism), and intergroup relations. As seen in **Figure 1**, a total of 46 articles were discarded following the inclusion criteria and focus of review after abstract and full-text examination. After finalizing the first search, all included articles' reference lists were scanned. From the reference lists we included an additional 10 articles. A final data set of 26 articles were identified for analysis.

The final data set was analyzed thematically (e.g., Attride-Stirling, 2001). All papers were read thoroughly and repeatedly by both authors. While reading, notes and codes in relation to veganism and vegan identity were made. The codes were then discussed and organized into clusters based on recurring meaning in relation to veganism and vegan identity. For example, rejecting the label of vegan and vegaphobia were collated with other codes in a category of stigma and stereotyping. The categories were then reviewed and discussed between the authors to develop themes of recurring meaning within the dataset.

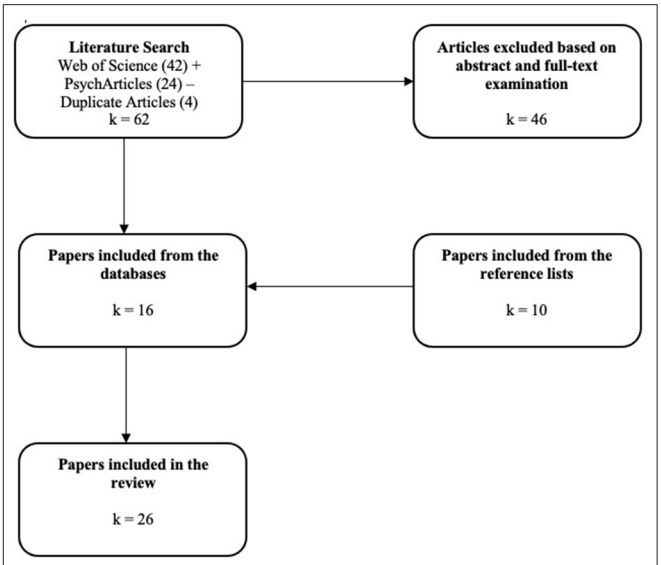


FIGURE 1 | Selection process of included articles.

FINDINGS

Through thematically analyzing the papers in the dataset in relation to veganism and vegan identity four categories of social psychological research on veganism were created: (1) veganism as disadvantaged stigmatized identity ($n = 10$); (2) the role of ideology in attitudes toward vegans ($n = 9$); (3) the role of moral and ethical beliefs in sustaining or changing dietary preferences ($n = 10$); and (4) veganism as a social movement and vegan activism ($n = 4$). Some papers were included in more than one category based on their conceptual content (see **Table 1**).

Vegans as a Disadvantaged and/or Stigmatized Group

Many studies on veganism or vegans within the social psychological discipline use a critical discursive framework to focus on vegans as a disadvantaged stigmatized group and seek the predictors of vegan stigma (e.g., Rothgerber, 2014; Bresnahan et al., 2016; Markowski and Roxburgh, 2019). For instance, through a discursive analysis that critically examined *vegaphobia* in the UK newspapers it was demonstrated that vegans were stigmatized and stereotyped as unrealistic sentimentalists, fanatics or extremists (Cole and Morgan, 2011). Similarly, Potts and Parry (2010) focused on online comments in digital media and identified aggression toward particular vegan groups, labeled as *vegansexuals* (vegans who have romantic or sexual relationships with only vegan people), by heterosexual omnivore cis-men. In Potts and Parry's study, vegans were found to be stereotyped in a negative way and labeled as deviants and bigots. The authors suggest that the relationship between meat-eating and masculinity in western societies could be a potential reason for cis-men's aggressive response to refusal of the meat culture. The masculinity, or lack thereof in relation to veganism could be suggested to stem from a social identity where vegans are seen as "soft and caring" as a consequence of the identity framework of non-harm.

While some studies focus on the predictors of vegan stigma, others have focused on how vegans perceive stigmatization and the consequences of stigmatization. Bagci and Olgun (2019) examined how vegans and vegetarians in Turkey perceive stigmatization and whether social identity needs (esteem, meaning, belonging, efficacy, distinctiveness, and continuity) were associated with perceived discrimination of vegans. They showed that satisfaction of esteem and meaning needs were the most correlated variables with perceived discrimination (Bagci and Olgun, 2019). Furthermore, through a discursive analysis, focusing on stigmatized vegans' problematic interaction with omnivores, it was found that vegans experienced several ideological dilemmas in relation to their different identity manifestation or performance such as veganism as choice of diet, for environmental reasons or ethical considerations (Buttny and Kinefuchi, 2020). Stuart et al. (2013) demonstrated effects of vegan stigmatization in an activist group where members have multiple identities. Although most of the Sea Shepherd Conservation Society members position themselves as radical activists, some of them rejected being labeled as vegan to avoid being considered as "hardcore vegan" which implies an inflexible ideological position, and the organization should keep a distance from this position. Moreover, Markowski and Roxburgh (2019) showed that stigmatization of vegans also has negative impacts for omnivores as it can inhibit dietary shifts toward veganism due to the negative label. Related to the perception of stigmatization and its consequences are the attitudes toward vegans, and especially the role that ideology plays in creating and maintaining the attitudes.

The Role of Ideology in Attitudes Toward Vegans

There are an increasing number of studies in social psychology focusing on the role of ideology-related variables such as right-wing authoritarianism (RWA), social dominance orientation (SDO), system justification, and political

TABLE 1 | List of reviewed studies and their features.

References	Method(s)	Focus	Data	Country	Theme(s)
Bagci and Olgun (2019)	Quantitative: Cross-sectional survey	Vegan stigmatization, perceived discrimination, social identity needs, well-being	$N = 350$; community sample	Turkey	1
Bresnahan et al. (2016)	Quantitative: Experiments	Predictors of vegan stigma, impact of pro- and anti-vegan messages, anger, discomfort	$N_1 = 261$, $N_2 = 225$; student samples	*no information*	1
Butterfield et al. (2012)	Quantitative: Experiments	Anthropomorphism, support for animal welfare and rights	$N_1 = 42$, $N_2 = 57$; student samples	*no information*	3
Buttny and Kinefuchi (2020)	Qualitative: Critical discursive analysis to discussions	How vegans deal with their identity and problematic interaction with omnivores	7 vegan students	The US	1
Cole and Morgan (2011)	Qualitative: Discursive analysis to news	Vegan stigmatization in media	397 newspaper articles	The UK	1
Cruwys et al. (2020)	Mixed method: Qualitative and quantitative survey	Big Five, moral foundations, self-efficacy, social identification with dietary group, diet adherence	$N = 292$; community sample	*no information*	3
Davis et al. (2019)	Qualitative: Sentiment analysis and mean word counts through big data	Social identity, social movement, identity feedbacks, identity verification	9,994 YouTube comments	*multinational*	4
Dhont and Hodson (2014)	Quantitative: Cross-sectional surveys	RWA, SDO, perceived threat from non-exploitative ideologies, human supremacy belief	$N_1 = 260$, $N_2 = 489$; community samples	Belgium	2, 3
Dhont et al. (2014)	Quantitative: Cross-sectional surveys	SDO, ethnic prejudice and speciesist attitudes	$N = 191$; student sample	Canada	2
Dhont et al. (2016)	Quantitative: Cross-sectional surveys	Role of SDO, RWA and conservatism in speciesism and ethnic prejudice	$N_1 = 118$, $N_2 = 198$; student samples & $N_3 = 573$; community sample	Belgium (Study 1) & the UK (Study 2) & the US (Study 3)	2
Earle et al. (2019)	Quantitative: Experiments	Negative attitudes toward vegans, visual reminders of meat's animal origins, empathy for animals, disgust for meat, vegan threat	$N_1 = 299$, $N_2 = 280$; community samples	The US	2, 3
Graça et al. (2016)	Mixed method: In-depth interviews and cross-sectional surveys	Moral disengagement of meat consumption, SDO, speciesism, human supremacy beliefs	$N_1 = 1013$, $N_2 = 318$; community samples	Portugal (Study 1) & the US (Study 2)	2, 3
Greenebaum (2012)	Qualitative: In-depth interviews	Contradictions of ethical vegans, impression management, vegans' presentation of self, identity performance	16 vegans	the US	1
Hodson and Earle (2018)	Quantitative: Cross-sectional survey	Reasons for adopting vegan diet, social support, conservatism	$N = 1313$; community sample	the US	2, 3
Hoffarth et al. (2019)	Quantitative: Cross-sectional surveys	SDO, conservatism, economic system justification, speciesism, attitudes toward animal welfare	$N_{1a} = 2219$, $N_{1b} = 1500$, $N_2 = 395$; community samples	the US	2
Janssen et al. (2016)	Qualitative: In-depth interviews	Vegan motives for adherence and attitudes toward animal agriculture	329 vegans	Germany	3
Judge and Wilson (2019)	Quantitative: Cross-sectional survey	Attitudes toward vegans, RWA, SDO, dangerous worldview, competitive-jungle worldview	$N = 1326$	New Zealand	1, 2
Kalte (2021)	Quantitative: Cross-sectional survey	Vegans' political behaviors, different motives of vegans	$N = 628$ vegans; community sample	Switzerland	3, 4
Leach et al. (2020)	Quantitative: Experiments	How information about animals shifted moral beliefs about omnivores' diet and harming animals	$N_{1a} = 241$, $N_{1b} = 213$, $N_2 = 318$, $N_3 = 210$; student samples	The UK	3
MacInnis and Hodson (2017)	Quantitative: Cross-sectional surveys	Negative attitudes toward vegans, threat perception against vegans, bias	$N_1 = 278$, $N_2 = 280$, $N_3 = 371$; community samples	the US (Studies 1 and 2) & mostly the US and Canada (Study 3)	2

(Continued)

TABLE 1 | Continued

References	Method(s)	Focus	Data	Country	Theme(s)
Markowski and Roxburgh (2019)	Qualitative: Focus groups	Vegan stigma, behavioral distancing	Focus group discussion with 34 university students	the US	1
Potts and Parry (2010)	Qualitative: Textual examination and thematic analysis of web sources	Aggressive response of omnivore heterosexual cis-men against a particular vegan group (vegansexuals)	Comments in 12 cyberspace sources	New Zealand	1
Rosenfeld (2019)	Quantitative: Cross-sectional surveys	Different motives of vegans, disgust toward meat, dietary adherence	$N_1 = 361$, $N_2 = 562$; community samples	the US	3
Rothgerber (2014)	Quantitative: Cross-sectional surveys	Group vulnerability, disloyal ingroup behaviors, intergroup distinctiveness	$N_1 = 404$, $N_2 = 400$, community samples	*no information* (Study 1) & the US (Study 2)	1
Stuart et al. (2013)	Qualitative: web sources and in-depth interviews	Multiple identity conflict, activist identity, social movement	21 editorial and commentary articles & 6 interviews	the US	1, 4
Thomas et al. (2019)	Quantitative: Cross-sectional survey	Social identification, animal right activism, politicization, radicalization	$N = 578$; community sample	the US	4

Theme 1: vegan stigmatization, Theme 2: ideology and attitudes, Theme 3: moral and ethical beliefs in sustained and changed diet, Theme 4: social movement and activism.

conservatism in human-animal relations in relation to attitudes toward vegans and vegetarians. Many of these studies argue that ideological variables that shape human-human relations, and prejudice or discrimination against human outgroups, also predict human-animal relations. Hence, they seek common ideological roots of speciesism and negative human outgroup attitudes (e.g., Dhont et al., 2014). Beyond the commonalities of human-human and human-animal relations, these studies position ideological variables at the core of negative attitudes toward stigmatized dietary and/or political groups such as vegans.

SDO and RWA as the most prominent right-wing ideological variables in social psychology have been tested as predictors of the speciesist attitudes. Both SDO and RWA have been found to predict negative attitudes toward vegans (Judge and Wilson, 2019). However, Dhont et al. (2014, 2016) found that SDO, more than RWA, was associated with speciesism. Moreover, they showed that both SDO and RWA were related to perceived threats against vegans and vegetarians. Perceived threat against non-meat eating groups was also found to mediate the relationships between SDO-RWA and meat consumption (Dhont and Hodson, 2014). Furthermore, beliefs in human superiority mediated the relationship between SDO and meat consumption. Similarly, MacInnis and Hodson (2017) demonstrated that omnivores have high levels of prejudice against vegans, and this prejudice was much higher among those scoring high in right-wing ideologies. They also found that omnivores have more negative attitudes toward vegans who are motivated by animal rights or environmental concerns than those motivated by health concerns. Relatedly, Hoffarth et al. (2019) found that political conservatism, in addition to SDO, was associated with greater endorsement of speciesism through economic system justification. As previous studies demonstrate, ideology is a strong predictor of attitudes toward vegans. When the perspective is turned and instead focuses solely on the consumer's dietary change or adherence, the main predictors identified previously are conceptualized as moral and ethical beliefs.

The Role of Moral and Ethical Beliefs in Changing or Sustaining (Vegan) Diet

Research on changing or sustaining meat-eating and plant-based diets mainly revolve around two predictors: moral and ethical beliefs. In their study of predictors of dietary adherence, Cruwys et al. (2020) found that the most frequently occurring facilitator for sustained diet was ethical/moral concerns (51.6%). Furthermore, in relation to veganism participants described their vegan diet as an "ethical way of life" (p.7). References to "way of life" and "lifestyle" in the dataset could further indicate the perception and incorporation of social identity as a vegan, or veganism as part of identity content.

In addressing changed dietary preferences in human-animal relations studies, there is an emphasis on the participants' morality and moral beliefs. For instance, Leach et al. (2020) examined whether receiving information about animals' traits and behaviors change moral beliefs about eating meat. They found that information that animals can feel nostalgia (i.e., secondary emotion) and others' suffering (i.e., empathy) as well as animals' capacity to feel pain affected individuals' moral beliefs about harming animals. Correspondingly, Butterfield et al. (2012) found that attributing human characteristics to animals (i.e., anthropomorphism) was associated with positive attitudes toward vegans. Graça et al. (2016) showed that frequency of eating meat was strongly associated with moral disengagement of meat consumption. Moreover, individuals' moral variables such as level of empathy, moral identity, and moral emotions was related to moral disengagement of meat consumption. Similarly, Earle et al. (2019) found that increased empathy for animals mediate the relationship between visual reminders of meat's animal origins and decreased meat consumption. Hence,

previous research demonstrates a strong case for the role of morality in changing to a more plant-based diet. When it comes to sustaining that dietary preference, most emphasize the role of ethical beliefs.

More than 70% of surveyed vegans consider animal rights the most important reason to being vegan (Kalte, 2021). Hodson and Earle (2018) explored reasons for lapsing back to meat eating after being vegan and found that former vegans, compared to current vegans, were less likely to be motivated by social justice along with scoring higher in conservatism. Rosenfeld (2019) focused on the ethical-health dichotomy in veganism and compared dietary goal orientation in terms of dietary adherence. Rosenfeld found that animal rights motivated vegans and vegetarians displayed stronger adherence than environmentally and health motivated vegans and vegetarians. Moreover, higher disgust toward meat among animal rights motivated vegans and vegetarians was associated with their stronger adherence. The motives for sustained diet are important for wider consumer habits and thereby extends beyond what is present on the dinner table. For example, Janssen et al. (2016) showed that ethical and self-oriented vegan consumers have different attitudes toward animal agriculture. They found that vegan consumers who did not refer to ethical concerns such as animal rights motives had more positive attitudes toward animal agriculture. Even though ideology is emphasized in attitudes toward vegans and veganism, and moral and ethical beliefs demonstrated as crucial in changing and sustaining diet there are few studies that go beyond the individual level of veganism. In the next, and last, category we outline studies that include a dimension of collectivism in the form of social movements or veganism as activism.

Veganism as a Social Movement and Vegan Activism

One of the most neglected areas of social psychological studies on vegans is activism and social movement aspects of veganism. While seeking the answer to whether veganism is an individualized form of political participation Kalte (2021) showed that a majority of vegans are politically motivated. However, when focussing on social movements, veganism as activism, and collective identity processes there is very sparse research. Stuart et al. (2013) identified in their interviews with anti-Whaling activists that veganism can, but does not necessarily need to, be part of activist identity content. Thomas et al. (2019), following the social identity approach, classified animal right activists by using latent profile analysis. They identified three animal rights activist groups: omnivores, lifestyle activists, and vegetarian radical groups. In their study, Thomas et al. (2019) demonstrated that participants who had higher vegan identification tended to be more committed to radical actions. Finally, Davis et al. (2019) argue that veganism is a social movement identity by using qualitative analysis of YouTube comments and showing that non-verifying identity feedbacks elicit negative emotional response among vegans. Through sentiment analysis with a qualitative element they demonstrate how distress is created when the content is not aligned with the perceived collective vegan identity, and how positive emotions increase when the content and collective identity are aligned.

Although previous research makes important contributions to insights about human-animal relations and attitudes toward vegans, veganism and vegan identity is not addressed comprehensively within social psychology. Consequently, based on the results from our systematic mapping review, we argue that there are several issues that need to be addressed in how vegans are viewed in the social psychological literature. These issues are mainly in relation to the identity content and context of vegans and veganism.

DISCUSSION

In our systematic mapping review we created four categories of study focus and content in relation to veganism and vegan identity: stigmatization, ideology and attitudes toward vegans, moral and ethical beliefs in changing and sustaining diet, and veganism as social movement and vegan activism. Based on the reviewed literature we argue that there are four crucial issues and gaps needed to discuss: (1) merging all non-meat eaters, (2) reduction of veganism to dietary or life-style choices neglecting the politicized content and movement, (3) lack of social psychological processes of emergence and endurance of vegan identity, and (4) decontextualization of vegan identity and lack of cultural factors.

Merging all Non-Meat Eaters

We argue that vegetarian and vegan identities are distinct identities. This argument follows theorizing by MacInnis and Hodson (2021) who found that, for example, vegans often prefer vegans over vegetarians. Further adding to the need for a distinction between vegans and vegetarians MacInnis and Hodson (2021) found that both groups had more positive experiences within their own group (and more negative with the outgroup). Furthermore, vegan identity is often politicized whereas vegetarian identity may or may not be politicized. For example, vegans are often politically active (Stuart et al., 2013; Kalte, 2021) and radical animal rights activists are often vegan (Stuart et al., 2013). Kalte (2021) found that 89% of the vegans reported political reasons for being vegan. Similarly, Cruwys et al. (2020) found that vegans often understood their dietary choices in terms of social and political contexts, were vegans (80.5%) more often than vegetarians (46.7%) emphasized moral and ethical reason for their sustained diet. Even though only a small difference, vegans (9.8%) referred to a shared identity more often than vegetarians (8.9%) (Cruwys et al., 2020). Moreover, Markowski and Roxburgh (2019) demonstrated that vegetarians and omnivores often shared negative perceptions of vegans and veganism, further highlighting the need for differentiation between non-meat eaters. Hence, even though similar, there are differences between vegans and vegetarians in terms of politicized content and identification which suggests that they should be studied as distinct groups.

Human-animal relation research lacks focus on the role of shared social identity in human-animal relations and veganism. To our knowledge, there are only three studies that addressed

veganism/vegetarianism with insights from the social identity approach (i.e., Thomas et al., 2019; Cruwys et al., 2020; Judge et al., 2022). Thomas et al. (2019) identified three profiles (ambivalent omnivores, life-style choice activists, and vegetarian radicals) who all engaged in animal welfare actions. However, the authors did not address vegan identity as a distinct identity, instead, it was conceptualized as a vegetarian lifestyle activist group or radical vegetarian profile (including both vegan and vegetarians). Cruwys et al. (2020) differentiated between vegans and vegetarians; however, their focus was on adherence to diet rather than the dimensions of such identities. Judge et al. (2022) approach veganism as an activist identity, and emphasize the action based framework for the identity.

We suggest that vegan identity, as different from vegetarian identity, should be addressed as a (disadvantaged) politicized social identity. Related to the neglect of differentiating between non-meat-eating identities, there is also a neglect of the content of vegan identity often reducing it to dietary or lifestyle choice.

Reduction of Veganism Into Dietary or Lifestyle Choices, Neglecting the Politicized Content and Movement

Veganism can be argued to be more than a lifestyle, it can be seen as a feature of a social movement standing against the exploitation of animals (including humans) and environment (e.g., Vestergren et al., 2018, 2019). Through their choice of diet activists can display and perform their activist identity (e.g., Vestergren et al., 2019). Activist Michael Pollan emphasize how people make political acts by using their fork, and states "The wonderful thing about food is that you get three votes a day. Every one of them has the potential to change the world" (Nourish, 2020). Hence, veganism, as a tool for political motives and behaviors, can be seen as a vehicle for societal change (Kalte, 2021).

We acknowledged that human-animal relations are complex, precarious, and paradoxical as some animals are loved family members and others slaughtered. However, there is a need to focus on how people understand these paradoxical behaviors. For example, Leach et al. (2020) suggest that people change their moral beliefs about animals as food or friends based on information about the animal's ability. They highlight animal abilities such as feeling secondary emotions, understanding morality, capacity for empathy, forming social bonds and experiencing negative emotions as key dimensions for why participants would not consider them as food (Leach et al., 2020). Interestingly the authors did not find type of diet (vegan, vegetarian, pescatarian, omnivore) to qualify for main effects in any of their studies. Consequently, regardless of diet, the moral judgements were similar throughout the data set. Hence, the decision of whether an animal is food or not was not dependent on the current diet. This could indicate that being vegan contains more than just adhering to dietary choices or animal characteristics. Therefore, vegans, as a political group who stand against animal and environmental exploitation, should be more than objects of social psychological studies.

Vegans, and the motives for veganism, can be organized under three types: health (e.g., Radnitz et al., 2015; Cramer et al., 2017), animal rights (e.g., Greenebaum, 2012), and environment (e.g., Janssen et al., 2016). Greenebaum (2012) uses the terms "ethical" vegans and "environmental" vegans to differentiate between animal-rights and environmental vegans. The division of vegans is based upon the behaviors and attitudes they might hold. For example, environmental vegans might prefer second-hand leather over PVC, whereas ethical vegans might condone the use of soy (Greenebaum, 2012). Hence, the content of the shared identity, and thereby legitimate action, can vary between different types of vegans. In the case of health vegans, the dietary choices are assumed to be more related to self-interest rather than a shared political identity. The division into these types of vegans in previous literature mainly consists of asking participants about their main motive for veganism. However, by doing so there is a risk of neglecting similarities and overlaps. For example, when the question targeted main motive, Kalte (2021) found that 71% stated animal welfare and only 12% environment as their main reason for being vegan. However, when asking for important factors of their veganism (without having to choose only one) 78% stated that environmental concerns was an important factor for their veganism (see also Janssen et al., 2016).

Consequently, previous research can be seen as reductionist in terms of identity content as veganism is often referred to in the context of animal-human relations. However, reduction of animal products has been emphasized as an important element in fighting the climate crisis (Peta, 2015). Therefore, there is a need to be more inclusive in the theorizing around veganism and go beyond the animal related foundation to explore vegan identity and all its dimensions. Addressing the social and political dimensions of the identity content includes going beyond treating veganism as an individual choice where the shared ideological, moral, or ethical content of the identity becomes shadowed by the more practical individual choice of diet or lifestyle. A few previous studies have identified consumption choices as content of a salient social identity (e.g., Stuart et al., 2013; Vestergren et al., 2018, 2019). Vegan identity might be included in both animal rights and environmental rights activist identity and the intersectionality of these needs addressing. To our knowledge, no studies have yet sought to explore the distinction or inclusion of these two dimensions in relation to a wider vegan identity. Examining vegans' construal of what it means to be vegan, by exploring similarities and differences between animal rights vegans and environmental vegans and discussing the intersectionality between animal-environmental dimensions/identities is needed.

Kurz et al. (2020) argue that vegan identity can be seen as a moralized-minority-practice identity (MMP) and thereby has further implications in terms of accepted or normative behaviors. In comparing newspaper accounts of meat-eaters and vegans, Cole and Morgan (2011) found that vegans were portrayed in a derogatory manner, described as hostile extremists, ascetics, fad, and oversensitive, and were ridiculed for promoting something that was portrayed as impossible to sustain. Several additional studies have emphasized stigmatization toward vegans (Potts and Parry, 2010; Wright, 2015; MacInnis and Hodson, 2017;

Markowski and Roxburgh, 2019) and strategies to cope with the stereotypical attributes (Buttny and Kinefuchi, 2020; Schwartz, 2020). For example, Israeli vegans adopted strategies to de-stigmatize veganism such as adhering to masculine features by posting pictures reflecting strength and muscles, reporting male behaviors such as barbequing, or ridiculing left-wing ideology to compensate for their veganism and navigate different identities (Schwartz, 2020). Similarly, Buttny and Kinefuchi (2020) suggests that vegans might use the term "plant-based" instead of vegan to avoid the negative stigma and highlight the ideological dilemma vegans face in terms of when and how to communicate their beliefs and attitudes. By developing strategies to deal with the ideological dilemma vegans acknowledge that their identity is stigmatized and goes against the normative mainstream culture (Buttny and Kinefuchi, 2020). Moreover, prejudice against vegans has been demonstrated to be stronger when ideological dimensions are involved. For example, prejudice views of being vegan for moral and ethical reasons, in relation to animal rights and environment, were higher than toward people who were vegan for health reasons (MacInnis and Hodson, 2017). To sum up, in relation to previous research it is suggested that reducing veganism to an individual lifestyle or dietary choice neglects the underlying social, ideological, and political dimensions of the identity. In addressing the content of the shared identity, it is also important to address the processes of emergence and endurance of the identity.

Processes of Emergence and Endurance of a Vegan Identity

Social psychological studies of veganism and vegan identity have mostly overlooked addressing factors underlying the process of becoming vegan. In general, contemporary research emphasizes questions in relation to single variables predicting justifying eating meat (or not), and why some people endorse speciesism more than others (Dhont and Hodson, 2014; Hoffarth et al., 2019; Leach et al., 2020). We propose that veganism can be part of a politicized social identity, as well as it can emerge through intragroup interaction with other vegans or activists (see also Drury and Reicher, 2000; Vestergren et al., 2019). In a study of environmental activists, Vestergren et al. (2019) found that some participants became vegan through their participation in collective action. The participants explained this change because of change in the way they viewed themselves and their social world, specifically, the change in consumption was related to a change in perceived intergroup and intragroup relations (Vestergren et al., 2019). Similarly, Cherry (2015) found that participants in the punk movement changed their diet to become vegan. The shift in diet was suggested to emerge through a shift in identity, lifestyle, emerged through intragroup interaction. The reconstruction of the identity was related to moral and ethical issues and what the punk movement stood for. Therefore, the emergence of veganism was related to a reconstruction of identity content. Social psychological research should explore the reasoning behind becoming vegan and factors motivating the change in behavior and beliefs. Hence, research needs to explore what the processes of emerging vegan identity are, ingroup norms of movements where veganism is common, types of identity processes involved and more specifically, how people navigate the status quo and politicized vegan identity.

In addition to the lack of accounts of social psychological processes of emergence, there is also a lack of detailed processes of endurance of vegan identity. Previous studies demonstrate that different motives of being vegan affects whether the diet is sustained or not (e.g., Moore et al., 2015; Cruwys et al., 2020). However, these studies mainly focus on a general concept such as morality. In addition to the moral and ethical animal-rights factor affecting endurance, other political dimensions have been identified that should be addressed and explored on a deeper level along with the meaning of morality and ethical motives of sustained diet. For example, the connection between diet and ideology was demonstrated in relation to sustained diet (Hodson and Earle, 2018). Hodson and Earle (2018) found that conservative vegans relapsed (resume meat consumption) at higher rates than vegans who held a more liberal ideology (Hodson and Earle, 2018). As previous research has identified that different motives to veganism affect adherence, these need to be explored further to identify what it is more specifically about the various motives. We argue that being motivated by ideological or ethical reasons also contains a dimension of social identity and group membership that reasons related to individual health do not. Perceiving to be part of a social group, sharing a social identity, also brings with it expected support and social networks.

The importance of shared identity and social support has been identified in relation to sustained veganism. However, in most studies, the factors used to explain sustained diet excludes the social dimension, or if included (e.g., Hodson and Earle, 2018; Cruwys et al., 2020) there is no further theorizing what it is about the social that facilitates endurance. For example, Cruwys et al., (2020) found that participants who identified with their dietary group also were more likely to sustain their diet. Similarly, Hodson and Earle (2018) found that their participants who lapsed back from veganism to meat-eating lacked social support in relation to their veganism. However, none of the studies go beyond the variable to try to explain what it is about the social that facilitates adherence to veganism. We argue that intragroup relations/interaction can facilitate the endurance of identity content, in this case actions and beliefs related to veganism (see Vestergren et al., 2018). Related to the social dimension is identity performance, if you are in a social space where you can perform your identity content, for example eating vegan or discuss legitimate behaviors with like-minded, you get to enact your identity which could further facilitate the endurance (see Vignoles et al., 2006, 2011; Klein et al., 2007). Previous studies have emphasized the importance of social networks, to exchange knowledge and resources, for endurance of environmental identity (Kennedy, 2011; Vestergren et al., 2018). Similar to Cherry (2006, 2015), we argue that veganism can be a social identity, and for this identity to endure the social relations informing it needs to be sustained. However, there is a lack of research exploring what it is specifically about these social networks, why and how they facilitate a sustained vegan identity or lifestyle. Hence, we need

an account of what it is about the perceived social interaction that facilitates a vegan identity to be sustained. In addressing the social interaction that vegan identity emerges and endures, it is also crucial to include the cultural context that the interactions occurred.

Decontextualization

The fourth identified gap in the existing literature relates to decontextualization of the human-animal relations, and related intergroup behaviors such as animal liberation movements or veganism. If human-animal relations should be addressed as an intergroup relation (see Amiot and Bastian, 2015), then we should not neglect the effect of cultural contexts in intergroup relations (see bimodal relationships; Klein et al., 2007). Shared social identity provides definitions of possible conduct and enables people to act collectively in normative ways according to ingroup norms (see Drury and Reicher, 2000). However, it is important to acknowledge that enactment of ingroup norms also takes place in intergroup contexts where ingroups and outgroups might have different values and perceptions of these norms. These intergroup contexts are often created by the dynamic actions of other groups such as political and religious authorities, anti-vegans, meat-eaters, or third parties. In other words, there is no universal or singular performance for vegan identity across cultures, the performance will depend on the structures of the social interactive and cultural context they are placed in.

Previous research on psychological change through participation in social movements have identified both intergroup and intragroup as crucial for psychological changes to emerge and endure (e.g., Vestergren et al., 2018, 2019). Accordingly, we believe that interaction and cultural beliefs may deeply affect the factors that motivate people to become vegan, stay vegan, and how vegan and animal liberation movements escalate in specific intergroup contexts. For instance, one in ten people in Sweden identifies as vegetarian or vegan (Molloy, 2014). In 2018 two percent (∼202,400) of Sweden's population (2018: 10.12 million) reported being vegan (Statista, 2020a). This was a decrease compared to four percent in 2015. Contrary to Sweden, other countries have seen a large increase in veganism. In the UK, the vegan population grew from 150,000 in 2014 to over 600,000 in 2018 (Statista., 2020b). Moreover, the UK launched more vegan products than any nation (Mintel, 2019). Culturally, other countries face even more complex dimensions of veganism than Sweden and the UK. For example, being Muslim may add an even more complex relationship with veganism and vegan identity. Meat consumption, through sacrifice, is one of the five main religious duties of Muslims. Hence, for many Muslims there is a need to navigate their vegan and Muslim identity. Nevertheless, the vegan movement is increasing in some Muslim countries too, such as Turkey (Rasmussen, 2017) and vegans are finding strategies to cope with complexities such as veganism and Eid. Hence, vegan identity, just like other shared social identities, are affected by social locations and positions and require various social identity performances across different times, cultures, and contexts (see Drury et al., 2012). Moreover, political meta-factors such as political openness (Saavedra and Drury, 2019), trust (van Stekelenburg and Klandermans, 2018), procedural justice (Gerber et al., 2018), presence of violent repression (Ayanian et al., 2021), political regime type (Regan and Henderson, 2002) have important impacts on diversity of social movements, in turn, emergence, endurance, change and performance of shared social identity across cultures. We suggest that underlying factors of politicized vegan identity formation and performance might have different cultural patterns although the main ideological and ethical reasons might be the same. Alongside the processes of emergence and endurance of vegan identity, we argue that there is a need to focus on the intersectionality of vegan identity, not only in terms of ideology and politics, but also in terms of culture and context.

CONCLUSION

Our aim with this paper was to gather and compare the studies of veganism and vegan identity. Through a systematic mapping review of the literature on veganism and vegan identity within the social psychological field of research we identified a data set of 26 papers published between 2010 and 2021. This review is not intended to gather and outline all studies on veganism and vegan identity, as there are studies within different disciplines such as sociology and nutrition. This review constitutes a comprehensive account of social psychological studies identified using general key terms related to veganism. Through analyzing the papers thematically, we created four categories of study focus and content: stigmatization of vegans, role of ideology in negative attitudes toward vegans, role of moral and ethical beliefs in changing or sustaining veganism, and veganism as a social movement and vegan activism, and conclude that there are four main gaps in the literature that needs addressing in future studies: merging all non-meat eaters, reduction of veganism to dietary choices or lifestyle, lack of processes underlying emergence and endurance of veganism, and decontextualization of vegan identity. We argue that filling these gaps are fundamental on several levels. Firstly, in addressing the climate crisis and fighting it we need to focus on both individual and collective solutions. Providing research of for example sustainable living (incl. diet) would be facilitated by understanding the wider identity content and context to facilitate individual and collective action. Secondly, in an increasingly "unhealthy" world there is a need to focus on more healthy living in terms of individual diets. Dietary recommendations and research should include processes of emergence and endurance of such diets, and how the importance of a social dimension needs to be included. Thirdly, identities are not stable, they vary depending on the social context and are influenced by the intersectionality of other identities. These elements, variability and intersectionality, need to be further explored to advance not only theorizing around shared identities but also in terms of fighting prejudice, climate crisis, inequalities. Finally, throughout our systematic mapping review, as well as our own theorization (and recent literature e.g., Judge et al., 2022) there is still an elephant present in the room. The

importance of understanding veganism in a social and political perspective is clear, as well as the relation to a minoritised, politicized, opinion-based identity. However, what still is not clear, and needs to be addressed further, is whether vegan identity is the framework for a shared identity or part of the identity content in related social identities (e.g., climate change activist identity). Only by including these elements can theories, structures, and policies become inclusive and general beyond the individualized core to facilitate for the much needed social and behavioral changes addressed by the International Panel of Climate Change 2022.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

Both authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

REFERENCES

Amiot, C. E., and Bastian, B. (2015). Toward a psychology of human–animal relations. *Psychol. Bull.* 141, 6–47. doi: 10.1037/a0038147

Amiot, C. E., and Bastian, B. (2017). Solidarity with animals: assessing a relevant dimension of social identification with animals. *PLoS One* 12, e0168184. doi: 10.1371/journal.pone.0168184

Attride-Stirling, J. (2001). Thematic networks: an analytical tool for qualitative research. *Qual. Res.* 1, 385–405. doi: 10.1177/146879410100100307

Ayanian, A. H., Tausch, N., Acar, Y. G., Chayinska, M., Cheung, W.-Y., and Lukyanova, Y. (2021). Resistance in repressive contexts: a comprehensive test of psychological predictors. *J. Pers. Soc. Psychol.* 120, 912–939. doi: 10.1037/pspi0000285

Bagci, S., and Olgun, S. (2019). A social identity needs perspective to veg*nism: associations between perceived discrimination and well-being among Veg*ns in Turkey. *Appetite* 143, 104441. doi: 10.1016/j.appet.2019.104441

Becker, J. C., Radke, H. R. M., and Kutlaca, M. (2019). Stopping wolves in the wild and legitimizing meat consumption: effects of right-wing authoritarianism and social dominance on animal-related behaviors. *Group Process. Intergr. Relat.* 22, 804–817. doi: 10.1177/1368430218824409

Bliuc, A., McGarty, C., Reynolds, K., and Muntele, D. (2007). Opinion-based group membership as a predictor of commitment to political action. *Eur. J. Soc. Psychol.* 37, 19–32. doi: 10.1002/ejsp.334

Bresnahan, M., Zhuang, J., and Zhu, X. (2016). Why is the vegan line in the dining hall always the shortest? Understanding vegan stigma. *Stigma Health,* 1, 3–15. doi: 10.1037/sah0000011

Butterfield, M. E., Hill, S. E., and Lord, C. G. (2012). Mangy mutt or furry friend? Anthropomorphism promotes animal welfare. *J. Exp. Soc. Psychol.* 48, 957–960. doi: 10.1016/j.jesp.2012.02.010

Buttny, R., and Kinefuchi, E. (2020). Vegans' problem stories: negotiating vegan identity in dealing with omnivores. *Discourse Soc.* 31, 565–583. doi: 10.1177/0957926520939689

Caviola, L., Everett, J., and Faber, N. S. (2019). The moral standing of animals: towards a psychology of speciesism. *J. Pers. Soc. Psychol.* 116, 1011–1029. doi: 10.1037/pspp0000182

Cherry, E. (2006). Veganism as a cultural movement: a relational approach. *Soc. Mov. Stud.* 5, 155–170. doi: 10.1080/14742830600807543

Cherry, E. (2015). I was a teenage vegan: motivation and maintenance of lifestyle movements. *Sociol. Inq.* 85, 55–74. doi: 10.1111/soin.12061

Cole, M., and Morgan, K. (2011). Vegaphobia: derogatory discourses of veganism and the reproduction of speciesism in UK national newspapers. *Br. J. Sociol.* 62, 134–153. doi: 10.1111/j.1468-4446.2010.01348.x

Cramer, H., Kessler, C. S., Sundberg, T., Leach, M. J., Schumann, D., Adams, J., et al. (2017). Characteristics of Americans choosing vegetarian and vegan diets for health reasons. *J. Nutr. Educ. Behav.* 49, 561–567.e1. doi: 10.1016/j.jneb.2017.04.011

Cruwys, T., Norwood, R., Chachay, V. S., Ntontis, E., and Sheffield, J. (2020). "An important part of who I am": the predictors of dietary adherence among weight-loss, vegetarian, vegan, paleo, and gluten-free dietary groups. *Nutrients* 12, 970. doi: 10.3390/nu12040970

Davis, J. L., Love, T. P., and Fares, P. (2019). Collective social identity: synthesizing identity theory and social identity theory using digital data. *Soc. Psychol. Q.* 82, 254–273. doi: 10.1177/0190272519851025

Dhont, K., and Hodson, G. (2014). Why do right-wing adherents engage in more animal exploitation and meat consumption? *Pers. Individ. Dif.* 64, 12–17. doi: 10.1016/j.paid.2014.02.002

Dhont, K., Hodson, G., Costello, K., and MacInnis, C. C. (2014). Social dominance orientation connects prejudicial human–human and human–animal relations. *Pers. Individ. Dif.* 61–62, 105–108. doi: 10.1016/j.paid.2013.12.020

Dhont, K., Hodson, G., and Leite, A. C. (2016). Common ideological roots of speciesism and generalized ethnic prejudice: the social dominance human-animal relations model (SD-HARM). *Eur. J. Pers.* 30, 507–522. doi: 10.1002/per.2069

Drury, J., and Reicher, S. (2000). Collective action and psychological change: the emergence of new social identities. *Br. J. Soc. Psychol.* 39, 579–604. doi: 10.1348/014466600164642

Drury, J., Reicher, S., and Stott, C. (2012). "The psychology of collective action: crowds and change," in *Culture and Social Change: Transforming Society Through Power of Ideas,* eds B. Wagoner, E. Jensen, and J. Oldmeadow (Charlotte, NC: Information Age Publishing), 19–38.

Earle, M., Hodson, G., Dhont, K., and MacInnis, C. (2019). Eating with our eyes (closed): effects of visually associating animals with meat on antivegan/vegetarian attitudes and meat consumption willingness. *Group Process Intergr. Relat.* 22, 818–835. doi: 10.1177/1368430219861848

Everett, J. A. C., Caviola, L., Savulescu, J., and Faber, N. S. (2019). Speciesisim, generalized prejudice, and perceptions of prejudiced others. *Group Process Intergr. Relat.* 22, 785–803. doi: 10.1177/1368430218816962

Forgrieve, J. (2018). The growing acceptance of veganism. *Forbes.* Available online at: https://www.forbes.com/sites/janetforgrieve/2018/11/02/picturing-a-kindler-gentler-world-vegan-month/?sh=5255983a2f2b (accessed July 22, 2021).

Gerber, M. M., González, R., Carvacho, H., Jiménez-Moya, G., Moya, C., and Jackson, J. (2018). On the justification of intergroup violence: the roles of procedural justice, police legitimacy, and group identity in attitudes toward violence among indigenous people. *Psychol. Violence* 8, 379–389. doi: 10.1037/vio0000177

Graça, J., Calheiros, M. M., and Oliveira, A. (2016). Situating moral disengagement: motivated reasoning in meat consumption and substitution. *Pers. Individ. Dif.* 90, 353–364. doi: 10.1016/j.paid.2015.11.042

Greenebaum, J. (2012). Veganism, identity and the quest for autheticity. *Food Cult Soc.* 15. doi: 10.2752/175174412X13190510222101

Haslam, N., and Loughnan, S. (2014). Dehumanization and Infrahumanization. *Annu. Rev. Psychol.* 65, 399–423. doi: 10.1146/annurev-psych-010213-115045

Hodson, G., and Earle, M. (2018). Conservatism predicts lapses from vegetarian/vegan diets to meat consumption (through lower social justice concerns and social support). *Appetite* 120, 75–81. doi: 10.1016/j.appet.2017.08.027

Hoffarth, M. R., Azevedo, F., and Jost, J. T. (2019). Political conservatism and the exploitation of nonhuman animals: an application of system

justification theory. *Group Process. Intergr. Relat.* 22, 858–878. doi: 10.1177/1368430219843183

Hudepohl, D. (2021). Why going vegan is one of the best things you can do for the environment. *Forks Over Knives.* Available online at: https://www.forksoverknives.com/wellness/vegan-diet-helps-environmental-sustainability/ (accessed August 04, 2021).

Janssen, M., Busch, C., Rödiger, M., and Hamm, U. (2016). Motives of consumers following a vegan diet and their attitudes towards animal agriculture. *Appetite* 105, 643–651. doi: 10.1016/j.appet.2016.06.039

Jones, L. (2020). *Veganism: why are vegan diets on the rise? BBC News*. Available online at: https://www.bbc.com/news/business-44488051 (accessed August 04, 2021).

Judge, M., Fernando, J., and Begeny, C. (2022). Dietary behaviour as a form of collective action: a social identity model of vegan activism. *Appetite* 168, 105730. doi: 10.1016/j.appet.2021.105730

Judge, M., and Wilson, M. S. (2019). A dual-process motivational model of attitudes towards vegetarians and vegans. *Eur. J. Soc. Psychol.* 49, 169–178. doi: 10.1002/ejsp.2386

Kalte, D. (2021). Political veganism: an empirical analysis of vegans' motives, aims, and political engagement. *Polit. Stud*. doi: 10.1177/0032321720930179

Kennedy, E. (2011). Rethinking ecological citizenship: the role of neighbourhood networks in cultural change. *Env. Polit.* 20, 843–860. doi: 10.1080/09644016.2011.617169

Klein, O., Spears, R., and Reicher, s. (2007). Social identity performance: extending the strategic side of SIDE. *Pers. Soc. Psychol. Rev.* 11, 1–18. doi: 10.1177/1088868306294588

Kurz, T., Prosser, A., Rabinovich, A., and O'Neill, S. (2020). Could vegans and lycra cyclists be bad for the planet? Theorizing the role of moralized minority practice identities in processes of societal-level change. *J. Soc. Issues* 76, 86–100. doi: 10.1111/josi.12366

Leach, S., Sutton, R. M., Dhont, K., and Douglas, K. M. (2020). When is it wrong to eat animals? The relevance of different animal traits and behaviors. *Eur. J. Soc. Psychol.* 51, 113–123. doi: 10.1002/ejsp.2718

Leite, A. C., Dhont, K., and Hodson, G. (2019). Longitudinal effects of human supremacy beliefs and vegetarianism threat on moral exclusion (vs. inclusion) of animals. *Eur. J. Soc. Psychol.* 49, 179–189. doi: 10.1002/ejsp.2497

Liberati, A., Altman, D., Tetzlaff, J., Mulrow, C., Gotzche, P. C., Ioannidis, J. P. A., et al. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: explanation and elaboration. *BMJ* 339, b2700. doi: 10.1136/bmj.b2700

MacInnis, C., and Hodson, G. (2017). It ain't easy eating greens: evidence of bias toward vegetarians and vegans from both source and target. *Group Process. Intergr. Relat.* 20, 721–744. doi: 10.1177/1368430215618253

MacInnis, C., and Hodson, G. (2021). Tensions within and between vegans and vegetarians: meat-free motivations matter. *Appetite* 164, 105246. doi: 10.1016/j.appet.2021.105246

Markowski, K. L., and Roxburgh, S. (2019). "If I became a vegan, my family and friends would hate me:" Anticipating vegan stigma as a barrier to plant-based diets. *Appetite* 135, 1–9. doi: 10.1016/j.appet.2018.12.040

Mintel (2019). *#Veganunary: UK overtakes Germany as world's leader for vegan food launches.* Available online at: https://www.mintel.com/press-centre/food-and-drink/veganuary-uk-overtakes-germany-as-worlds-leader-for-vegan-food-launches (accessed August 04, 2021).

Molloy, A. (2014). One in ten Swedes is vegetarian or vegan, according to study. *Independent*. Available online at: https://www.independent.co.uk/news/world/europe/one-ten-swedes-vegetarian-or-vegan-according-study-9212176.html (accessed August 04, 2021).

Moore, W. J., McGrievy, M. E., and Turner-McGrievy, G. M. (2015). Dietary adherence and acceptability of five different diets, including vegan and vegetarian diets, for weight loss: The New DIETs study. *Eat. Behav.* 19, 33–38. doi: 10.1016/j.eatbeh.2015.06.011

North, M., Kothe, E., Klas, A., and Ling, M. (2021). How to define "Vegan": an explanatory study of definition preferences among omnivores, vegetarians, and vegans. *Food Qual. Prefer.* 93, 104246. doi: 10.1016/j.foodqual.2021.104246

Nourish. (2020). *Vote with your fork*. Available online at: https://www.nourishlife.org/2011/03/vote-with-your-fork/ (accessed September 12, 2021).

Pedersen, H., and Staescu, V. (2014). "Conclusion: future directions for critical animal studies," in *The Rise of Critical Animal Studies: From the Margins to Centre*, eds N. Taylor and R. Twine (New York: Routledge). 262–276

Peta (2015). 16 facts that show how going vegan helps stop climate change (accessed November 2, 2021).

Potts, A., and Parry, J. (2010). Vegan sexuality: challenging heteronormative masculinity through meat-free sex. *Fem. Psychol.* 20, 53–72. doi: 10.1177/0959353509351181

Radnitz, C., Beezhold, B., and DiMatteo, J. (2015). Investigation of lifestyle choices of individuals following a vegan diet for health and ethical reasons. *Appetite* 90, 31–36. doi: 10.1016/j.appet.2015.02.026

Rasmussen, E. K. (2017). *Vegan Movement is Just Getting Started in Turkey*. Hurriyet Daily News. Available online at: https://www.hurriyetdailynews.com/vegan-movement-is-just-getting-started-in-turkey-110700 (accessed August 05, 2021).

Regan, P., and Henderson, E. (2002). Democracy, threats and political repression in developing countries: are democracy internally less violent? *Third World Q.* 23, 119–136. doi: 10.1080/01436590220108207

Rosenfeld, D. L. (2019). Why some choose the vegetarian option: are all ethical motivations the same? *Motiv. Emot.* 43, 403–411. doi: 10.1007/s11031-018-9747-6

Rothgerber, H. (2014). Evaluation of ingroup disloyalty within a multi-group context. *Soc. Psychol.* 45, 382–390. doi: 10.1027/1864-9335/a000196

Saavedra, P., and Drury, J. (2019). Including political context in the psychological analysis of collective action: development and validation of a measurement scale for subjective political openness. *J. Soc. Polit. Psychol.* 7, 665–694. doi: 10.5964/jspp.v7i2.1030

Schwartz, R. H. (2020). *Vegan Revolution: Saving our World, Revitalizing Judaism*. London: Lantern Publishing and Media.

Statista. (2020a). *Are you Vegetarian or Vegan*? Available online at: https://www.statista.com/statistics/684820/survey-on-vegetarianism-and-veganism-in-sweden/ (accessed August 05, 2021).

Statista. (2020b). *Numbers of Vegans in Great Britain From 2014 to 2018*. Available online at: https://www.statista.com/statistics/1062104/number-of-vegans-in-great-britain/ (accessed August 05, 2021).

Stuart, A., Thomas, E., Donaghue, N., and Russell, A. (2013). 'We may be pirates, but we are not protesters': identity in the Sea Shepherd Conservation Society. *Polit. Psychol.* 34, 753–777. doi: 10.1111/pops.12016

Tajfel, H., and Turner, J. C. (1979). An integrative theory of intergroup conflict. In *The Social Psychology of Intergroup Relations*. W. G. Austin and S. Worchel, editors. (Monterey, CA: Brooks, Cole Pub), p. 33–47.

Thomas, E., and McGarty, C. (2009). The role of efficacy and moral outrage norms in creating the potential for international development activism through group-based interaction. *Br. J. Soc. Psychol.* 48, 115–134. doi: 10.1348/014466608X313774

Thomas, E. F., Bury, S. M., Louis, W. R., Amiot, C. E., Molenberghs, P., Crane, M. F., et al. (2019). Vegetarian, vegan, activist, radical: using latent profile analysis to examine different forms of support for animal welfare. *Group Process. Intergr. Relat.* 22, 836–857. doi: 10.1177/1368430218824407

Thomas, E. F., Mavor, K. I., and McGarty, C. (2012). Social identities can facilitate and encapsulate action relevant constructs. *Group Process. Intergr. Relat.* 15, 75–88. doi: 10.1177/1368430211413619

Turner, J. C., Hogg, M. A., Oakes, P. J., Reicher, S. D., and Wetherell, M. S. (1987). Rediscovering the social group: A self-categorization theory. Oxford/New York: Blackwell.

van Stekelenburg, J., and Klandermans, B. (2018). In politics we trust…or not? Trusting and distrusting demonstrators compared. *Polit. Psychol.* 39, 775–792. doi: 10.1111/pops.12464

Vestergren, S., Drury, J., and Chiriac, E. H. (2018). How collective action produces psychological change and how that change endures over time: a case study of an environmental campaign. *Br. J. Soc. Psychol.* 57, 855–877. doi: 10.1111/bjso.12270

Vestergren, S., Drury, J., and Chiriac, E. H. (2019). How participation in collective action changes relationships, behaviors, and beliefs: an interview study of the role of inter- and intragroup process. *J. Soc. Polit. Psychol.* 7, 76–99. doi: 10.5964/jspp.v7i1.903

Vignoles, V. L., Regalia, C., Manzi, C., Golledge, J., and Scabini, E. (2006). Beyond self-esteem: influence of multiple motives on identity construction. *J. Pers. Soc. Psychol.* 90, 308–333. doi: 10.1037/0022-3514.90.2.308

Vignoles, V. L., Schwartz, S. J., and Luyckx, K. (2011). "Introduction: toward an integrative view of identity," in *Handbook of Identity Theory and Research,* eds S. J. Schwartz, K. Luyckx, and V. L. Vignoles (Springer), 1–27. doi: 10.1007/978-1-4419-7988-9_1

Wright, L. (2015). *The Vegan Studies Project: Food, Animals, and Gender in the Age of Terror*. University of Georgia Press.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's Note: All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

frontiers | Frontiers in Psychology

BRIEF RESEARCH REPORT
published: 19 July 2022
doi: 10.3389/fpsyg.2022.807958

I Like the Food You Made! Overly Positive Feedback Is Most Likely Given to Those That Want to Excel in a Task and Handle Failure Badly

Katarzyna Cantarero, Katarzyna Byrka, Aleksandra Kosiarczyk and Dariusz Dolinski*

Faculty of Psychology in Wroclaw, Social Behavior Research Center, SWPS University, Wroclaw, Poland

In this article, we focus on how people resolve the dilemma between honest feedback and a prosocial lie depending on the context. In a pre-registered study ($N = 455$), we asked participants to choose between telling the blatant truth or lying prosocially regarding a dish made poorly by a stranger. The results showed that participants were most eager to pass on overly positive feedback when the stranger cared about cooking and was very sensitive to negative feedback. Perceived harm in truth telling mediated the relationship between desire to excel in a task with high ability to handle failure and choosing a prosocial lie.

Keywords: honesty, care, prosocial lying, other-oriented dishonesty, white lies, feedback

OPEN ACCESS

Edited by:
Karsten Specht,
University of Bergen, Norway

Reviewed by:
Eitan Elaad,
Ariel University, Israel
Sarah Zanette,
University of Regina, Canada

****Correspondence:***
Katarzyna Cantarero
kcantarero@swps.edu.pl

Specialty section:
This article was submitted to Personality and Social Psychology, a section of the journal Frontiers in Psychology

Received: *02 November 2021*
Accepted: *13 June 2022*
Published: *19 July 2022*

Citation:
Cantarero K, Byrka K, Kosiarczyk A and Dolinski D (2022) I Like the Food You Made! Overly Positive Feedback Is Most Likely Given to Those That Want to Excel in a Task and Handle Failure Badly. Front. Psychol. 13:807958. doi: 10.3389/fpsyg.2022.807958

INTRODUCTION

> "A white lie is excusable. You cannot forgive someone who speaks the truth when nobody needs that truth."—Karl Kraus.

When do people choose to tell the truth and when do they prefer to lie[1] to others? Truth is one of the foundations of many moral systems. The rule to tell the truth can be found in the Bible, Koran, or lay proverbs coming from different cultural backgrounds. Consequently, in many life circumstances, opting for the truth is the default option. For example, imagine that someone asks for your opinion regarding a dish they made. You think that the dish is far from appetizing or esthetically appealing. Imagine then that you know that the cook wants to master the art of cooking and knows how to handle any feedback very well. Giving them your honest opinion for some may seem the most natural thing to do. But what if the person cares about cooking, but you know that they have difficulties in dealing with negative feedback? Would one prefer to tell them the truth? At times a prosocial lie might be the 'lesser of two evils' and be preferred by people faced with the dilemma of whether to be honest or use a prosocial lie.

In this article, we focus on how people resolve the dilemma between giving honest feedback and lying prosocially. In the current research, we explored the context of giving feedback regarding a failed dish and tested if participants are less eager to tell the truth depending on

[1]In this article we use the terms: lying, deception and dishonesty interchangeably and define prosocial lies as lies that are primarily aimed at benefitting another person.

whether the recipient wants to excel in a task and how they handle failures. Additionally, we tested the perception of the truth and prosocial lies regarding their deceitfulness, to verify if such polite lies are indeed perceived as lies. The article offers new insights regarding conditions under which people decide to employ a lie rather than honest feedback, which enriches understanding of prosocial deception.

Characteristic of Prosocial Deception

According to the Truth-Default Theory (TDT), individuals tend to tell the truth by default and think that others do so as well (Levine, 2014). TDT stresses that context determines boundary conditions under which some may decide to deviate from the truth. Levine (2014) argues that trigger events push people to not turn to honest communication. One such triggering event may be when honest feedback can be harmful to the target of the information. Such instances should favor telling a prosocial lie.

While egoistic lies are intended to benefit only the liar, prosocial lies (also referred to as other-oriented lies, and those prosocial lies that are of a lower stake as white lies) are aimed at primarily benefiting another person (DePaulo et al., 1996). In general, prosocial lies are perceived in a different manner to egoistic lies. For example, cross-cultural research shows that such lies are found to be more acceptable that egoistic lies (e.g., Cantarero et al., 2018). What is more, children of ages 9–11 (Cheung et al., 2015) and adults (Cantarero and Szarota, 2017) perceive prosocial lies as lies to a lesser extent. For example, when one person lies that they cannot stay at work to do extra hours, such a lie is perceived as a lie to a higher extent when it is told to please personal interests (e.g., one does not feel like working), than when it is told for the benefit of others (e.g., one knows that a co-worker really needs extra money; Cantarero and Szarota, 2017). Additionally, Levine (2021) showed that lying is perceived as ethical when it prevents unnecessary harm. She suggests that the extent to which truth yields a significant change related to learning or growth is important in deciding whether deviating from the truth is ethical. We hypothesize that when making actual decisions about whether to give honest feedback, or tell a prosocial lie, people also turn to the value of the communication.

When Is Honest Feedback Desirable?

Brown and Dutton (1995, p. 1293) argued that "people do not always need to know the truth about themselves' regarding their own self-views." They reasoned that positive self-views (if not exaggerated) might be beneficial for individuals (see also Taylor and Brown, 1988). One reason for this is that, by doing so, individuals do not get discouraged from what they are doing, or simply feel good about themselves. Additionally, if a person is engaging in a behavior without the goal of maximizing their ability in that behavior, then getting accurate feedback might not be what the person wants (or needs). How do people decide whether to communicate honest feedback or tell a prosocial lie? Lupoli et al. (2017) showed that compassion is one of the factors that drives people to overinflate feedback passed to a recipient. In their study, when participants learned that a person, to whom they were about to pass feedback about a badly written essay, has recently gone through a difficult time, they were more likely to overinflate their evaluation of the essay. Drawing on the works by Levine (2021), we hypothesize that when faced with an actual dilemma about whether to tell the truth or a prosocial lie, individuals take into consideration both whether the information can cause any harm and if it is useful. Accordingly, a prosocial lie is preferred when the target has difficulties in dealing with the blatant truth. Honest feedback is chosen when improvement is being sought by the target of the information. We also hypothesize that individuals are more likely to provide a positive but false evaluation (i.e., a prosocial lie) when the target does not want to improve in an activity or area (to spare him from the blatant truth that the target would probably not use). Importantly, we predict that individuals do not necessarily make unequivocal and objectively beneficial choices for another person. For example, giving accurate feedback is in general beneficial (Ilgen et al., 1979; Sapyta et al., 2005), as it improves the performance of individuals (Mauger et al., 2011; Kingsley Westerman et al., 2018). We hypothesize that people will choose what they *think* is preferable for another person at that time.

In the study by Lupoli et al. (2017), the authors did not test interaction effects between compassion and whether honest feedback is needed by the recipient (e.g., if the target wants to write good essays or not). Additionally, their study did not examine if people were consciously aware of the fact that they were deviating from the truth. In this article, we paid attention to examining if telling a prosocial lie is indeed perceived as a lie by others. This is due to the premise that deviating from the truth for the benefit of another person could be perceived in fact as a mistake, a social norm or a form of self-deception (and thus no longer a lie). In our study, we additionally addressed this question and controlled whether participants perceived the communication that they decided to pass on as a lie (i.e., we tested perceived deceitfulness of the feedback).

To sum up, we focus on how individuals resolve the dilemma of whether to give honest feedback, or to lie prosocially. We expect main effects of willingness to excel in a task and the ability to deal with negative feedback by the target of the feedback. Specifically, we hypothesize that individuals exert a higher preference toward lying when the target does not want to excel in a task than when they want to get better at it. We expect that the preference toward lying is more likely when the target does not handle failure well than when they do. We hypothesize an interaction in that individuals prefer telling prosocial lies the most when the target of feedback does not handle failure well and does not want to excel in a task. We expect that the second context with most frequent preference toward prosocial lying is when the target does not handle failure well and wants to excel in a task. Additionally, we hypothesize that the third context with most frequent prosocial lies is when the target knows how to handle failure and does not want to excel in a task. We expect most frequent honest feedback when the target knows how to handle failure and wants to excel in a task.

Similar to Levine (2021), we think that preference toward prosocial lies is grounded in the desire to protect individuals

from harm. We hypothesize that perceived harm in telling the truth mediates the relationship between willingness to excel in a task, ability to deal with failure, and preference toward prosocial lies. Namely, we expect the effect of the experimental manipulation on preference toward prosocial lies to be mirrored in perceived harm of telling the truth. We expect a positive relationship between perceived harm in truth telling and preference toward prosocial lies. Additionally, we tested if prosocial lies are indeed perceived as lies (and not equated to truthful statements), as one could argue that given that politeness is social norm compliance, prosocial lies may no longer be perceived as deception.

MATERIALS AND METHODS

The study was pre-registered at aspredicted.org (the anonymized pre-registration is available at https://aspredicted.org/1K2_FY1). All measures, manipulations, and exclusions in the study are disclosed.

Participants

The sample's size was determined before conducting the study and before any data analysis. Sample size estimate was calculated using G*Power for χ^2, assuming power $(1-\beta)=0.95$, probability level $\alpha=0.05$, and effect size of $\omega=0.17$. We aimed to reach 450 participants. Four hundred and fifty-five participants residing in the United States took part in this online study *via* Prolific. We invited to participate in the study those who had at least a 95% acceptance rate in previous studies. Three hundred and seventeen women and 127 men (eight participants did not state their gender) participated in the study in exchange for 0.75£.[2] Ages ranged from 19 to 70 ($M_{age}=33.77$, $SD_{age}=12.73$). No data was excluded.

Procedure and Materials

First, participants read that the study focused on feelings and opinions that people have toward daily activities (e.g., cooking). Then, they responded to 17 buffer questions regarding cooking and food (e.g., "*I eat at least four meals a day*"). After completing the questionnaire, participants read the instruction that they would be asked to evaluate a dish. Participants were randomly assigned to one of four conditions in a between-subjects design (high vs. low desire to excel in task; high vs. low ability to handle failures). Participants first read: *You will now be asked to give your opinion on a dish that was prepared by another person. You will be able to see what the person wanted to prepare and what the person prepared in the end. This person spent a lot of time preparing the dish.*

Next, participants read one of four descriptions of the person:

1. They do not really like cooking and do not want to get better at it. They do not really handle failure well, which makes the person feel really down.
2. They do not really like cooking and do not want to get better at it. They know how to handle failure really well, which makes the person feel a lot stronger.
3. They care very much about cooking and wish to get better at it. They do not really handle failure well, which makes the person feel really down.
4. They care very much about cooking and wish to get better at it. They know how to handle failure really well, which makes the person feel a lot stronger.

Participants were then presented with information that was meant to strengthen the ecological validity of the set up:

You can address your opinion directly to that person, who will be able to see your answer. We will send your answer to that person and the information might be published on social media.

Then, participants saw a picture of a professional dish that the described person supposedly planned to cook followed by a picture of an unattractive dish that the person actually prepared (a cooking fail). We used visual examples of dishes that did not turn as planned and manipulated the extent to which cooking was important to the author of the dish. In Study S1 in the **Supplementary Materials**, we showed that the cooking fails used in this study were indeed perceived as much worse than the original version of a dish.

Next, participants were asked to choose what they would like to say to the person who prepared the dish: "*The dish looks nice*' or '*The dish does not look nice.*" Each participant received only one out of eight randomly assigned sets of a professional dish and a cooking fail.

Relying on a within-subject design, participants were asked to evaluate the extent to which both types of feedback were useful, good, the truth, and harmful to the person on a 7-point scale (1 = *strongly disagree,* to 7 = *strongly agree*). Participants also evaluated if they considered both of the possible feedbacks a lie using a 1 = *strongly disagree,* to 7 = *strongly agree* scale.

Additionally, participants evaluated whether the dish that the person had prepared resembled the one that the person wanted to prepare, whether the person who had prepared the dish cared much about cooking, whether they felt sympathy toward the person that prepared the dish, and whether they had previously seen the picture of the dish. Responses were collected using a 1 = *definitely not*, to 5 = *definitely yes* scale. We also asked how participants thought that the person would react after having heard the feedback coming from them using a 1 = *The person will feel very bad*, to 5 = *The person will feel very good* scale.

At the end of the study, we gathered demographic data and debriefed participants.[3]

[2]The study lasted on average less than 6 min, mode was 3 min.

[3]We also asked an attention check question. One person did not answer it correctly. Fourteen participants did not respond to this question. As pre-registered, we checked if the results differed when excluding those that failed to reply to the attention check question. The results remained consistent regardless of whether these 15 participants were excluded. The main effect of dealing with feedback was significant, χ^2 (1, $N=440$) = 12.92, $p<0.001$, and $\omega=0.17$ as well as the interaction with the desire to excel in cooking, χ^2 (3, $N=440$) = 15.32, $p<0.001$, and $\omega=0.19$.

Results

In general, participants preferred telling the truth (54%) to prosocial lying (46%), χ^2 (1, N=455)=3.01, p=0.083, and ω=0.08, yet this difference did not reach the conventional $p<0.05$.[4] The results showed that manipulating whether the described person can handle feedback affected the preference of a lie over truth, χ^2 (1, N=455)=12.72, $p<0.001$, and ω=0.17. When the person could handle failure well, individuals preferred to tell them the blatant truth (62%) over prosocial lying (38%). The reverse was true when they were bad at handling failures with participants showing a preference for lying more frequently (55%), than toward telling the truth (45%). There was no main effect of whether the described person wanted to excel in cooking or not, χ^2 (1, N=455)=0.19, p=0.662, and ω=0.02. When the person wanted to excel, the truth was preferred more (53%) to lying (47%), similar to when the person did not want to excel, with 55% preferring the blatant truth, as compared to 45% of preference toward lying.

Most interestingly, there was a significant interaction between the variables, χ^2 (3, N=455)=14.76, p=0.002, and ω=0.18. When the cook could handle failure well, individuals preferred telling them the blatant truth both when they wanted to excel in cooking (64% vs. 36% preferred prosocial lying) and when they did not want to excel in cooking (60% vs. 40% preferred prosocial lying). The proportion of preference toward prosocial lying between the latter two conditions did not differ from each other. When the cook could not handle failure well and was not interested in excelling in cooking, individuals preferred telling the blatant truth less than in the previous two cases, yet there was no difference in frequency of choices between lying (50%) and telling the truth (50%). The highest preference toward prosocial lying (59%) compared to telling the blatant truth (41%) was observed in the condition where the cook did not know how to handle failure well but wanted to excel in cooking (**Figure 1**).

Next, we conducted a mediation analysis using Model 4 Hayes PROCESS Macro (Hayes, 2013) with a bias-corrected bootstrapping procedure (10,000 samples). The experimental manipulation was introduced as a multicategorical IV, perceived harm in telling the truth was the mediator, and preference toward prosocial lying was the DV in the model. We used indicator coding with high desire to excel and high ability to handle failure as reference group.[5] The only significant relative direct effect on the preference of lying was in the condition of desire to excel in the task when dealing with failure badly compared to the remaining conditions, $b_{\text{path } c'3}$ = 0.72, p=0.020, 95% CI [0.12, 1.32].[6] This condition was related to higher preference toward prosocial lying. The same condition, as compared to others, was related to higher perception of harmfulness of truth telling, $b_{\text{path } a3}$ = 0.63, p=0.004, 95% CI [0.20, 1.06]. The other conditions did not relate to perceived

[4]This general analysis was not pre-registered. In the Supplementary Materials, we present the results of the manipulation check. Participants correctly recognized whether the described person wanted to excel in a task or not, but we were not successful in creating a situation that differed in perception of usefulness of the information.

[5]We used this condition as the reference group as we hypothesized and found that this group could be treated as baseline as it was related to the highest rate of honest feedback.

[6]Detailed results are presented in **Supplementary Table S2** in **Supplementary Materials**.

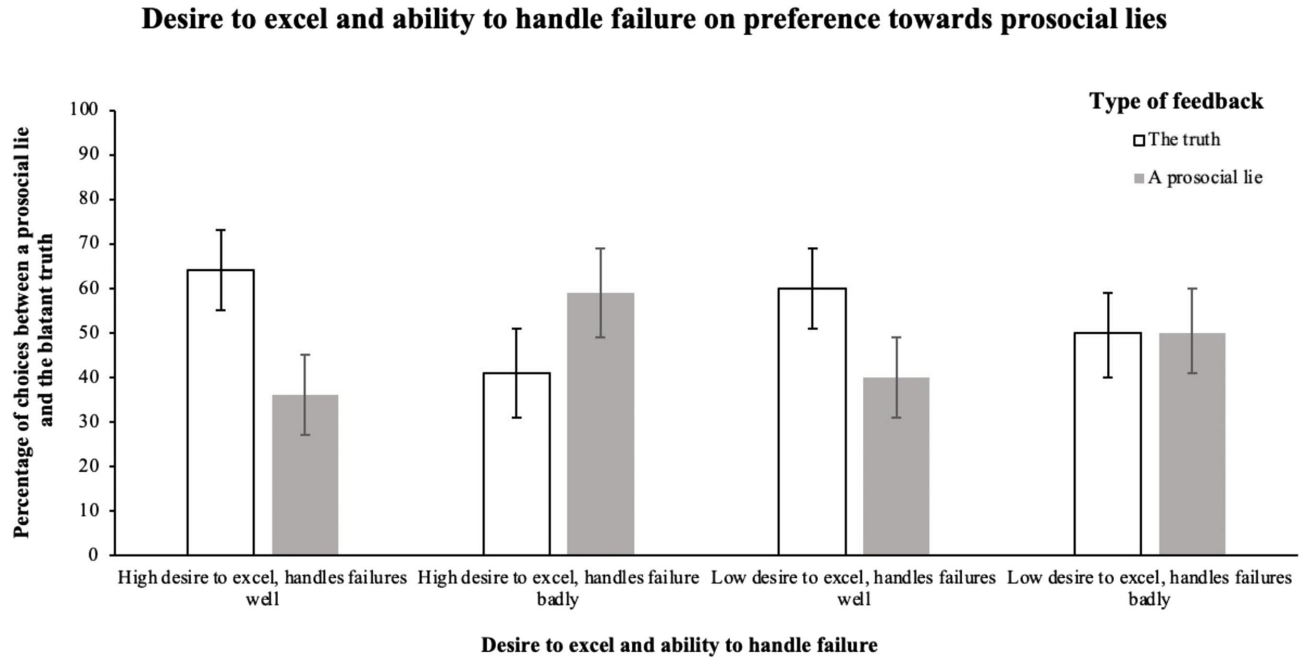


FIGURE 1 | The effect of the desire to excel in a task and ability to handle failure on preference toward overly positive feedback. Figure shows percentage of the preference toward prosocial lies within each condition. Error bars represent 95% confidence intervals.

harmfulness of truth telling in a significant way. When both the experimental manipulation and perceived harm in truth telling were entered into the equation, perceived harm in truth telling significantly predicted positively choosing a lie over the truth, $b_{\text{path } b} = 0.62$, $p < 0.001$, and 95% CI [0.47, 0.76]. The relative indirect effect was statistically significant only in this condition, $b_{\text{path } a3b} = 0.39$, bootSE = 0.14, and bootCI [0.13, 0.70] (**Figure 2**).

We compared perceived deceitfulness (where 1 = *definitely not a lie* and 7 = *definitely a lie*) of the two types of feedback that could be communicated using paired t-tests. This way we could examine if overly positive feedback and the blatant truth differ in being perceived as a lie. Higher scores of overly positive feedback would suggest that it is treated more as a lie, than the blatant truth. The results showed that telling the person that what they prepared looks nice was perceived as more deceitful ($M = 5.40$, SD = 1.68), than telling them that the dish does not look nice ($M = 2.31$, SD = 1.47), $t(453) = 22.73$, $p < 0.001$, and $d = 1.07$.[7] Similarly, one-sample *t*-test allowed us to test if perception of deceitfulness falls above the mid-point of the scale, with (4) as the tested value, which would additionally suggest that overly positive feedback is perceived as a lie. The results showed that the evaluation of deceitfulness of the overly positive feedback was significantly above the mid-point of the scale ($M = 5.40$, SD = 1.68), $t(452) = 17.71$, $p < 0.001$, and $d = 0.83$, suggesting that it was perceived as a lie.

[7]Similarly, telling the person that what they prepared looks nice was perceived less as the truth ($M = 2.79$, SD = 1.83), than telling them that the dish does not look nice ($M = 5.49$, SD = 1.58), $t(454) = 22.73$, $p < 0.001$, and $d = 1.07$.

DISCUSSION

The findings of this research are in line with the TDT that argues that individuals prefer to tell the truth unless there are triggering events that push individuals' preference toward deception (Levine, 2014). We show that manipulating whether the target of information needs honest feedback and how they can handle it influences the decision of whether to be honest or to lie. When the target did not know how to handle failure, the likelihood of telling them the blatant truth diminished. This result is in line with Lupoli et al. (2017) who showed that compassion influences choosing prosocial lying. We found that among those that want to excel in a task, it is especially those that handle failure well that were more likely to be given honest feedback. We think that it may be due to a general preference to be honest (e.g., Abeler et al., 2019). It seems that the situation with low desire to excel in a task did not present itself as a sufficient trigger to push individuals to deviate from the truth. It is possible that compassion plays a vital role as a trigger of deviating from the truth. Together with the mediating role of harm attributed to telling the truth, the results corroborate the findings pointing to the determining role of consideration of harm for moral judgments and behavior (e.g., Schein and Gray, 2018).

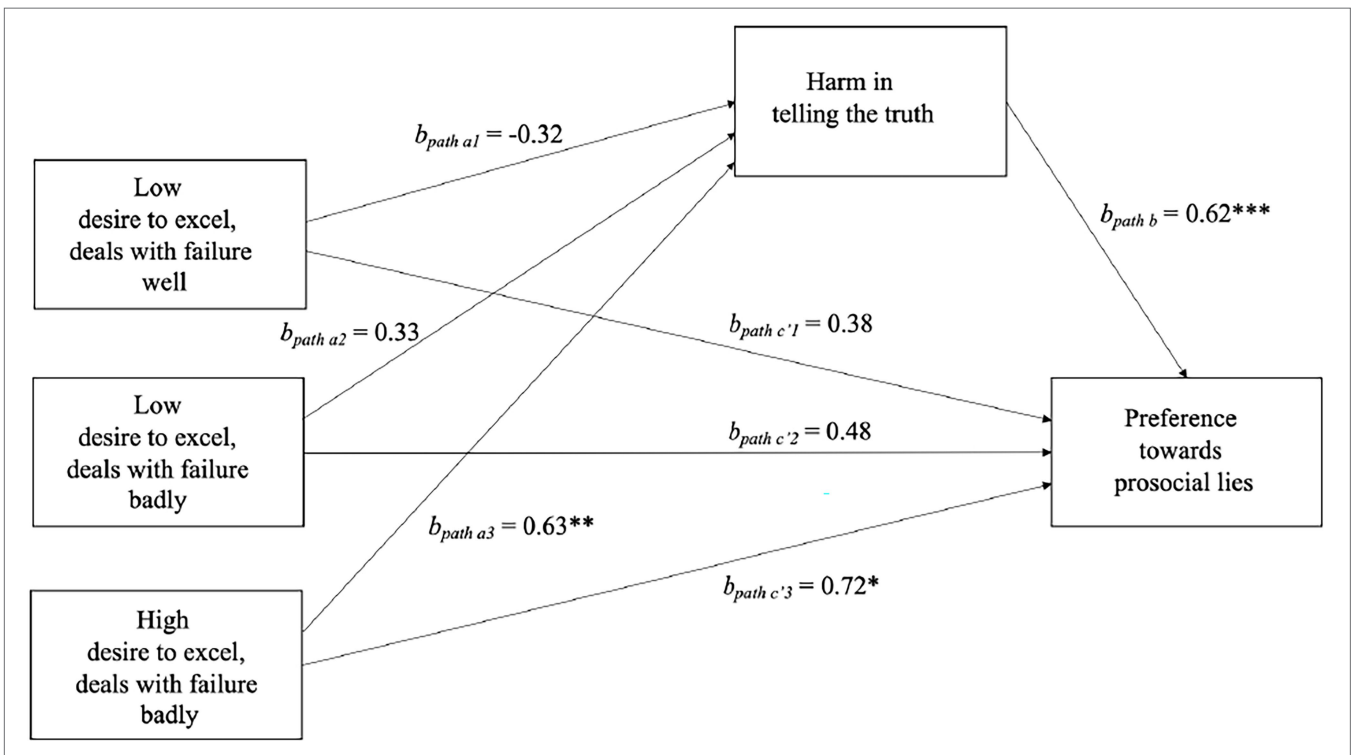


FIGURE 2 | Mediation model testing that harm in telling the truth mediates the effect of desire to excel and ability to deal with feedback on preference toward prosocial lies. In this model, high desire to excel in a task and dealing with feedback well is the reference group, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

We also did not find that it is above all those who do not want to excel in a task and do not handle failure well that most frequently receive overly positive feedback. The relationship between the two factors proved to be more complex than we expected. Lying comes with the price of having to juggle positive self-views as an honest person and possible benefits related to lying (Mazar et al., 2008). Our study showed that only when the target wants to excel in a task and does not know how to handle failure, are people more willing to lie prosocially toward them. This suggests that individuals most likely want to deviate for the benefit of another person when it is really worth it. Although we did not ask participants to provide a more specific reason for their decision, it may be that by passing on overly positive feedback, individuals did not want to discourage the motivated individual from further work toward reaching excellence in the task. This possible explanation could be tested in future studies. Additional analyses showed that the prosocial lie was perceived as more deceptive than telling the blatant truth. This suggests that false and overly positive feedback should not be reduced to social norm compliance and simple acts of politeness.

Limitations and Directions of Future Studies

There are some limitations of the conducted study that should be mentioned. First, we preferred to measure the DV right after the experimental manipulation, to make sure that the result can be attributed to the manipulation and not be inflated by having marked additional measures in between. The variable we chose for the mediation analysis was the one that was most theoretically sound, but it was not measured in chronological order (i.e., first the IV, next the mediator, and finally the DV) and such alignment would be optimal to test causal relationships.

We recognize that limiting sample to Northern American participants enrolled at Prolific is a drawback of the present study. Research shows that there are cultural differences in both attitudes toward lying (e.g., Cantarero et al., 2018) and dishonest behavior (e.g., Cohn et al., 2019). Preference for a prosocial lie vs. telling the truth could vary across cultures and testing such possible differences seems an exciting line of future research. Initial findings by Giles et al. (2019) suggest that members of individualistic cultures may favor more strongly telling blatant truth to prosocial lying. Additionally, we tested preference for overly positive feedback vs. the blatant truth in a virtual context. Cantarero et al. (2017) found that when individuals were asked to give their opinion regarding a picture, they provided more positive feedback to the alleged author of the work in person, than when the opinion was gathered privately in writing. It would be interesting to see if in face-to-face communication, desire to excel and ability to handle failure exerted the same effect on preference toward prosocial lies as in the online setting. Here, we limited our design to giving feedback anonymously to a stranger. Future studies could include the type of relation and whether the information is conveyed anonymously or not, as these factors relate to lying prosocially (e.g., DePaulo and Kashy, 1998; Levine, 2021).

The two options of the dilemma (blatant truth vs. a prosocial lie) do not exhaust the range of possible reactions to situations where one is asked for feedback (e.g., one could try to omit responding, resort to irony, or provide a blurry response that does not answer the question). In this study, however, we wanted to focus only on the dilemma between blatant honesty and a prosocial lie. Future studies may want to explore preferences toward the two options together with the gray zone in between and test how individuals perceive forms of feedback other than telling the blatant truth to a target (e.g., concealment, irony, and half-truths).

Cantarero and Szarota (2017) point out that other-oriented lies are seen as lies to a smaller extent, and Levine and Schweitzer (2014) found that prosocial lying is seen as more ethical than self-centered truth telling. It is worthwhile to expand on the determinants of when a lie is perceived as less of a lie. In our research, we measured whether individuals perceived communication that intentionally misled another person for their benefit as lying and found that these acts were not perceived as equal to truth telling. This indicates that although a prosocial lie is less of a lie, it still remains a lie.

To sum up, our study employed a social decision-making dilemma to show that when deciding to choose between honest feedback and prosocial lying, people most likely opt for prosocial lies when the target wants to excel in a task but has trouble dealing with failure. What is more, the preference for prosocial lying is most likely due to the perception of harm attributed to truth telling. This is the first study that relies on actual behavior and tests the role of target's desire to excel and ability to handle failure on preference toward telling them prosocial lies. Results of this study could be applied to academic or work-related environment in general. If a student, or a worker, who wants to excel in a task, would like to make sure that they receive honest feedback on their work, they should try to convey that they have no trouble in handling failures. Otherwise, their interlocutor may want to spare them from unnecessary harm and overinflate positive feedback.

AUTHOR'S NOTE

Parts of this article can be found in a pre-print version at the https://psyarxiv.com/jm7y4.

DATA AVAILABILITY STATEMENT

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found at: https://osf.io/6rjka/?view_only=8319d26515354a959d552ab20c7efdb2.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Faculty of Psychology in Wroclaw

Committee of Ethics of Scientific Research at SWPS University, number 02/P/11/2018. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

KC, KB, AK, and DD designed the main study and the supplementary study, and contributed to the writing of the manuscript. KC conducted the studies and the analysis. All authors contributed to the article and approved the submitted version.

FUNDING

This work was supported by a research grant awarded by the National Science Center in Poland to KC (2020/39/B/HS6/02196) and by research grants awarded by the Ministry of Science and Education in Poland to KB (BST/Wroc/2018/A/2) and to DD (BST/Wroc/2018/A/3).

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.807958/full#supplementary-material

REFERENCES

Abeler, J., Nosenzo, D., and Raymond, C. (2019). Preferences for truth-telling. *Econometrica* 87, 1115–1153. doi: 10.3982/ECTA14673

Brown, J. D., and Dutton, K. A. (1995). Truth and consequences: the costs and benefits of accurate self-knowledge. *Personal. Soc. Psychol. Bull.* 21, 1288–1296. doi: 10.1177/01461672952112006

Cantarero, K., Parzuchowski, M., and Dukala, K. (2017). White lies in hand: are other-oriented lies modified by hand gestures? Possibly not. *Front. Psychol.* 8:814. doi: 10.3389/fpsyg.2017.00814

Cantarero, K., and Szarota, P. (2017). When is a lie more of a lie? Moral judgment mediates the relationship between perceived benefits of others and lie-labeling. *Pol. Psychol. Bull.* 48, 315–325. doi: 10.1515/ppb-2017-0036

Cantarero, K., Szarota, P., Stamkou, E., Navas, M., and Dominguez Espinosa, A. (2018). When is a lie acceptable? Work and private life lying acceptance depends on its beneficiary. *J. Soc. Psychol.* 158, 220–235. doi: 10.1080/00224545.2017.1327404

Cheung, H., Siu, T. C., and Chen, L. (2015). The roles of liar intention, lie content, and theory of mind in children's evaluation of lies. *J. Exp. Child Psychol.* 132, 1–13. doi: 10.1016/j.jecp.2014.12.002

Cohn, A., Maréchal, M. A., Tannenbaum, D., and Zünd, C. L. (2019). Civic honesty around the globe. *Science* 365, 70–73. doi: 10.1126/science.aau8712

DePaulo, B. M., and Kashy, D. A. (1998). Everyday lies in close and casual relationships. *J. Pers. Soc. Psychol.* 74, 63–79. doi: 10.1037/0022-3514.74.1.63

DePaulo, B. M., Kashy, D. A., Kirkendol, S. E., Wyer, M. M., and Epstein, J. A. (1996). Lying in everyday life. *J. Pers. Soc. Psychol.* 70, 979–995. doi: 10.1037/0022-3514.70.5.979

Giles, R. M., Rothermich, K., and Pell, M. D. (2019). Differences in the evaluation of prosocial lies: a cross-cultural study of Canadian, Chinese, and German adults. *Front. Commun.* 4:38. doi: 10.3389/fcomm.2019.00038

Hayes, A. F. (2013). *Introduction to Mediation, Moderation, and Conditional Process Analysis. A Regression-Based Approach*. New York, NY: Guilford Publications.

Ilgen, D. R., Fisher, C. D., and Taylor, M. S. (1979). Consequences of individual feedback on behavior in organizations. *J. Appl. Psychol.* 64, 349–371. doi: 10.1037/0021-9010.64.4.349

Kingsley Westerman, C. Y., Reno, K. M., and Heuett, K. B. (2018). Delivering feedback: supervisors' source credibility and communication competence. *Int. J. Bus. Commun.* 55, 526–546. doi: 10.1177/2329488415613338

Levine, T. R. (2014). Truth-default theory (TDT) a theory of human deception and deception detection. *J. Lang. Soc. Psychol.* 33, 378–392. doi: 10.1177/0261927X14535916

Levine, E. E. (2021). Community standards of deception: deception is perceived to be ethical when it prevents unnecessary harm. *J. Exp. Psychol. Gen.* 151, 410–436. doi: 10.1037/xge0001081

Levine, E. E., and Schweitzer, M. (2014). Are liars ethical? On the tension between benevolence and honesty. *J. Exp. Soc. Psychol.* 53, 107–117. doi: 10.1016/j.jesp.2014.03.005

Lupoli, M. J., Jampol, L., and Oveis, C. (2017). Lying because we care: compassion increases prosocial lying. *J. Exp. Psychol. Gen.* 146, 1026–1042. doi: 10.1037/xge0000315

Mauger, A. R., Jones, A. M., and Williams, C. A. (2011). The effect of non-contingent and accurate performance feedback on pacing and time trial performance in 4-km track cycling. *Br. J. Sports Med.* 45, 225–229. doi: 10.1136/bjsm.2009.062844

Mazar, N., Amir, O., and Ariely, D. (2008). The dishonesty of honest people: a theory of self-concept maintenance. *J. Mark. Res.* 45, 633–644. doi: 10.1509/jmkr.45.6.633

Sapyta, J., Riemer, M., and Bickman, L. (2005). Feedback to clinicians: theory, research, and practice. *J. Clin. Psychol.* 61, 145–153. doi: 10.1002/jclp.20107

Schein, C., and Gray, K. (2018). The theory of dyadic morality: reinventing moral judgment by redefining harm. *Personal. Soc. Psychol. Rev.* 22, 32–70. doi: 10.1177/1088868317698288

Taylor, S. E., and Brown, J. D. (1988). Illusion and well-being: a social psychological perspective on mental health. *Psychol. Bull.* 103, 193–210. doi: 10.1037/0033-2909.103.2.193

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's Note: All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

frontiers | Frontiers in Psychology

ORIGINAL RESEARCH
published: 20 July 2022
doi: 10.3389/fpsyg.2022.930168

Responding to Distress Choosing Between Care and Food: Attachment Orientation and Emotion Regulation

Arcangelo Uccula[1]*, *Mauro Enna*[1] and *Claudio Mulatti*[2,3]

[1] Department of History, Human Sciences and Education, University of Sassari, Sassari, Italy, [2] Department of Psychology and Cognitive Science, University of Trento, Trento, Italy, [3] Department of Developmental Psychology and Socialisation, University of Padova, Padova, Italy

According to attachment theory, care-seeking is the primary coping strategy in threatening situations. However, anxious and avoidant individuals often use secondary regulation strategies. The purpose of this study was to test whether, in a potentially threatening situation, the participants' attachment orientation affects whether they prefer to resort to care or food to regulate their negative emotions. Ninety-two participants took part in an experimental situation in which they had to choose between pictures of care or food, following the presentation of threatening images randomly alternating with neutral ones. Results showed that care pictures were chosen to a greater extent in the threatening condition compared to the food pictures and the neutral condition, without distinction of attachment orientation. In addition, in threatening condition, anxious individuals chose to care less than non-anxious individuals. Finally, avoidant participants chose care pictures to a lesser extent than individuals low on avoidance in the neutral condition, but not in the threatening condition. In conclusion, attachment anxiety was associated with more difficulty in the choice of representation of care in a threatening condition, while avoidant individuals show their defensive strategies in the neutral condition rather than in the threatening condition.

Keywords: seek social support, comfort, anxiety, threat, avoidance

OPEN ACCESS

Edited by:
Miriam Bocarsly, Rutgers, The State University of New Jersey, United States

Reviewed by:
Alessandra Santona, University of Milano-Bicocca, Italy
Laura Louise Wilkinson, Swansea University, United Kingdom

***Correspondence:**
Arcangelo Uccula
uccula@uniss.it

Specialty section:
This article was submitted to Personality and Social Psychology, a section of the journal Frontiers in Psychology

Received: *27 April 2022*
Accepted: *17 June 2022*
Published: *20 July 2022*

Citation:
Uccula A, Enna M and Mulatti C (2022) Responding to Distress Choosing Between Care and Food: Attachment Orientation and Emotion Regulation. Front. Psychol. 13:930168. doi: 10.3389/fpsyg.2022.930168

INTRODUCTION

Within the classical framework of the attachment theory, when people experience a threatening situation, they activate the attachment system and tend to seek the proximity of significant others (Bowlby, 1969). Support-seeking, in fact, plays a critical role in decreasing the impact of psychophysiological stress (Coan et al., 2017; Feeney and Collins, 2019). Later studies have shown that this strategy in dealing with a threatening stimulus begins to be shaped during a person's experience in early childhood (Waters and Waters, 2006). Of particular, relevance is the behavioral pattern of attachment that an individual has built during infancy through the interactions with the caregiver(s): different attachment styles can either facilitate or interfere with the search for proximity as a strategy to deal with the emotions triggered by a given threat (Waters and Waters, 2006). Whether to seek the proximity of others or not is, thus, an individual difference, which reflects the strategy that individuals use to regulate their emotions, a strategy that results from the individual's pattern of attachment (Mikulincer and Shaver, 2019).

Adults' attachment orientation—shaped in childhood through the interaction with the caregiver (Ainsworth et al., 1978)—can be organized along two emotional dimensions: anxiety and avoidance (Bartholomew and Horowitz, 1991; Mikulincer and Shaver, 2019). Within this two-dimensional

framework, different attachment orientations are paired with different emotion regulation strategies, stress coping strategies, and the individuals' expectations concerning their capability to deal with threatening situations (Caldwell and Shaver, 2012). Anxious individuals find it difficult to seek support, but adopt indirect strategies that intensify the expression of emotions to attract the attention of significant others (Mikulincer and Shaver, 2016). Conversely, avoidant individuals downregulate threat-related emotions with strategies that deny stress or divert attention from the source of the emotions. Thus, attachment theory provides a powerful framework for clustering how individuals tend to regulate their emotions (Brumariu, 2015; Mikulincer and Shaver, 2019). Although, during infancy, the primary strategy for restoring the emotional balance following a potential threat is seeking the proximity of significant others (Bowlby, 1969); in adulthood, this strategy is not necessarily the behavior of seeking physical proximity, but it may also consist in the activation of mental representations of their symbolic presence (Mikulincer and Shaver, 2016).

This primary strategy, however, is more easily available to those individuals who have had a positive experience in childhood with their caregivers' availability and have, thus, developed an attachment style characterized by both the low avoidance and low anxiety (Waters and Waters, 2006): those individuals tend to seek support to regulate their negative emotions in times of need. On the contrary, individuals either high in anxiety or high in avoidance have not had a positive experience with the availability of their caregiver. Those individuals have learned that they cannot rely on others when they feel uneasy and, thus, have to resort to other strategies to regulate their emotions in case of need (Mikulincer and Shaver, 2019).

It has been shown that some individuals prefer resorting to food intake to regulate their negative emotions (typically anxiety) when they experience distress (Evers et al., 2018; Devonport et al., 2019). In other studies, the presentation of anxiogenic (vs. secure) prime stimuli increased snack consumption (Wilkinson et al., 2013). So, the negative emotions triggered by distress might be regulated by the search for proximity by some individuals and by food intake by others. In accordance with these premises, our study aimed to test whether attachment orientation affects the way they respond to a perceived potential threat to cope with their negative emotions.

Receiving adequate parental care and food in childhood is essential to promote healthy physical and mental development (Atzil et al., 2018). In addition, food can perform a regulatory function during affective development. In fact, in addition to having a nutritional function, food also plays an interpersonal regulatory role, for example, when parents use food to soothe their children's negative emotions or discomfort (Stifter et al., 2011; Hamburg et al., 2014). Studies show that mothers' attachment anxiety is associated with using emotional feeding strategies with their children with the aim of feeling closer to them (Hardman et al., 2016). Moreover, parents–child concordance in the child's eating behavior is lower in families where the child shows an insecure attachment with respect to families where the child shows a secure attachment (Uccula et al., 2012). Food consumption can, in fact, activate cognitions linked to the relationship through a learned empathic symbolization of eating experiences within close relationships (Hamburg et al., 2014). For example, comfort food consumption was associated with positive social interactions and a reduction in feelings of loneliness (Troisi and Gabriel, 2011). Consequently, a link between emotion regulation, food intake, and attachment style has been found (Faber et al., 2018) and eating disorder symptoms have been associated with avoidance in intimacy and abandonment-related anxiety (Gonçalves et al., 2019). Thus, to regulate their negative emotions, individuals with anxious attachment might attempt to seek support through the intensification of their emotional expression—a strategy with limited coping efficacy—and might resort to food intake as coping strategy. This happens because individuals with anxious attachment have ambivalent cognitions regarding the context of care-seeking: in case of need, while seeking support for obtaining care and security, they also experience doubts regarding the actual availability of care and support (Vogel and Wei, 2005). Instead, avoidant attachment individuals attempt to block threat-related emotions in stressful situations by adopting a defensive behavior, attentional disengagement (Mellor and Psouni, 2021), denying stress, and, in addition, they do not typically seek the support of others (McLeod et al., 2020). Although avoidant individuals' difficulties in seeking support were found, several studies have shown that such difficulties can be reduced in particular conditions (Rholes et al., 2021). It has been shown that the undeniable, self-evident availability of significant others decreases the frequency of occurrence of defensive behaviors in adult avoidant individuals (Overall et al., 2022). In addition, Diamond and Fagundes (2010) reported a discrepancy between the self-reported dismissive feelings and the measures of physiological activation of individuals with avoidant attachment in a stressful context (e.g., the exposure to infant crying; Ablow et al., 2013). It was as if their defensive attitude was a strategy to mask (i.e., to cope by denying) their emotions, as indexed by their physiological activity. Other studies confirm that avoidant defenses collapse under pressure (Mikulincer and Shaver, 2016).

Present Study

In accordance with these premises, the purposes of the study were: (a) to test whether the representations of care or food were associated with threatening vs. neutral situations and (b) to test whether the attachment orientation of a given individual affects the way they react to a perceived potential threat. More in detail, the following hypotheses were put forward:

- First, regardless of the attachment orientation, we expected that participants in the threatening condition would choose representations of care more often than food ones and with respect to the neutral condition.
- Second, in the threatening condition, we expected that individuals with an anxious attachment would choose representations of care less often than low-anxious individuals and small-to-no differences in the frequency of choice

of representations of care between avoidant and low-avoidant individuals.
- Third, in the neutral condition, we expected less frequently chosen representations of care by avoidant individuals and small-to-no differences in anxious attachment individuals.

MATERIALS AND METHODS

Participants

Ninety-two Italian students volunteered to take part in this study (48 women, 44 men, M_{age} = 22.57 years, SD = 2.87; age range: 19–31 years). A priori power analysis was conducted using G*Power version 3.1.9.7 (Faul et al., 2007) to determine the minimum sample size required to test the study hypothesis. Results indicated the required sample size to achieve 85% power for detecting a small/medium effect (0.3; Cohen, 1988), at a significance criterion of α =0.05, was N = 82 for a within-participant design. Thus, the obtained sample size of N = 92 is adequate to test the study hypothesis. The experimental protocol conformed to the Declaration of Helsinki and was approved by the Ethics Committee of the University of Padova, Italy. Written informed consent was obtained from all the participants.

Design and Statistics

The differences between care and food choices [here operationalized as a preference for pictures representing a caring scenario, Rowe et al. (2020) or as a preference for pictures representing various kinds of comfort food] in the threatening and neutral conditions were analyzed using a within-subject ANOVA. *Post-hoc* pairwise comparisons were done, if the omnibus test found a significant difference. After that, the dimensions of anxiety and avoidance of attachment were included in the analysis as covariates. In order to highlight possible significant associations, we will show the differences in the choices by using standardized Z-scores (−1 SD vs. 1 SD) of attachment orientations.

The potential confounding variables that would be correlated with the choices of food were considered. Some studies have found an association between restrained eating (Evers et al., 2018), body mass index (BMI), and eating behavior (Wilkinson et al., 2018). Likewise, the status of hunger at the time of the experiment was evaluated. However, in experimental studies (food-related attentional bias), these associations were sometimes not found (Hardman et al., 2021); therefore, we wanted to test whether these variables were associated with food image choice. Before the main analyses, backward stepwise regressions between BMI, restrained eating (yes or no), the status of hunger (1 = Not at all hungry; 5 = Extremely hungry), and food choice were performed. The variables that showed no significant association (p > 0.05) were not included in further analysis. Statistical analysis was conducted using SPSS software version 26.

Materials

The attachment style was assessed with the Italian version (Busonera et al., 2014) of the Experiences in Close Relationships-Revised (ECR-R; Fraley et al., 2000). The ECR-R is a widely used self-report questionnaire to assess the two basic dimensions of anxiety and avoidance of attachment and has excellent internal consistency (Fraley et al., 2000). In the present study, Cronbach's alpha coefficients were 0.91 for the anxiety items and 0.89 for the avoidance items. The means of the ECR-R were in line with the Italian adaptation.

The stimuli were 180 pictures selected from various sources:

- Forty pictures from the International Affective Picture System (IAPS; Lang et al., 2008)[1] were used for the threatening (e.g., lunging dogs) and neutral (e.g., domestic objects) conditions. Mean ratings of valence and arousal were as per by Lang et al., 2008 (nine points Likert-type scale: 1 = negative, low). Valence and arousal were significantly different between the two conditions, $F_{(1,38)}$ = 264 and $F_{(1,38)}$ = 438, respectively. The threatening images we used had also been used by Kappenman et al. (2015) and showed that they were capable of activating the threatening system. **Table 1** shows the descriptive statistics of the ECR-R questionnaire and the IAPS pictures.
- Forty pictures from the Food-Pics_Extended (Blechert et al., 2019)[2] were selected. The pictures were of typical comfort foods (sweet and salty snacks) and they were randomly divided into two lists of 20 items: one for the neutral condition and one for the threatening condition. Mean ratings of calories, palatability, and craving were as per by Blechert et al. (2019): the two lists did not significantly differ on any dimension, all $Fs < 1$.
- Forty pictures from the Besançon Affective Picture Set-Adult (BAPS-Adult; Szymanska et al., 2019)[3] were selected. The 40 pictures depicted comfort-related scenarios where care was represented (e.g., an adult comforts an infant in distress). Two lists of 20 pictures were created: one for the neutral condition and one for the threatening condition. Mean ratings of valence, arousal, and perceived comfort were as per by Szymanska et al. (2019): the two lists did not significantly differ on any dimension, all $Fs < 1$.
- Sixty neutral pictures from the IAPS and the Food-Pics_Extended were selected for the 20 filler trials.

Procedure

Demographics include participants' age and gender. Body mass index (BMI) and restrained eating status were collected, as well as a rating of the current hunger level prior to the experiment. Participants filled in the ECR-R questionnaire and performed the experiment in a counterbalanced way: half of them started with the questionnaire and the other half started with the experiment. A program coded within the OpenSesame software (Mathôt et al., 2012) controlled the presentation of the stimuli and the recording

[1]Threatening pictures: 1120 – 1300 – 1304 – 1930 – 3230 – 3500 – 3530 – 6250 – 6312 – 6313 – 6315 – 6350 – 6370 – 6510 – 6540 – 6550 – 6560 – 6570 – 9414 - 9635.1.
Neutral pictures: 7040 – 7002 – 7004 – 7018 – 7020 – 7026 – 7053 – 7059 – 7061 – 7062 – 7080 – 7090 – 7095 – 7150 – 7175 – 7185 – 7205 – 7211 – 7233 – 7235.
[2]Food pictures: 4 – 15 – 26 – 31 – 43 – 44 – 48 – 66 – 67 – 80 – 93 – 94 – 102 – 103 – 104 – 107 – 109 – 113 – 115 – 116 – 127 – 133 – 137 – 140 – 150 – 170 – 173 – 177 – 183 – 186 – 205 – 225 – 286 – 287 – 510 – 539 – 673 – 676 – 869 – 878.
[3]Care pictures: 1 – 2 – 3 – 4 – 5 – 8 – 9 – 11 – 12 – 14 – 15 – 16 – 19 – 20 – 22 – 23 – 24 – 25 – 26 – 27 – 28 – 29 – 30 – 32 – 34 – 35 – 40 – 42 – 46 – 47 – 48 – 49 – 50 – 51 – 52 – 55 – 56 – 57 – 59 – 64.

TABLE 1 | Mean and SD of attachment orientations and prime stimulus in the two conditions.

	ECR-R		IAPS threatening		IAPS neutral	
	Anxiety	**Avoidance**	**Valence**	**Arousal**	**Valence**	**Arousal**
M	3.30	2.45	2.52	6.62	5.11	2.91
S.D.	0.88	0.73	0.64	0.41	0.32	0.68

TABLE 2 | Means, SD, and differences between care and food choices in the two conditions.

	Neutral ***M (SD)***	**Threatening** ***M (SD)***	**Differences** **Neutral—threatening**
Care	9.89 (5.03)	16.15 (3.86)	−6.26
Food	10.11 (5.03)	3.85 (3.86)	6.26
Differences care—food	−0.22	12.30	

TABLE 3 | Descriptive statistics of the confounding variables.

	N	**%**	***M (SD)***
BMI			21.83 (3.46)
Restrained eating			
No	59	64.1	
Yes	33	35.9	
Hunger			
Not at all hungry	36	39.1	
Lightly hungry	42	45.7	
Moderately hungry	13	14.1	
Very hungry	1	1.1	

of the response. Stimuli were displayed on a 15.6 inches monitor, set at a distance of 60 cm from the participant. Before initiating the experiment, participants were presented with the following instructions (instructions were presented in Italian, below is the English equivalent):

"You will see neutral images and other images that will probably make you feel negative emotions, then you will have to choose one of the two images that follow, the one that at that time can help you to overcome the negative emotion of the single image you saw before."

Then, the experiment started and consisted of 60 randomly intermixed trials: 20 trials in the threatening condition, 20 trials in the neutral condition, and 20 filler trials. Each trial began with a fixation dot presented for 500 ms in the center of the screen; at its offset, a prime picture replaced the fixation dot and remained visible for 3 s. In the neutral condition, each prime picture had a neutral content. In the threatening condition, each prime picture had threatening content. In the filler trials, the prime picture had a neutral content. At the offset of the prime picture, two probe pictures were concurrently presented side-by-side. In the neutral and threatening conditions, one of the two pictures depicted a caring scenario, whereas the other picture depicted food. In the filler trials, the two probe pictures had a neutral content. Participants had to choose at their own discretion the picture they favored the most between those two probe pictures. The two probe pictures remained visible until participants responded. The relative position of the two pictures (left vs. right) was counterbalanced (Uccula et al., 2020b). The 60 experimental trials were preceded by 10 practice trials.

RESULTS

To evaluate our hypotheses, we calculated the relative frequency of choice of care vs. food pictures. **Table 2** shows the means and SDs of the choices according to conditions.

From the stepwise regression to selection for potential confounding variables, none of those evaluated: BMI ($r = 0.082$, $p = 0.218$), restrained eating status ($r = -0.011$, $p = 0.458$), and hunger ($r = -0.100$, $p = 0.172$) were associated with the choices of food in neutral and threatening conditions. **Table 3** shows the descriptive statistics of the potential confounding variables.

In order to verify our first hypothesis, the repeated measures ANOVA was carried out. The first hypothesis was that participants choose care pictures more often than food pictures in the threatening condition and that participants choose care pictures more often in the threatening condition than the neutral condition, regardless of the attachment orientation. Results of the omnibus ANOVA indicated a significant effect, $F_{(1,91)} = 149.867$, $p < 0.001$. Because the choice of food vs. care is mutually exclusive, this result concerns both the predictions of the first hypothesis. Out of the 20 trials of the neutral condition, care pictures were selected 9.89 times on average ($SD = 5.03$), i.e., almost half of the time. Out of the 20 trials of the threatening condition, care pictures were selected 16.15 times on average ($SD = 3.86$) vs. a mean of 3.85 for food choices (**Figure 1**).

The *post-hoc* comparisons (Bonferroni correction) showed that in the threatening condition, the differences between care and food choices were significantly greater than in the neutral condition [mean difference – 0.22 + 12.30 = 12.52, $t = 12.24$, $p < 0.001$, 95% *CI* (10.49, 14.55)].

The repeated measures ANCOVA with the dimensions of anxiety and avoidance of attachment as covariates were performed. The results showed a main effect, $F_{(1,89)} = 5.298$, $p = 0.024$, and interactions effects between care and food choices with both the attachment anxiety, $F_{(1,89)} = 4.819$, $p = 0.031$ and attachment avoidance, $F_{(1,89)} = 9.243$, $p = 0.003$.

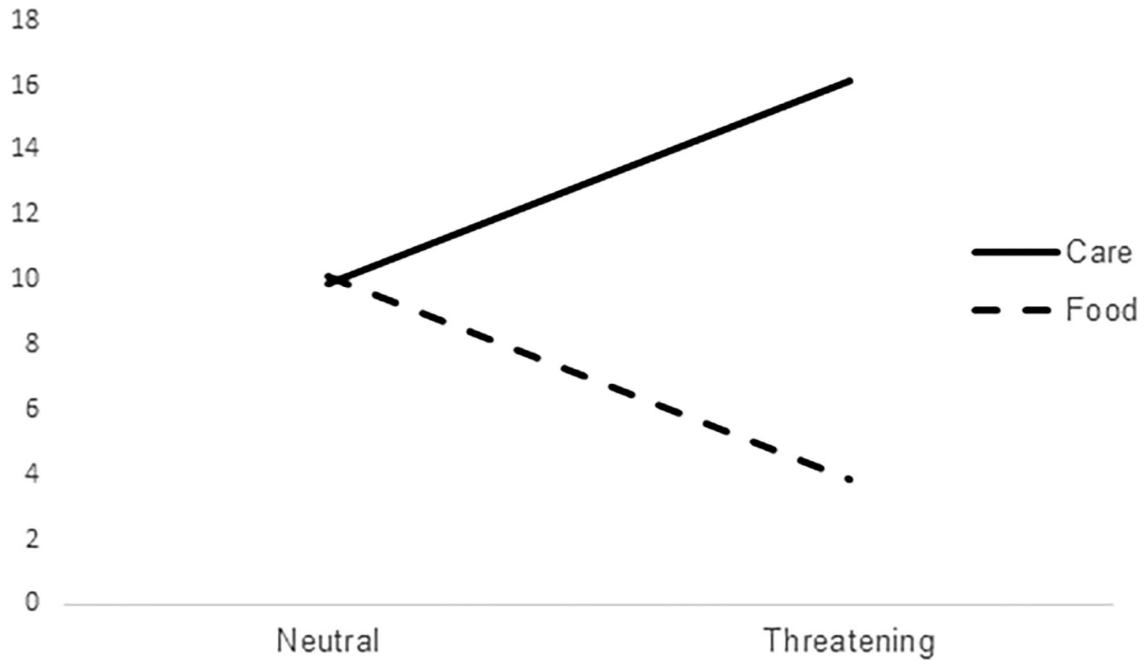


FIGURE 1 | Means of care and food choices in the two conditions.

Whereas the effect of anxiety is significant in the threatening condition, $t = -3.042$, $p < 0.005$, it is not significant in the neutral condition, $|t| < 1$ (**Figure 2**). In addition, whereas the effect of avoidance is not significant in the threatening condition, $|t| < 1$, it proves significant in the neutral condition, $t = -2.650$, $p < 0.01$ (**Figure 3**).

DISCUSSION

The purposes of the present study were to test whether—in a threatening (vs. neutral) condition—participants resort to care more than to food pictures to regulate their emotions and to test whether this tendency is associated with attachment orientation. Our finding accords with the attachment theory framework: under threat, individuals seek the support of others to regulate their emotional distress. This finding confirms, even in an experimental situation, that the attachment-related mental representations of care and social support are activated and are associated with a greater choice of care pictures, following the experience of an emotional distress/threat. On the other hand, it should be noted that in the neutral condition, in the absence of distress, the choices of care are almost equivalent to the food pictures choices.

However, our findings also show that these choices are associated with the individual's attachment orientation. In the threatening condition, individuals with an anxious attachment choose care pictures less often than those individuals who have a low-anxious attachment. This result is consistent with the ambivalent representation of attachment characterizing this attachment style: their mental representations of the attachment figure are unstable and unreliable; the attachment figure is inconstant, it might be present or it might not be present (Cheng et al., 2015). The intensification of the expression of emotions as a signal for inconstant caregivers/partners together with negative expectations regarding their availability and their support (Gökdag, 2021) might lead anxious individuals to attempt to regulate their emotions through food (Wilkinson et al., 2018) instead of through social support. In fact, individuals with a higher level of anxious attachment could have a negative image of themselves as unlovable and could develop an attitude of distrust toward others (Santona et al., 2022). In our study, the relative higher preference for food pictures in anxious individuals is also in line with clinical studies showing a greater risk (Pace et al., 2022) and incidence of eating disorders in the anxious attachment (Tasca and Balfour, 2014).

Conversely, in our findings regarding the threatening condition, avoidant individuals similarly choose care and food as the non-avoidant individuals. Many studies show that individuals with avoidant attachment tend not to seek social support, but adopt a defensive coping strategy following exposure to threatening events and disengaging from others (Mikulincer and Shaver, 2016): this despite their physiological reaction and emotional response to the event is present (Diamond and Fagundes, 2010). However, when the intimacy of a situation is manageable and prorelationship, then, if the presence and availability of the support are undeniable, they can give up their dominant defensive strategy and resort to seeking social support in case of need (Stanton et al., 2017). Other studies confirm that individuals with an avoidant attachment can contrast their default defensive response and express their need for social

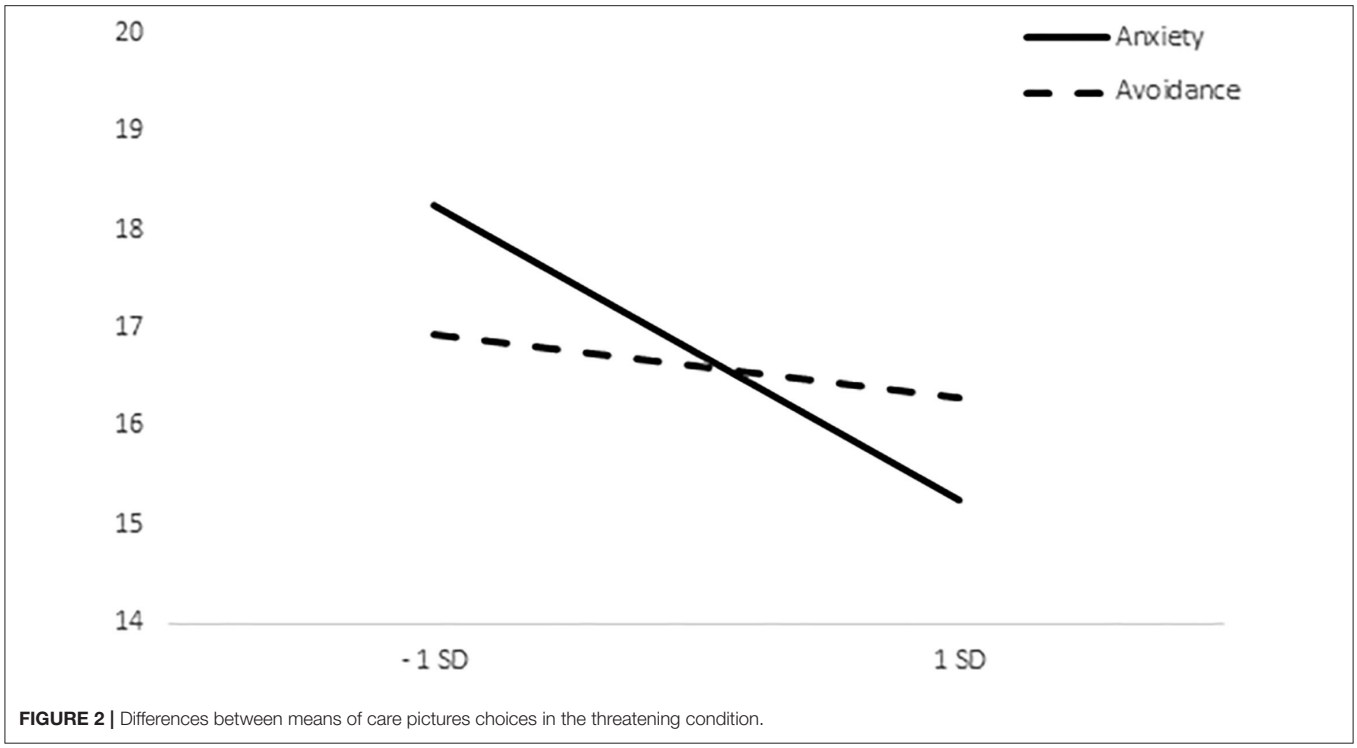


FIGURE 2 | Differences between means of care pictures choices in the threatening condition.

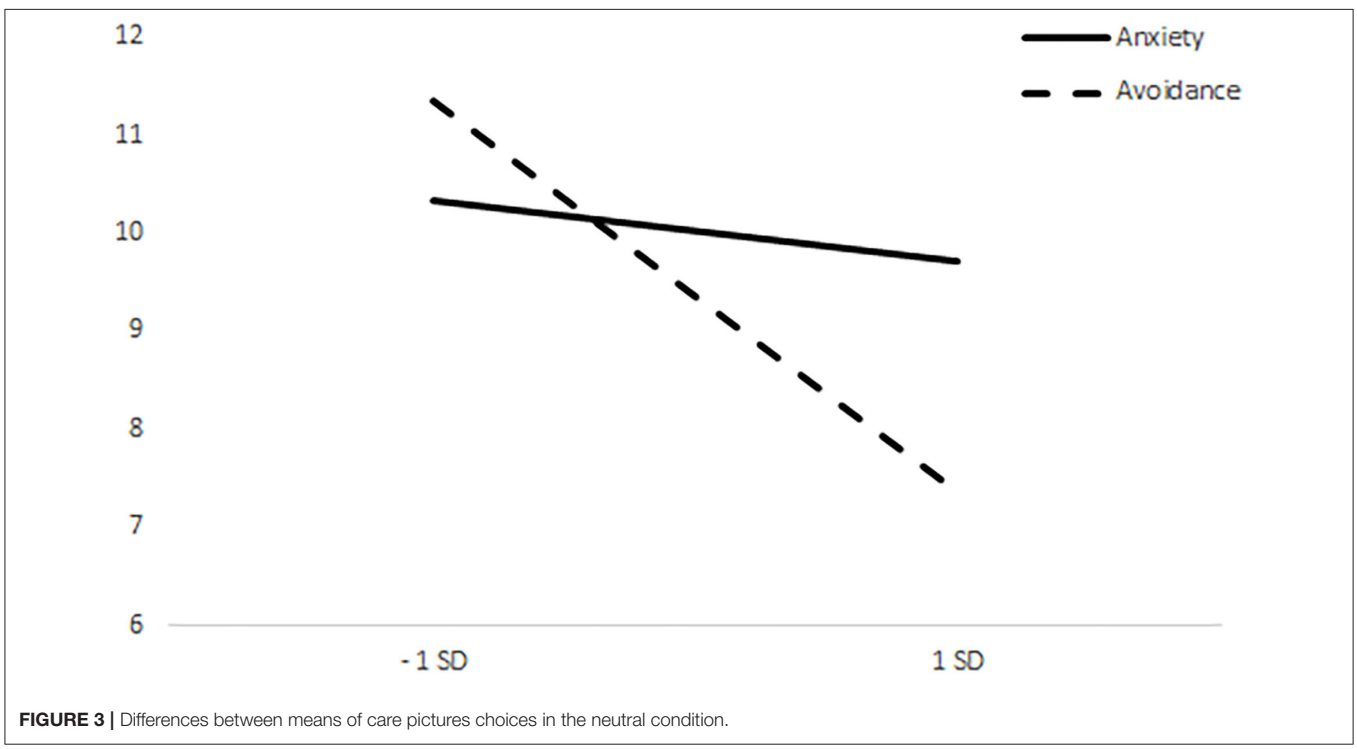


FIGURE 3 | Differences between means of care pictures choices in the neutral condition.

support more openly (Overall et al., 2022). The absence of differences in the choice of care pictures in the threatening condition that we found is consistent with this view: the pictures depicting a care scenario of an adult–child relation (a strong symbolic representation of care) can activate the attachment-related mental script of the support availability and allows the avoidant individuals to choose carefully as the non-avoidant individuals.

Conversely, in a more neutral condition, avoidant individuals are less motivated to choose care, they do not have to cope

with negative emotions, and they resort to their default defensive behavior, which, in our experiment, is indexed by the lower frequency of care choice shown by the avoidant as opposed to the non-avoidant. This is congruent with the view that the "neutral," default mode of avoidant individuals, entails the mental representation of the unavailability of the caregivers and that their attachment system was preconsciously deactivated (Mikulincer and Shaver, 2016). The experimental environment in which the experiment was carried out might have offered a set of conditions that favored the plasticity of avoidant behavior, thus allowing these individuals to differentiate their responses between the two levels of emotional context.

From a developmental perspective, these findings obtained with adults are partially consistent with previous results with children (Uccula et al., 2020a), although caution must be used in comparing categorical assessment of attachment during childhood with dimensional assessment in adulthood. The behavior of anxious and secure children (low anxiety and low avoidance in adults) in the threatening condition is similar. However, unlike adults, in avoidant children, a greater propensity to choose food in the threatening condition has been observed. This result could be interpreted by the different regulatory mechanisms underlying avoidant defenses in the two age groups, which may affect the emotional impact of the threat (e.g., to inhibit emotional states) and/or the choice of care (e.g., interference with the mental representation of support seeking).

In summary, our results clearly show that in the threatening situation, participants prefer representations of care as an emotional regulatory strategy. Within this general propensity, our results confirm that individuals with high (vs. low) attachment anxiety tend to choose secondary regulatory strategies, such as food. On the other hand, the choices of avoidant individuals in the threatening condition seem inconsistent with what is typically observed in these cases. Usually, in fact, avoidant individuals tend to not select representations of intimacy as a regulatory strategy, both in real-life contexts and in simulated contexts, and instead prefer secondary regulatory strategies in stressful situations. However, these defenses in our study emerge in the neutral condition, whereas in the threatening condition, it shows, also in line with recent studies, that in some circumstances when avoidantly attached individuals are distressed, they cannot use their normal defenses to regulate their emotions (Girme et al., 2015). The avoidant orientation in this study also emerges as rich insights for future research aimed at better defining the characteristics of this style, which has not yet found an agreed upon definition among researchers.

A potential limit has to do with the technique we employed to induce threat, since it might have limited ecological validity. However, the IAPS has been validated by a multiplicity of studies and has become a research paradigm and their emotional effects are well-established in the literature. Similarly, the constrained choice between pictures of food and pictures of a caring scenario, although they concern two strong forms of reward (Pool et al., 2016) and emotional regulation (Faber et al., 2018), might be considered as a limit of our study that will need to be addressed in future studies. A further limitation is that the pictures we used to prime the threat were selected from a standardized database (IAPS). This provides a reasonable guarantee that threatening pictures provide some degree of threat to the participant. However, this is only inferred in the context of our experiment: a methodologically more sound study to be performed in the future could include a manipulation check to determine the strength of threat the threatening (vs. neutral) pictures generate on a trial-by-trial basis. In addition, it has not been checked whether the participants had guessed the hypothesis of the study and this could be considered a limitation of the research. Another potential limitation of this study concerns the omission of disorganized attachment, which was not measured in this study. It was, in fact, found to be related to BMI and uncontrolled eating (Wilkinson et al., 2020).

CONCLUSION

According to attachment theory, when under threat, seeking care and support are confirmed to be the primary strategy with which individuals regulate their negative emotions. However, the frequency of employment of this dominant strategy is associated with the attachment orientation of the specific individual. The differences that emerge in the threatening condition between anxiety and avoidance individuals demonstrate the different strategies of negative emotion regulation that the two styles entail. On one hand, because of their ambivalent mental representation of the caregiver as intermittently available, individuals with an anxious attachment tend to select strategies to cope with distress consisting of the choice of care less often than low-anxious individuals. On the other hand, because of their mental representations of the caregiver as unavailable, in neutral situations, without distress, the default mode of the response of avoidant individuals is defensive, but under threat and together with the representation of care and social support, they might opt to choose carefully as low-avoidant individuals.

Overall, our findings support the association between anxious attachment individuals and their greater difficulties with seeking support and contribute to the understanding of the conditions enabling different behavioral responses in the presence of avoidant attachment.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethics Committee of the University of Padova,

Italy. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

AU: conceptualization, methodology, and writing—original draft, review, and editing. ME: investigation and formal analysis. CM: methodology and writing—review. All authors contributed to the article and approved the submitted version.

FUNDING

The study was supported by an internal funding (2020) received from Sassari University, Italy and Sardinian L.R. n.7/2007 (2019).

REFERENCES

Ablow, J. C., Marks, A. K., Shirley Feldman, S., and Huffman, L. C. (2013). Associations between first-time expectant women's representations of attachment and their physiological reactivity to infant cry. *Child Dev.* 84, 1373–1391. doi: 10.1111/cdev.12135

Ainsworth, M. D. S., Blehar, M. C., Waters, E., and Wall, S. (1978). *Patterns of Attachment: Assessed in the Strange Situation and at Home*. Hillsdale, NJ: Lawrence Erlbaum.

Atzil, S., Gao, W., Fradkin, I., and Barrett, L. F. (2018). Growing a social brain. *Nat. Hum. Behav.* 2, 624e636. doi: 10.1038/s41562-018-0384-6

Bartholomew, K., and Horowitz, L. M. (1991). Attachment styles among young adults: a test of a four-category model. *J. Pers. Soc. Psychol.* 61, 226–244. doi: 10.1037/0022-3514.61.2.226

Blechert, J., Lender, A., Polk, S., Busch, N. A., and Ohla, K. (2019). Food-pics_extended-an image database for experimental research on eating and appetite: additional images, normative ratings and an updated review. *Front. Psychol.* 10:307. doi: 10.3389/fpsyg.2019.00307

Bowlby, J. (1969). *Attachment and Loss, 2nd Edn, Attachment, Vol. 1*. New York, NY: Basic Books.

Brumariu, L. (2015). Parent–child attachment and emotion regulation. *New Dir. Child Adolesc. Dev.* 148, 31–45. doi: 10.1002/cad.20098

Busonera, A., San Martini, P., Zavattini, G. C., and Santona, A. (2014). Psychometric properties of an Italian version of the experiences in close relationships-revised (ECR-R) scale. *Psychol. Rep.* 114, 785–801. doi: 10.2466/03.21.PR0.114k23w9

Caldwell, J. G., and Shaver, P. R. (2012). Exploring the cognitive-emotional pathways between adult attachment and ego-resiliency. *Individ. Differ. Res.* 10, 141–152.

Cheng, H. L., McDermott, R. C., and Lopez, F. G. (2015). Mental health, self-stigma, and help-seeking intentions among emerging adults: an attachment perspective. *Couns. Psychol.* 43, 463–487. doi: 10.1177/0011000014568203

Coan, J. A., Beckes, L., Gonzalez, M. Z., Maresh, E. L., Brown, C. L., and Hasselmo, K. (2017). Relationship status and perceived support in the social regulation of neural responses to threat. *Soc. Cogn. Affect. Neurosci.* 12, 1574–1583. doi: 10.1093/scan/nsx091

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences, 2nd Edn*. Oxfordshire: Routledge.

Devonport, T. J., Nicholls, W., and Fullerton, C. (2019). A systematic review of the association between emotions and eating behaviour in normal and overweight adult populations. *J. Health Psychol.* 24, 3–24. doi: 10.1177/1359105317697813

Diamond, L., and Fagundes, C. (2010). Psychobiological research on attachment. *J. Soc. Pers. Relat.* 27, 218–225. doi: 10.1177/0265407509360906

Evers, C., Dingemans, A., Junghans, A. F., and Boevé, A. (2018). Feeling bad or feeling good, does emotion affect your consumption of food? A meta-analysis of the experimental evidence. *Neurosci. Biobehav. R.* 92, 195–208. neubiorev.2018.05.028 doi: 10.1016/j.neubiorev.2018.05.028

Faber, A., Dube, L., and Knauper, B. (2018). Attachment and eating: a meta-analytic review of the relevance of attachment for unhealthy and healthy eating behaviors in the general population. *Appetite* 123, 410–438. doi: 10.1016/j.appet.2017.10.043

Faul, F., Erdfelder, E., Lang, A. G., and Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behav. Res. Methods*. 39, 175–191. doi: 10.3758/BF03193146

Feeney, B. C., and Collins, N. L. (2019). The importance of relational support for attachment and exploration needs. *Curr. Opin. Psychol.* 25, 182–186. doi: 10.1016/j.copsyc.2018.11.011

Fraley, R., Waller, N., and Brennan, K. (2000). An item response theory analysis of self-report measures of adult attachment. *J. Pers. Soc. Psychol.* 78, 350–365. doi: 10.1037/0022-3514.78.2.350

Girme, Y. U., Overall, N. C., Simpson, J. A., and Fletcher, G. J. (2015). "All or nothing": attachment avoidance and the curvilinear effects of partner support. *J. Pers. Soc. Psychol.* 108, 450–475. doi: 10.1037/a0038866

Gökdag, C. (2021). How does interpersonal emotion regulation explain psychological distress? The roles of attachment style and social support. *Pers. Indiv. Differ.* 176:110763. doi: 10.1016/j.paid.2021.110763

Gonçalves, S., Vieira, A. I., Rogrigues, T., Machado, P. P., Brandao, I., Timoteo, S., et al. (2019). Adult attachment in eating disorders mediates the association between perceived invalidating childhood environments and eating psychopathology. *Curr. Psychol.* 40, 5478–5488. doi: 10.1007/s12144-019-00524-2

Hamburg, M. E., Finkenauer, C., and Schuengel, C. (2014). Food for love: the role of food offering in empathic emotion regulation. *Front. Psychol.* 5:32. doi: 10.3389/fpsyg.2014.00032

Hardman, C. A., Christiansen, P., and Wilkinson, L. L. (2016). Using food to soothe: Maternal attachment anxiety is associated with child emotional eating. *Appetite* 99, 91–96. doi: 10.1016/j.appet.2016.01.017

Hardman, C. A., Jones, A., Burton, S., Duckworth, J. J., McGale, L. S., Mead, B. R., et al. (2021). Food-related attentional bias and its associations with appetitive motivation and body weight: a systematic review and meta-analysis. *Appetite* 157:104986. doi: 10.1016/j.appet.2020.104986

Kappenman, E. S., MacNamara, A., and Hajcak-Proudfit, G. (2015). Electrocortical evidence for rapid allocation of attention to threat in the dot-probe task. *Soc. Cogn. Affect. Neurosci.* 10, 577–583. doi: 10.1093/scan/nsu098

Lang, P. J., Bradley, M. M., and Cuthbert, B. N. (2008*). International Affective Picture System (IAPS): Affective Ratings of Pictures and Instruction Manual. Technical Report A-8*. Gainesville, FL: University of Florida.

Mathôt, S., Schreij, D., and Theeuwes, J. (2012). OpenSesame: an open-source, graphical experiment builder for the social sciences. *Behav. Res. Methods* 44, 314–324. doi: 10.3758/s13428-011-0168-7

McLeod, S., Berry, K., Hodgson, C., and Wearden, A. (2020). Attachment and social support in romantic dyads: a systematic review. *J. Clin. Psychol.* 76, 59–101. doi: 10.1002/jclp.22868

Mellor, R. L., and Psouni, E. (2021). The study of security priming on avoidant attentional biases: combining microsaccadic eye-movement measurement with a dot-probe task. *Front. Psychol.* 12:726817. doi: 10.3389/fpsyg.2021.726817

Mikulincer, M., and Shaver, P. R. (2016). *Attachment in Adulthood: Structure, Dynamics, and Change, 2nd Edn*. New York, NY: The Guilford Press.

Mikulincer, M., and Shaver, P. R. (2019). Attachment orientations and emotion regulation. *Curr. Opin. Psychol.* 25, 6–10. doi: 10.1016/j.copsyc.2018.02.006

Overall, N. C., Pietromonaco, P. R., and Simpson, J. A. (2022). Buffering and spillover of adult attachment insecurity in couple and family relationships. *Nat. Rev. Psychol.* 1, 101–111. doi: 10.1038/s44159-021-00011-1

Pace, C. S., Muzi, S., Parolin, L., Milesi, A.;, Tognasso, G., and Santona, A. (2022). Binge eating attitudes in community adolescent sample and relationships with interview-assessed attachment representations in girls: a multi-center study from North Italy. *Eat.Weight. Disord.* 27, 495–504. doi: 10.1007/s40519-021-01183-8

Pool, E., Brosch, T., Delplanque, S., and Sander, D. (2016). Attentional bias for positive emotional stimuli: a meta-analytic investigation. *Psychol. Bull.* 142, 79–106. doi: 10.1037/bul0000026

Rholes, W. S., Eller, J., Simpson, J. A., and Arriaga, X. B. (2021). Support processes predict declines in attachment avoidance across the transition to parenthood. *Pers. Soc. Psychol. B.* 47, 810–825. doi: 10.1177/0146167220948706

Rowe, A. C., Gold, E. R., and Carnelley, K. B. (2020). The effectiveness of attachment security priming in improving positive affect and reducing negative affect: a systematic review. *Int. J. Environ. Res. Public Health* 17:968. doi: 10.3390/ijerph17030968

Santona, A., Milesi, A., Tognasso, G., Gorla, L., and Parolin, L. (2022). Anxiety in attachment and sexual relationships in adolescence: a moderated mediation model. *Int. J. Environ. Res. Public Health* 19:4181. doi: 10.3390/ijerph19074181

Stanton, S. C. E., Campbell, L., and Pink, J. C. (2017). Benefits of positive relationship experiences for avoidantly attached individuals. *J. Pers. Soc. Psychol.* 113, 568–588. doi: 10.1037/pspi0000098

Stifter, C., Anzman-Frasca, S., and Voegtline, L. B. K. (2011). Parent use of food to soothe infant/toddler distress and child weight status: an exploratory study. *Appetite* 57, 693–699. doi: 10.1016/j.appet.2011.08.013

Szymanska, M., Comte, A., Tio, G., Vidal, C., Monnin, J., Chateau Smith, C., et al. (2019). The Besançon affective picture set-adult (BAPS-adult): development and validation. *Psychiatry Res.* 271, 31–38. doi: 10.1016/j.psychres.2018.11.005

Tasca, G. A., and Balfour, L. (2014). Attachment and eating disorders: a review of current research. *Int. J. Eat. Disord.* 47, 710–717. doi: 10.1002/eat.22302

Troisi, J. D., and Gabriel, S. (2011). Chicken soup really is good for the soul: "comfort food" fulfills the need to belong. *Psychol. Sci.* 22, 747–753. doi: 10.1177/0956797611407931

Uccula, A., Enna, M., and Mulatti, C. (2020a). Care vs food as an emotional regulation strategy in elementary school children: the role of the attachment style. *J. Genet. Psychol.* 181, 336–347. doi: 10.1080/00221325.2020.1768504

Uccula, A., Enna, M., and Treccani, B. (2020b). Compatibility between response position and either object typical size or semantic category: SNARC- and MARC-like effects in primary school children. *J. Exp. Child Psychol.* 189:104682. doi: 10.1016/j.jecp.2019.104682

Uccula, A., Nuvoli, G., and Aiello, E. (2012). Parental attribution and attachment styles in children eating behaviour. *Psicol. Clin. Svil.* 16, 347–370. doi: 10.1449/37833

Vogel, D. L., and Wei, M. (2005). Adult attachment and help-seeking intent: the mediating roles of perceived social support and psychological distress. *J. Couns. Psychol.* 52, 347–357. doi: 10.1037/0022-0167.52.3.347

Waters, H. S., and Waters, E. (2006). The attachment working models concept: among other things, we build script-like representations of secure base experiences. *Attach. Hum. Dev.* 8, 185–197. doi: 10.1080/14616730600856016

Wilkinson, L. L., Rowe, A. C., and Heath, G. H. (2013). Eating me up inside: priming attachment security and anxiety, and their effects on snacking. *J. Soc. Pers. Relat.* 30, 795–804. doi: 10.1177/0265407512468371

Wilkinson, L. L., Rowe, A. C., and Millings, A. (2020). Disorganized attachment predicts body mass index *via* uncontrolled eating. *Int. J. Obes.* 44, 438–446. doi: 10.1038/s41366-019-0378-0

Wilkinson, L. L., Rowe, A. C., Robinson, E., and Hardman, C. A. (2018). Explaining the relationship between attachment anxiety, eating behaviour and BMI. *Appetite*. 127, 214–222. doi: 10.1016/j.appet.2018.04.029

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's Note: All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

frontiers | Frontiers in Psychology

ORIGINAL RESEARCH
published: 22 July 2022
doi: 10.3389/fpsyg.2022.926098

Similar Attitudes, Different Strategies: A Limited Survey of the Discourse Strategies to Oppose Genetically Modified Organisms Conspiracy Theories by Chinese Scientist Communicators and Citizen Communicators on Zhihu

*Zheng Yang**

Center for Chinese Urbanization Studies, School of Communication, Soochow University, Suzhou, China

The development of the digital media environment has led to a diversification in the role of science communicators. Both scientists and non-scientist citizens can act as science communicators in relation to online discussion of genetically modified organisms (GMOs). Through a limited study, based on thematic and open coding of 60 answers provided by scientist science communicators and citizen science communicators on GMOs on Zhihu, the biggest Chinese knowledge sharing network, it has been found that "business conspiracy theories" about GMOs are the most mentioned and discussed theories, followed by the conspiracy theory of "GMOs as state control tool" on Zhihu. Both citizen science communicators and scientist science communicators are inclined to show oppositional attitudes to GMOs conspiracy theories on Zhihu, despite the differences in their scientific backgrounds; however, they use very different discourse strategies. Citizen science communicators tend to use "lay logic" with more rhetoric, while scientist science communicators tend to use direct scientific knowledge and logic with less rhetoric.

Keywords: GMOs conspiracy theories, citizen science communicators, scientist science communicators, online science communication, discourse strategies

OPEN ACCESS

Edited by:
Reza Rastmanesh, American Physical Society, United States

Reviewed by:
Carlos Alberto Roman Collazo, Catholic University of Cuenca, Ecuador
Tetsuya Ishii, Hokkaido University, Japan

***Correspondence:**
Zheng Yang
yangzheng@suda.edu.cn

Specialty section:
This article was submitted to Personality and Social Psychology, a section of the journal Frontiers in Psychology

Received: *22 April 2022*
Accepted: *24 June 2022*
Published: *22 July 2022*

Citation:
Yang Z (2022) Similar Attitudes, Different Strategies: A Limited Survey of the Discourse Strategies to Oppose Genetically Modified Organisms Conspiracy Theories by Chinese Scientist Communicators and Citizen Communicators on Zhihu. Front. Psychol. 13:926098. doi: 10.3389/fpsyg.2022.926098

INTRODUCTION

From their earliest conception, genetically modified organisms (GMOs) have been widely discussed in public and media reports, giving rise to several conspiracy theories (Burke, 1999; Lyons et al., 2019; Evanega et al., 2022). In China, a country with a more conservative attitude toward crops and food, although its public's acceptance of GMOs is higher than other GM producers (around 40%, Zhao et al., 2019), such as United States, Argentina, Brazil, India, negative discussions and conspiracy theories about GMOs are still widespread (Chameides et al., 1999; Yang et al., 2014; Li et al., 2019; Wang et al., 2021). These conspiracy theories have affected the promotion of GMOs and formulation of relevant policies in China (Cao, 2018; Jiang and Fang, 2019; Li et al., 2019). Discussions of GMOs conspiracy theories seem to be further diffused in the digital media environment, as the public has more discourse power and the possibility of becoming

communicators based on the empowerment afforded by digital media (Jiang and Fang, 2019; Li et al., 2019). Lay citizens are often singled out as the major believers and communicators of such conspiracy theories as they have limited scientific literacy and ability to identify conspiracy theories (Xu and Lu, 2019; Yang et al., 2021). Is this still the case in China's current network society? To answer this question, this study explores the attitudes toward current popular GMOs conspiracy theories of Chinese scientist science communicators and citizen science communicators. It also explores the discourse strategies used to defend attitudes toward GMOs conspiracy theories on Zhihu, the biggest Chinese knowledge-sharing network, based on an open coding of the answers provided by these two kinds of science communicators in the GMOs section on Zhihu.

GENETICALLY MODIFIED ORGANISM CONSPIRACY THEORIES IN CHINA

Conspiracy theories about GMOs have been around since their birth and have already become one of the important factors influencing GMO promotion, making it a controversial topic (Lewandowsky et al., 2013). According to Douglas et al. (2019), "'Conspiracy theories' are attempts to explain the ultimate causes of significant social and political events and circumstances with claims of secret plots by two or more powerful actors" (p. 4). Conspiracy theories occur when an event or situation is seen as the result of a secret plan by powerful actors, even though other possible, plausible, explanations exist (Keeley, 2019). GMOs conspiracy theories relate to the production, trade and consumption of GMOs and foods (Uscinski and Parent, 2014).

There are four main types of popular GMOs conspiracy theories: (1) GMOs as biological weapons, whereby genetically modified technology transfers bacterial and viral genes into animal and plant cells, with the resultant GMOs sold to other countries to harm their citizens (Bielecka and Mohammadi, 2014; Zhang, 2016). (2) GMOs as state control tool, which believes GMOs are a tool of Western developed countries, especially the United States, to control developing nations and the world's food supply. These theorists believe that developing countries are increasingly reliant on genetically modified technology and crops developed by developed Western countries, thus their food strategy and security are tightly controlled by developed countries (Lynas, 2013; Smith, 2016; Li et al., 2019). (3) Business conspiracy theories, which believes that GMOs are a ploy by giant international agrichemical corporations such as Monsanto to sell more pesticides or herbicides. Conspiracists suggest that GMOs use more insecticides, thus giant international agrichemical corporations can make more money from selling pesticides or herbicides by promoting the cultivation of genetically modified crops (Lynas, 2013). (4) Genocide conspiracy theories, which believe that GMOs technology is a bioweapon used by White people to wipe out other people of color – this theory was popularized after an outbreak of the Zika virus, which was suspected of being produced and spread by genetically modified mosquitoes (Smallman, 2018; Mitchell, 2019).

The types of GMO conspiracy theories described above are also widespread in the Chinese context, especially "GMOs as state control tool" and "GMOs as biological weapons." According to Cui and Shoemaker (2020), more than 45% of Chinese respondents believed that "GMOs is a huge conspiracy, a tool used by Monsanto Corporation and the United States government behind it to destroy Chinese agriculture, and further a biological weapon against developing countries" (p. 155). Some Chinese public figures, like economist Xianping Lang, have linked negative social news in China, such as "more than half of the college students in Guangxi province have infertile semen," and 'the southwest of China suffers from severe drought' to the promotion of GMOs, which has further fuelled the spread of conspiracy theories in China (Liu, 2012). According to Liu's observation (Liu, 2012), many Chinese believe that GMOs are a biological weapon used by the United States to wage future wars, to control and even destroy other nations and races. Some Chinese scholars think that the prevalence of GMOs conspiracy theories in China is mainly due to the long-term political confrontation between China and the West, especially the United States, the politicization of food and GMOs, Chinese people's naturalism, nostalgia and old-fashioned mood on food, and the Chinese lack of trust in institutions such as science and government (Fan, 2014; Cui and Shoemaker, 2020; Yang, 2021a).

The rapidly developed digital environment is considered to have fuelled the amplification and dissemination of conspiracy theories, including those that are GMOs related (Mahl et al., 2022), especially since it gives the public a greater voice and the possibility of becoming communicators based on the empowerment of the digital media environment (Hussein et al., 2020; Mahl et al., 2022). When the growth of the public's scientific literacy cannot keep up with the growth of their voice power in the digital age, Xu and Lu (2019) found that conspiracy theories about GMOs are more likely to appear on the Chinese Internet. Other scholars have found that the professionalism and credibility of the Chinese public (non-scientists) as communicators of GMOs are not inferior to those Chinese scientists who are considered to be an effective and active force against GMOs conspiracy theories (Yang, 2021a,b). As science communicators, the Chinese public has become a powerful force against conspiracy theory and rumors, and further delivers accurate scientific information in the discussion of GMOs in the Chinese digital environment (Yang, 2021a,b).

CITIZEN SCIENCE COMMUNICATORS AND MORE DIVERSE SCIENCE COMMUNICATORS IN ONLINE GENETICALLY MODIFIED ORGANISM COMMUNICATION

In the digital media environment, science communication about GMOs has been found to be diverse, especially in relation to those who act as science communicators (Dickel and Franzen, 2016; Jia et al., 2017; Yang, 2021a,b). In China, the role of science communicators has been found to include more

than just a monopoly by scientists as the public – without a professional scientific background – are also effective and recognized science communicators on many scientific topics, such as GMOs, rare diseases, and climate change (Nerlich et al., 2010; Vicari, 2021; Yang, 2021a,b). Public citizens without professional scientific backgrounds who are actively engaging in the science communication process as communicators have been identified as "citizen science communicators" (Yang, 2021a,b). For instance, a real estate agent with an educational background in sociology actively answered 16 questions about GMOs on Zhihu by the end of March 2022 – this user has been identified as a typical citizen science communicator in the Chinese online science communication system (Yang, 2022a).

On the topic of GMOs, citizen science communicators present a series of characteristics that are different from scientist communicators, such as offering a perspective that is more pluralistic than a purely scientific approach, using a more humorous tone, having an equal perspective to the public, and using more trust mechanisms (Yang, 2021a,b). Although scientist communicators have been found to occupy a central position in online GMOs discussion (Xu et al., 2018; Wang and Song, 2020; Yang, 2022b), citizen science communicators have already played a very important role in online GMOs communication and discussion (Yang, 2021a,b). In science communication, the attitude of science communicators is often believed to have a strong impact on the audience's attitude toward a specific topic, such as GMOs (Nielsen, 2010; Brownell et al., 2013; Castell et al., 2014; Baram-Tsabari and Lewenstein, 2017). If the communicators believe in conspiracy theories on a certain topic, this will have a significant impact on the audiences' attitude in the process of communication (Laziæ and Žeželj, 2021). The public, without a scientific background and limited scientific literacy, has generally been regarded as the main constituent of conspiracy believers and one of the culprits in the spread of conspiracy theories in society, such as those about GMOs and vaccines, especially in the Chinese context (Lynas, 2015; Fasce and Picó, 2019; Jia and Luo, 2021; Luo and Jia, 2021; Yang et al., 2021). Therefore, when non-scientist citizens become science communicators on the topic of GMOs especially in the digital environment, are their attitudes toward GMOs conspiracy theories trustable? And whether those attitudes will further affect the other public's attitudes toward GMOs conspiracy theory? Studies have also found that scientist communicators and citizen science communicators adopt significantly different discourse strategies to persuade their audience during the science communication process (Fähnrich et al., 2020; Yang, 2021a,b). Therefore, we can also assume that scientist communicators and citizen science communicators will also use different discourse strategies to prove their attitude toward GMOs conspiracy theories and further persuade their audience, no matter they have the similar or different attitude toward GMOs conspiracy theories. Combining the discussion of the types of GMOs conspiracy theory above, this study proposes the following three research questions:

RQ1. In the Chinese digital media environment, what kinds of GMOs conspiracy theories are most common?

RQ2. What are the attitudes of scientist communicators and citizen science communicators toward GMOs conspiracy theories?

RQ3. What kinds of discourse strategies do scientist communicators and citizen science communicators use to prove their attitude toward GMOs conspiracy theories?

Answering the three research questions could help to clarify the situation of GMOs conspiracy theories in the increasingly diversified and complex Chinese online science communication system, especially in the online discussions dominated by different science communicators.

RESEARCH OBJECT AND METHODS

Research Object

This study uses Zhihu[1] as a case study to explore GMOs conspiracy theories in the Chinese digital media environment. Zhihu, founded in 2010, is now the biggest Chinese knowledge-sharing network, or Q&A platform, with more than 100 million monthly active users until the end of 2021. This research uses Zhihu as the research platform for two main reasons. Firstly, many citizen science communicators have been found on Zhihu, especially in the GMOs section (Vicari, 2021; Yang, 2021a). According to Yang's research, citizen science communicators provided more than 60% of excellent answers in the GMOs section on Zhihu, while scientists only provided around 27% (Yang, 2022a). Since the present study aims to explore the different communicators' attitudes toward GMOs conspiracy theories and the discourse strategies, they adopt to defend their attitudes, Zhihu – which involves both notable citizen science communicators and scientist science communicators in GMOs communication and discussion – can provide sufficient recourse and data. Secondly, Zhihu accommodates more than 3,000 scientific sections (topics), 1.5 million science-related questions, and more than 3 million answers, which makes Zhihu one of the most comprehensive and popular science communication digital platforms in China. Furthermore, compared with other social media platforms like Weibo and WeChat that face more stringent online censorship, due to its target users having a higher education level and its special characteristics of knowledge sharing, the severity of online censorship on Zhihu is relatively weaker. Therefore, Zhihu is a more suitable platform for discussing conspiracy theories in science communication.

The GMOs section on Zhihu was established in February 2011 and has become one of the most active science sections with more than 6,000 questions, attracting more than 400,000 followers by the end of 2021. To explore the attitudes toward GMOs conspiracy theories and the discourse strategies adopted to defend them, this study uses 30 answers provided by citizen science communicators and 30 by scientist science communicators, chosen randomly from 1,000 excellent answers in the Zhihu GMOs section. "Excellent answers" (精品回答) are automatically selected by Zhihu in each topic based on the

[1] https://www.zhihu.com/

number of likes, comments, and content quality of the answers, combined with comprehensive algorithmic measurements. The selected excellent answers all feature higher quality content, contain more information, and are the most popular and influential answers in each topic section.

In this study, scientists have been identified as those who had at least a master's degree in a scientific discipline and were engaged in science-related work, which may not be related to GMOs. This approach was taken because, in China, most science students need to spend 3 years completing their master's degree and most of their study time involves laboratory work, which makes it easier for those science students with a master's degree to be accepted and recognized as scientists by both others and themselves. When manually confirming the identities of users as scientists or not, the author first observed the users' homepages and identity information they provided. Zhihu issues blue marks to those users with verified identities (including education background and employment situation) to prove that the identities and identity certificates provided by them are accurate. For those users who do not provide identity information or whose identity information is not authenticated, the author sent enquiries to them through the private message function on Zhihu to determine whether they were scientists. Sixty randomly chosen GMOs answers provided by citizen science communicators and scientist science communicators constitute the analysis samples in this study.

Research Methods

This study adopts a research method that combines thematic coding and open coding. Thematic coding involves recording or identifying passages of text or images that are linked by a common theme or idea and indexing the text into categories, thereby establishing a "framework of thematic ideas about it" (Gibbs, 2007). In this study, thematic coding was used to answer RQ1 and RQ2. All expressions of conspiracy theory in the 60 GMOs answer samples were coded as "GMOs as biological weapons," "GMOs as state control tool," "business conspiracy theories," "genocide conspiracy theories," and others, and answer providers' attitudes toward those GMOs conspiracy theories were coded as "support," "oppose," and "neutral" (as **Table 1**). Among them, "GMOs as biological weapons" and 'Genocide conspiracy theories' need to be further distinguished which both of them treated GMOs as a kind of biological attack tools. In "Genocide conspiracy theories" expressions, there are clear racist tendencies, which the target of the attack or even exterminate was limited to ethnic groups, such as people of color. Under this kind of conspiracy theory, the purpose of GMOs is considered as a premeditated racial destruction operated by White people. But the subject and object mentioned in the conspiracy theory of 'GMOs as biological weapons' are relatively flexible. The target of attack can be human or other creatures. And in some GMOs as biological weapons' cases, the use of such weapons is not premeditated or deliberate but comes from the characteristics of (immature) transgenic technology itself. Therefore, there is a clear distinction between these two kinds of GMOs conspiracy theories, even they both treat GMOs as bioweapons.

Open coding aims to develop substantial codes based on labeling concepts and defining and developing categories based on their properties and dimensions. Although some scholars have proposed how to deal with GMOs conspiracy theories, such as improving public media literacy and their scientific literacy, using more facts and science-focused corrections, organizing public participation activities, and so on (Lynas, 2013; Douglas et al., 2019), few studies clearly indicate the discourse strategies people use to support or oppose such theories. There are no ready-made coding guidelines that can be directly used in this study for reference. Therefore, this study adopts the method of open coding for RQ3, retaining the flexibility of coding, mainly referring to the trust generation mechanism: based on reputation; based on mechanism and system; based on social similarity, etc. (Zucker, 1986). The mechanism of trust generation, or the discourse strategies that can be used to generate trust, is like the discourse strategies used to protect someone's particular attitude or point of view. Therefore, this study takes this as the main reference basis, but still maintain the flexibility of public coding.

Findings

More Discussion Around Business Conspiracy Theories

Through the thematic coding of 60 GMOs answers provided by citizen science communicators and scientist science communicators on Zhihu, it can be found that GMOs conspiracy theories have gained some traction in GMOs discussions on Zhihu. In citizen science communicators' and scientist science communicators' answers, conspiracy theories were mentioned 16 and 11 times, respectively (some answers contained more than one kind of theory, which were coded based on the number of conspiracy theories) (**Table 2**). Obviously, it can be found that more answers provided by scientist science communicators and citizen science communicators do not involve conspiracy theories, that is to say, more scientist science communicators and citizen science communicators are not inclined to discuss relevant contents of GMO conspiracy theories, regardless of whether they support those conspiracy theories or opposes them. Among those answers involving conspiracy theories, citizen science communicators are somewhat more concerned with GMOs conspiracy theories than scientist science communicators on Zhihu. Some studies have also shown that conspiracy theories are more likely to spread among the public rather than among scientists (Gough et al., 2014; Lakhvich, 2021).

Among the four defined GMOs conspiracy theories, it is clear that business conspiracy theories received more attention and discussion in both citizen science communicators' and scientist science communicators' answers followed by "GMOs as state control tool" and "GMOs as biological weapons" for both groups (**Table 1**). The "genocide conspiracy theories" were not represented in the sample; thus, it seems that this kind of theory is not popular in online discussions in China. All the conspiracy theories discussed in the samples can be effectively classified into these four defined GMOs conspiracy theories, except the "Genocide conspiracy theories," which proves that expect the

TABLE 1 | Thematic coding books.

	Theme	Description
GMOs conspiracy theories categories	GMOs as biological weapons	Genetically modified technology can transfer bacterial and viral genes into animal and plant cells; these genetically modified crops or foods are sold to other countries as biological weapons against their citizens
	GMOs as state control tool	GMOs are a tool of Western developed countries, especially the United States, to control developing nations and the world's food supply
	Business conspiracy theories	GMOs are a ploy by some giant international agrichemical corporations, such as Monsanto to sell more pesticides or herbicides
	Genocide conspiracy theories	GMOs technology is a bioweapon used by the White race to wipe out other people of color
	Others	Other GMOs conspiracy theories not mentioned above
Attitude toward GMOs conspiracy theories	Support	User supports mentioned conspiracy theory
	Oppose	User opposes mentioned conspiracy theory
	Neutral	User is neutral about mentioned conspiracy theory

"Genocide conspiracy theories" which may not be applicable to Chinese social and cultural environment about GMOs discussion, the effectiveness of such thematic classification is still reliable.

In statements by China's official media, discussions about GMOs conspiracy theories are more generally around "GMOs as state control tool," for example: "there is a saying circulating on the Internet that GMO is a conspiracy of the western countries to calculate and control China" (China Science Daily: 2021-06-01), or "for a long time, there has been a saying about GMO that GMO is a conspiracy of the west, especially US imperialism, to scam China and the Chinese people" (China Science Daily, 2017-01-24). Indeed, it is also significantly discussed on Zhihu, which is just less that "Business conspiracy theories." In online discussions dominated by individual digital media users, discussions around "Business conspiracy theories" occur more often than discussions around "GMOs as state control tool" and other GMOs conspiracy theories. There seems to be a gap between China's official discussions and public concerns about GMOs conspiracy theories. In the GMOs discussion on Zhihu, both citizen and scientist users tend to base discussions on GMOs being a kind of commercial technology, which should firstly belong to some commercial companies, such as Monsanto.

TABLE 2 | Frequency of discussion about different GMOs conspiracy theories on Zhihu.

	Citizen science Communicators	Scientist science Communicators	Total
GMOs as biological weapons	4 (14.8%)	2 (7.4%)	6 (22.2%)
GMOs as state control tool	5 (18.5%)	4 (14.8%)	9 (33.3%)
Business conspiracy theories	7 (25.9%)	5 (18.5%)	12 (44.4%)
Genocide conspiracy theories	0 (0%)	0 (0%)	0 (0%)
Other	0 (0%)	0 (0%)	0 (0%)
Total	16 (59.3%)	11 (40.7%)	27 (100%)

Therefore, their discussions would be more inclined to focus on "Business conspiracy theories." For instance:

> *GMO is just a technology, which is no different from computer technology. Monsanto just wants to use this technology to do reasonable business* (Citizen science communicator, No. 6).

Similar Opposition Toward Genetically Modified Organisms Conspiracy Theories

Although their backgrounds are different, citizen science communicators and scientist science communicators on Zhihu have shown very similar attitudes toward the GMOs conspiracy theories mentioned in their answers. According to the thematic coding of 60 GMOs answers, except for minimal neutrality toward the GMO conspiracy theories mentioned (3/13 citizens' answers and 1/11 scientists' answers), both citizen science communicators and scientist science communicators demonstrated a clear rejection of the GMOs conspiracy theories they mentioned (**Table 3**). For instance:

> *Several posts about GMOs circulated on the Internet are full of conspiracy theories. The more famous saying is: GMOs is the biochemical weapon developed by the United States government (or Freemasonry?) against China as a big killer to destroy the Chinese people. I don't think you will still believe this even if you have seen any documentary about GMOs* (Citizen science communicator, No. 11).

> *Imagine if a conspirator really transfers the highly toxic protein harmful to people into rice, the rice is 100% unsafe, who will eat it and buy it?* (Scientist science communicator, No. 4)

Therefore, unlike what many Chinese official media or even some scholars claim – for example: "many people (in China) on the Internet have a conspiracy theory about GMOs, believing that it is the conspiracy of large western enterprises" (People's Daily Online, 2013-10-14), "in recent years, GMOs conspiracy theory has been widely spread on the Internet in China" (Gao and Qi, 2020) – at least as communicators, both Chinese non-scientists and scientists are opposed to GMOs conspiracy theories. Even those neutral expressions toward some mentioned GMOs conspiracy theories are only simple descriptions with

TABLE 3 | Attitudes of citizen science communicators and scientist science communicators toward GMOs conspiracy theories on Zhihu.

	Support	Oppose	Neutral	Total
Citizen science communicators	0 (0%)	13 (48.2%)	3 (11.1%)	16 (59.3%)
Scientist science communicators	0 (0%)	10 (37.0%)	1 (3.7%)	11 (40.7%)
Total	0 (0%)	23 (85.2%)	4 (14.8%)	27 (100%)

rational attitude, rather than "widespread" as some Chinese official media or scholars claim, for instance:

> *Conspiracy theories or something, I don't pay much attention to, personally. Whether GMOs are harmful to the human body depends on scientific research, not baseless conjecture* (Citizen science communicator, No. 28).

Different Discourse Strategies Toward Genetically Modified Organisms Conspiracy Theories

Through the open coding on the discourse strategies used to support attitudes toward GMOs conspiracy theories on Zhihu, referring to the trust generation mechanism (Zucker, 1986), it has been found that citizen science communicators and scientist science communicators adopt different discourse strategies, although they have very similar oppositional attitudes toward GMOs conspiracy theories.

Scientist science communicators prefer to demonstrate their attitude toward GMOs conspiracy theories by resorting to evidence that is endorsed by science, which is more like institution-based trust production proposed by Zucker (1986; Schilke et al., 2017). "Institution-based trust" refers to the trust generated by the guarantee of various professional materials, bureaucratic organizations and professional institutions (Jin, 2018, p. 160). When proving their attitude toward GMOs conspiracy theories, scientist science communicators suggest that it violates professional scientific knowledge or "science" as a social institution (Hartung, 1951). For instance:

> *From the retroviral drugs of HIV to the protein structure of Zika virus, even if there are problems, it is up to our scientists to find solutions. Those keyboard warriors who do not understand science and the history of science at all please do not spread those conspiracy theories* (Scientist science communicator, No. 9).

> *The scientists engaged in transgenics believe that this breeding method is more reliable than traditional cross-breeding, because the consequences of transplanting a gene are known and controllable. The whole process meets the scientific requirements. Therefore, there is no need to think like conspiracy theory* (Scientist science communicator, No. 29).

> *China's support-GMOs and reverse-GMOs should become a debate between science and conspiracy theory. All conspiracy theories are anti-science in nature* (Scientist science communicator, No. 11).

As in the above examples, when scientist science communicators express their opposition to GMOs conspiracy theories, their expressions are often direct and employ less rhetoric. However, citizen science communicators prefer to use rhetorical devices such as irony to express their opposition to GMOs conspiracy theories. For instance:

> *In order to thwart such genetically modified conspiracy, I honestly suggest that the questioner and all the anti-GMOs people immediately give up all food sold in the market (because you don't know whether there are genetically modified ingredients in it), and go to the virgin forest immediately to find the original species for cultivation. In this way, you can save mankind. Don't eat any food on the market! Remember!* (Citizen science communicator, No. 12)

In addition to more rhetorical devices, when trying to support their opposition to GMOs conspiracy theories, citizen science communicators resort to a kind of "lay logic" rather than professional scientific knowledge. "Lay logic" means thinking modes that are learned and used in citizens' daily life without professional training (Williams, 1983). For instance:

> *The reason why GMOs conspiracy theories are so popular is that too many people don't like to use their brains and like to judge the real world through simple imagination and dramatic deduction* (Citizen science communicator, No. 7).

> *If GMOs are really toxic, and Americans consume more of these foods than we do, then they should go extinct first* (Citizen science communicator, No. 16).

> *If it is really a conspiracy, then this conspiracy chain must spread all over the world, covering almost all scientists, agricultural companies and government departments. Monsanto? No matter how big, it is just a company, okay? God, does such a big interest group or conspiracy chain really exist? I don't think so* (Citizen science communicator, No. 6).

In the examples above, the citizen science communicators demonstrate the unreliability of GMOs conspiracy theories from the perspective of ordinary people, instead of resorting to more professional scientific knowledge, terminology or logic. The discourse strategy of lay logic is like the social similarity-based trust production described by Zucker (1986). "Similarity-based trust" refers to the trust generated by the similarities in demographic factors, social values, thinking modes, and behavior logic between communicators and audiences (Jin, 2018, p. 160). Using lay logic as a discourse strategy, the citizen science communicators may achieve greater logical and emotional resonance with a citizen audience based on their similar non-professional backgrounds and way of thinking, as professional scientific knowledge or logic is removed from citizen's daily lives (Yang, 2021a).

Although citizen science communicators and scientist science communicators both oppose GMOs conspiracy theories, they adopt very different discourse strategies to support their attitudes on Zhihu. Scientist science communicators tend to use direct scientific knowledge and logic to support their views with fewer rhetorical devices, while citizen science communicators are more inclined to use "lay logic" with more rhetorical devices. This reflects two completely different trust generation strategies: trust based on institution and trust based on social similarity.

DISCUSSION AND CONCLUSION

The public acceptance of GMOs is believed to be influenced by multiple factors, such as public perception of GMOs' adverse effect on the environmental and/or human health (Ishii and Araki, 2016), trust in science or governments (Pechar et al., 2018), public local knowledge and traditional morality (Motta, 2014), price and market circulation of GMOs (Paull, 2019), as well as the conspiracy theories around GMOs (Burke, 1999; Lyons et al., 2019; Evanega et al., 2022). And among those factors, conspiracy theories around GMOs are considered as one of the most important communicational and psychological factors in public discussion and acceptance of GMOs. If you want to understand the acceptance of GMOs in the society, and the public's psychological perception of GMOs, the studies on conspiracy theories around GMOs cannot be bypassed. Returning to the research questions proposed above, the results of this limited study based on thematic and open coding show that "business conspiracy theories" about GMOs are the most mentioned and discussed GMOs conspiracy theory, followed by "GMOs as state control tool" on Zhihu. Both citizen science communicators and scientist science communicators are inclined to show an oppositional attitude to all GMOs conspiracy theories on Zhihu, despite their different backgrounds. Although they have similar attitudes toward GMOs conspiracy theories, citizen science communicators and scientist science communicators adopt very different discourse strategies to demonstrate their attitude. Specifically, citizen science communicators tend to use "lay logic" with more rhetorical devices, while scientist science communicators tend to use direct scientific knowledge and logic with fewer rhetorical devices.

Many Chinese surveys and academic studies point out that GMOs conspiracy theories are very popular on China's Internet, especially among the public. For instance, Fan et al. (2013) analyzed the spread of the genetically modified "golden rice incident" on Weibo in the summer of 2012 and found that GMOs conspiracy theories was the main subject in public communication on the issue. Official reports by many Chinese media mentioned above imply that China's online public, especially those without a scientific background or with low scientific literacy, tend to believe in GMOs conspiracy theories. However, this study shows that, both non-scientific citizens and scientists on Zhihu tend to reject and refute GMOs conspiracy theories when playing the role of communicators. Echoing the existing research, especially those on the GMO conspiracy theories among the Chinese public (Fan et al., 2013; Liu and Huang, 2020), this study could be believed to have a great external reliability, which results maybe can be applied in a broader digital media environment, more than just Zhihu.

During the communication process, the role of audiences is often accompanied with the status of passive acceptance of information, while the role of communicators requires initiative from the people who play such roles when delivering information (Shaw, 2005; Illingworth, 2017). Such active delivering or communicating behaviors requires the intervention of more energy and more careful thinking (Rowan, 1994; Wick, 2000; Rush Hovde and Renguette, 2017), because being a communicator risks criticism by others and similar social pressures (Rowan, 1994). Therefore, when people intervene in the communication process as communicators, they tend to carefully choose those views that are considered more "correct" by society than being just "audiences," as per the "social skin" in the theory of "Spiral of Silence" (Asch, 1955; Noelle-Neumann, 1993). Although there may still be some conspiracy theories around GMOs in society, the overall trend is that people are more and more aware of the mistakes and inaccuracy of those conspiracy theories (Berman, 2020). Therefore, when they become science communicators, citizens and scientists should consider the pressure of such "social skin" to express the attitude mainly recognized by mainstream society. This may be why the attitude of both citizen science communicators and scientist science communicators toward GMOs conspiracy theories on Zhihu is consistently oppositional. In addition, the scientific literacy of citizens has also been found to be relevant to their attitude toward conspiracy theories (Fasce and Picó, 2019; Miller, 2020; Jia and Luo, 2021; Luo and Jia, 2021; Yang et al., 2021). The public with high scientific literacy tends to oppose conspiracy theories. Due to its characteristics of knowledge sharing, Zhihu's users are found to have generally higher scientific literacy than other Chinese social media, such as Weibo, WeChat, or Douyin. Studies have also found that users with higher information and scientific literacy are more inclined to spread information on digital media platforms and become communicators (Peng and Chen, 2021; Yang, 2021a). Therefore, we have reason to assume that citizen science communicators on Zhihu have higher information literacy and scientific literacy than ordinary Chinese Internet users, which also contribute to their attitude of rejection toward GMO conspiracy theories like scientist science communicators on Zhihu.

Based on the discussion above, perhaps a binary opposition between scientists and the public to understand GMOs conspiracy theories is incorrect – the idea that scientists oppose GMOs conspiracy theories and educate the public who believe in them is not accurate. This study shows that the communication system of GMOs conspiracy theories, especially in the digital environment, is more complex and diverse. Both scientists and the public can be communicators and advocates of anti-GMOs conspiracy theories. Differences in scientific background do not necessarily change attitudes and solidify their roles in the anti-GMOs conspiracy theories communication process. However, difference in background may change the discourse strategies adopted in anti-GMOs conspiracy theories communication. Citizen science communicators and scientist science communication both tend to adopt discourse strategies that match their social identity, background and experience. Which strategies are more effective in advocating anti-GMOs conspiracy theories? Such questions still need to be determined in more follow-up empirical studies.

An additional observation is that when scientist science communicators and citizen science communicators mention GMOs conspiracy theories, they both tend to think that other citizens will believe these conspiracy theories, but they are soberly

opposed to them. This is akin to the "third-person effect" theory by Davison (1983), which suggests that people tend to think that the information in the mass media (especially persuasive or negative information) may have a greater effect on others than on themselves, based on personal biases (Perloff, 1999). This kind of effect has also been found in conspiracy theories communication (Liu and Huang, 2020). In this study, both citizen science communicators and scientist science communicators saw their own views as rational, while others were more easily influenced by GMOs conspiracy theories.

In conclusion, in the face of GMO conspiracy theories, we need to take a more diversified perspective to consider those non-scientist publics and other potential actors. We should not treat their attitudes toward GMOs conspiracy theories and their roles in the communication of anti-GMOs conspiracy theories with a fixed or stereotyped attitude. We must attach more importance to the public's roles, which may not be inferior to scientists as communicators in anti-GMOs conspiracy theories. Since this study is only based on a qualitative analysis with limited samples, its conclusion may not be absolutely rigorous, which also requires us to continuously expand the analytical sample and research platform beyond Zhihu in the follow-up research.

DATA AVAILABILITY STATEMENT

The original contributions presented in this study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

ETHICS STATEMENT

This study was approved by Ethics Administrator Office of Sociological Studies, The University of Sheffield (Approval Number: 023021 on 23 November 2018). Written informed consent from the participants was not required to participate in this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

FUNDING

This research was funded by project "Study on the Optimization and Modernization of Township Science Communication System in the Age of Digitalization" of Center for Chinese Urbanization Studies, Soochow University (22CZHC011) and Key Project "Study on the permanent mechanism of communicating scientific spirit and professionalism in digital era" of National Social Science Foundation of China (No. 21AZD013).

REFERENCES

Asch, S. E. (1955). Opinions and social pressure. *Sci. Am.* 193, 31–35. doi: 10.1038/scientificamerican1155-31

Baram-Tsabari, A., and Lewenstein, B. V. (2017). "Preparing scientists to be science communicators," in *Preparing Informal Science Educators*, ed. P. G. Patrick (Cham: Springer), 437–471. doi: 10.1007/978-3-319-50398-1_22

Berman, J. M. (2020). *Anti-Vaxxers: How to Challenge a Misinformed Movement*. Cambridge, MA: MIT Press.doi: 10.7551/mitpress/12242.001.0001

Bielecka, A., and Mohammadi, A. A. (2014). State-of-the-art in biosafety and biosecurity in European countries. *Arch. Immunol. Ther. Exp.* 62, 169–178. doi: 10.1007/s00005-014-0290-1

Brownell, S. E., Price, J. V., and Steinman, L. (2013). Science communication to the general public: why we need to teach undergraduate and graduate students this skill as part of their formal scientific training. *J. Undergrad. Neurosci. Educ.* 12:E6–E10.

Burke, D. (1999). No GM conspiracy. *Nature* 401, 640–641. doi: 10.1038/44262

Cao, C. (2018). *GMO China: How Global Debates Transformed China's Agricultural Biotechnology Policies*. New York, NY: Columbia University Press.doi: 10.7312/cao-17166

Castell, S., Charlton, A., Clemence, M., Pettigrew, N., Pope, S., Quigley, A., et al. (2014). *Public Attitudes to Science 2014*, Vol. 194. London: Ipsos MORI Social Research Institute, 28.

Chameides, W. L., Yu, H., Liu, S. C., Bergin, M., Zhou, X., Mearns, L., et al. (1999). Case study of the effects of atmospheric aerosols and regional haze on agriculture: an opportunity to enhance crop yields in China through emission controls? *Proc. Natl. Acad. Sci. U.S.A.* 96, 13626–13633. doi: 10.1073/pnas.96.24.13626

Cui, K., and Shoemaker, S. (2020). Differences in public attitudes towards GM between China and the United States and the reasons for public questioning GM. *J. Huazhong Agricult. Univers.* 10, 155–159+168.

Davison, W. P. (1983). The third-person effect in communication. *Public Opin. Q.* 47, 1–15. doi: 10.1086/268763

Dickel, S., and Franzen, M. (2016). The" Problem of Extension" revisited: new modes of digital participation in science. *J. Sci. Commun.* 15, 1–15. doi: 10.22323/2.15010206

Douglas, K. M., Uscinski, J. E., Sutton, R. M., Cichocka, A., Nefes, T., Ang, C. S., et al. (2019). Understanding conspiracy theories. *Polit. Psychol.* 40, 3–35. doi: 10.1111/pops.12568

Evanega, S., Conrow, J., Adams, J., and Lynas, M. (2022). The state of the 'GMO' debate-toward an increasingly favorable and less polarized media conversation on ag-biotech? *GM Crops Food* 13, 38–49. doi: 10.1080/21645698.2022.2051243

Fähnrich, B., Riedlinger, M., and Weitkamp, E. (2020). Activists as "alternative" science communicators—Exploring the facets of science communication in societal contexts. *J. Sci. Commun.* 19:C01. doi: 10.22323/2.19060301

Fan, J. Q., Jia, H. P., Zhang, F., and Peng, G. M. (2013). Research on the communication form of controversial scientific topics in social media – Taking Sina Weibo of "golden rice event" as an example. *J. Commun. Res.* 20, 106–116+128.

Fan, K. (2014). Globalization and political imagination of genetically modified food. *J. Jiangsu Univers. Admin.* 21, 61–68.

Fasce, A., and Picó, A. (2019). Science as a vaccine. *Sci. Educ.* 28, 109–125. doi: 10.1007/s11191-018-00022-0

Gao, F. F., and Qi, L. (2020). Analysis of anti-gene discourse strategy from the perspective of public participation science. *Fut. Commun.* 27, 21–27.

Gibbs, G. R. (2007). Thematic coding and categorizing. *Anal. Qual. Data* 703, 38–56.

Gough, P., de Berigny Wall, C., and Bednarz, T. (2014). "Affective and effective visualisation: communicating science to non-expert users," in *Proceedings of the 2014 IEEE Pacific Visualization Symposium*, (Yokohama: IEEE), 335–339.

Hartung, F. E. (1951). Science as an institution. *Philos. Sci.* 18, 35–54. doi: 10.1109/PacificVis.2014.39

Hussein, E., Juneja, P., and Mitra, T. (2020). "Measuring misinformation in video search platforms: an audit study on YouTube," in *Proceedings of the ACM on Human-Computer Interaction*, *4*(CSCW1), (New York, NY), 1–27. doi: 10.1145/3392854

Illingworth, S. (2017). Delivering effective science communication: advice from a professional science communicator. *Semin. Cell Dev. Biol.* 70, 10–16.

Ishii, T., and Araki, M. (2016). Consumer acceptance of food crops developed by genome editing. *Plant Cell Rep.* 35, 1507–1518. doi: 10.1016/j.semcdb.2017.04.002

Jia, H., and Luo, X. (2021). I wear a mask for my country: conspiracy theories, nationalism, and intention to adopt covid-19 prevention behaviors at the later stage of pandemic control in China. *Health Commun.* Online ahead of print, doi: 10.1080/10410236.2021.1958982

Jia, H., Wang, D., Miao, W., and Zhu, H. (2017). Encountered but not engaged: examining the use of social media for science communication by Chinese scientists. *Sci. Commun.* 39, 646–672. doi: 10.1177/1075470177735114

Jiang, S., and Fang, W. (2019). Misinformation and disinformation in science: examining the social diffusion of rumours about GMOs. *Cult. Sci.* 2, 327–340. doi: 10.1177/209660831900200407

Jin, J. B. (2018). *Science Communication: The Formation and Evolution of Public's Perceptions of Controversial Technologies*. Beijing: Tsinghua University Press.

Keeley, B. L. (2019). "Of conspiracy theories," in *Conspiracy Theories*, ed. D. Coady (Milton Park: Routledge), 45–60. doi: 10.3390/ijerph18010266

Lakhvich, T. (2021). Public science education: some more roles and contributions. *J. Baltic Sci. Educ.* 20, 864–867. doi: 10.33225/jbse/21.20.864

Laziæ, A., and Žeželj, I. (2021). A systematic review of narrative interventions: lessons for countering anti-vaccination conspiracy theories and misinformation. *Public Underst. Sci.* 30, 644–670. doi: 10.1177/09636625211011881

Lewandowsky, S., Gignac, G. E., and Oberauer, K. (2013). The role of conspiracist ideation and worldviews in predicting rejection of science. *PLoS One* 8:e75637. doi: 10.1371/journal.pone.0075637

Li, Y., Luo, C., and Chen, A. (2019). The evolution of online discussions about GMOs in China over the past decade: changes, causes and characteristics. *Cult. Sci.* 2, 311–325. doi: 10.1177/209660831900200406

Liu, P. L., and Huang, L. V. (2020). Digital disinformation about COVID-19 and the third-person effect: examining the channel differences and negative emotional outcomes. *Cyberpsychol. Behav. Soc. Network.* 23, 789–793. doi: 10.1089/cyber.2020.0363

Liu, Y. W. (2012). Penetrate the fog of "genetically modified conspiracy". *Sci. News* 12, 82–83.

Luo, X., and Jia, H. (2021). When scientific literacy meets nationalism: exploring the underlying factors in the Chinese public's belief in COVID-19 conspiracy theories. *Chin. J. Commun.* 15, 227–249. doi: 10.1080/17544750.2021.1954963

Lynas, M. (2013). *Time to Call Out the Anti-GMO Conspiracy Theory. Mark Lynas Speech Hosted by the International ProgramsŰCollege of Agriculture and Life Sciences (50th Anniversary Celebration), and the Atkinson Center for a Sustainable Future.* Mount Vernon, IA: Cornell University.

Lynas, M. (2015). *With GMO Policies, Europe Turns Against Science* (New York, NY: New York Times), 10.

Lyons, B., Merola, V., and Reifler, J. (2019). Not just asking questions: effects of implicit and explicit conspiracy information about vaccines and genetic modification. *Health Commun.* 34, 1741–1750. doi: 10.1080/10410236.2018.1530526

Mahl, D., Schäfer, M. S., and Zeng, J. (2022). Conspiracy theories in online environments: an interdisciplinary literature review and agenda for future research. *N. Media Society*. 16:14614448221075759. doi: 10.1177/14614448221075759

Miller, B. L. (2020). Science denial and COVID conspiracy theories: potential neurological mechanisms and possible responses. *JAMA* 324, 2255–2256. doi: 10.1001/jama.2020.21332

Mitchell, S. S. (2019). Population control, deadly vaccines, and mutant mosquitoes: the construction and circulation of zika virus conspiracy theories online. *Can. J. Commun.* 44, 211–237. doi: 10.22230/cjc.2019v44n2a3329

Motta, R. (2014). Social disputes over GMOs: an overview. *Sociol. Compass* 8, 1360–1376. doi: 10.1111/soc4.12229

Nerlich, B., Koteyko, N., and Brown, B. (2010). Theory and language of climate change communication. *Wiley Interdiscip. Rev.* 1, 97–110. doi: 10.1002/wcc.2

Nielsen, K. H. (2010). More than "mountain guides" of science: a questionnaire survey of professional science communicators in Denmark. *J. Sci. Commun.* 9:2.

Noelle-Neumann, E. (1993). *The Spiral of Silence: Public Opinion–Our Social Skin*. Chicago, IL: University of Chicago Press.

Paull, J. (2019). Genetically Modified (GM) canola-price penalties and contaminations. *Biomed. J. Sci. Technic. Res.* 17, 12618–12621. doi: 10.1016/j.fct.2006.07.009

Pechar, E., Bernauer, T., and Mayer, F. (2018). Beyond political ideology: the impact of attitudes towards government and corporations on trust in science. *Sci. Commun.* 40, 291–313. doi: 10.1177/1075547018763970

Peng, A. Y., and Chen, S. (2021). Traditional Chinese medicine works: a politicised scientific debate in the COVID-19 pandemic. *Asian J. Commun.* 31, 421–435. doi: 10.1080/01292986.2021.1913618

Perloff, R. M. (1999). The third person effect: a critical review and synthesis. *Media Psychol.* 1, 353–378. doi: 10.1207/s1532785xmep0104_4

Rowan, K. E. (1994). Why rules for risk communication are not enough: a problem-solving approach to risk communication. *Risk Anal.* 14, 365–374. doi: 10.1111/j.1539-6924.1994.tb00253.x

Rush Hovde, M., and Renguette, C. C. (2017). Technological literacy: a framework for teaching technical communication software tools. *Technic. Commun. Q.* 26, 395–411. doi: 10.1080/10572252.2017.1385998

Schilke, O., Wiedenfels, G., Brettel, M., and Zucker, L. G. (2017). Interorganizational trust production contingent on product and performance uncertainty. *Socio Econ. Rev.* 15, 307–330. doi: 10.1093/ser/mww003

Shaw, K. (2005). An engagement strategy process for communicators. *Strateg. Commun. Manag.* 9:26.

Smallman, S. (2018). Conspiracy theories and the zika epidemic. *J. Int. Glob. Stud.* 9, 1–14.

Smith, G. (2016). "Look north": conspiracy and the sojazacíon of Argentina. *Stud. Anthropol.* 5, 5–23. doi: 10.1002/j.sda2.20160501.0001

Uscinski, J. E., and Parent, J. M. (2014). *American Conspiracy Theories*. Oxford: Oxford University Press.

Vicari, S. (2021). Is it all about storytelling? Living and learning hereditary cancer on Twitter. *N. Media Soc.* 23, 2385–2408. doi: 10.1177/1461444820926632

Wang, G., Wang, L., and Shen, J. (2021). Food to politics: representations of genetically modified organisms in cartoons on the Internet in China. *Public Underst. Sci.* 30, 274–284. doi: 10.1177/0963662520983564

Wang, X., and Song, Y. (2020). Viral misinformation and echo chambers: the diffusion of rumors about genetically modified organisms on social media. *Internet Res.* 30, 1547–1564. doi: 10.1108/INTR-11-2019-0491

Wick, C. (2000). Knowledge management and leadership opportunities for technical communicators. *Technic. Commun.* 47, 515–529.

Williams, R. (1983). Concepts of health: an analysis of lay logic. *Sociology* 17, 185–205. doi: 10.1177/0038038583017002003

Xu, Q., Yu, N., and Song, Y. (2018). User engagement in public discourse on genetically modified organisms: the role of opinion leaders on social media. *Sci. Commun.* 40, 691–717. doi: 10.1177/1075547018806526

Xu, Z., and Lu, Y. (2019). Imagining GMOs: the Chinese public's scientific perception in the digital age. *Cult. Sci.* 2, 241–253.

Yang, J., Xu, K., and Rodriguez, L. (2014). The rejection of science frames in the news coverage of the golden rice experiment in Hunan, China. *Health Risk Soc.* 16, 339–354. doi: 10.1177/209660831900200402

Yang, Z. (2021a). *Citizen Science Communicators, Boundary-Work and Scientific Authority: Struggle for Discourse Authority between Scientists and the Public in the Digital Media Environment of China* (Doctoral dissertation). Sheffield: University of Sheffield.

Yang, Z. (2021b). Deconstruction of the discourse authority of scientists in Chinese online science communication: investigation of citizen science communicators on Chinese knowledge sharing networks. *Public Underst. Sci.* 30, 993–1007. doi: 10.1177/09636625211005106

Yang, Z. (2022a). The new stage of public engagement with science in the digital media environment: citizen science communicators in the discussion of GMOs on Zhihu. *N. Genet. Soc.* 14, 1–20. doi: 10.1080/14636778.2022.2063826

Yang, Z. (2022b). Inadequate interactions and unbalanced power between scientists and the public in chinese knowledge sharing network: social network analysis of the topic of genetically modified food on Zhihu. *Soc. Sci. Comput. Rev.* 20:08944393221087668. doi: 10.1177/08944393221087668

Yang, Z., Luo, X., and Jia, H. (2021). Is it all a conspiracy? Conspiracy theories and people's attitude to COVID-19 vaccination. *Vaccines* 9:1051. doi: 10.3390/vaccines9101051

Zhang, H. (2016). The GMO controversy in China: more than food security. *IPP Rev*. 15:2016.

Zhao, Y., Deng, H., Yu, C., and Hu, R. (2019). The Chinese public's awareness and attitudes toward genetically modified foods with different labeling. *NPJ Sci. Food* 3:17. doi: 10.1038/s41538-019-0049-5

Zucker, L. (1986). Production of trust: institutional sources of economic structure, 1840-1920. *Res. Organ. Behav.* 8, 53–111.

Conflict of Interest: The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers | Frontiers in Psychology

TYPE Original Research
PUBLISHED 20 September 2022
DOI 10.3389/fpsyg.2022.955541

OPEN ACCESS

EDITED BY
Guoyan Wang,
Soochow University,
China

REVIEWED BY
Hepeng Jia,
Soochow University,
China
Zheng Yang,
Soochow University,
China

*CORRESPONDENCE
Jinghong Xu
123abctg@163.com

SPECIALTY SECTION
This article was submitted to Personality and Social Psychology, a section of the journal Frontiers in Psychology

RECEIVED 28 May 2022
ACCEPTED 19 August 2022
PUBLISHED 20 September 2022

CITATION
Du Z, Xiao Y and Xu J (2022) How does Information Exposure Affect Public Attitudes Toward GMO in China? The mediating and moderating roles of Conspiracy Belief and Knowledge. *Front. Psychol.* 13:955541. doi: 10.3389/fpsyg.2022.955541

How does Information Exposure Affect Public Attitudes Toward GMO in China? The mediating and moderating roles of Conspiracy Belief and Knowledge

Zhitao Du[1], Yuqi Xiao[1] and Jinghong Xu[2]*

[1]School of Journalism and Communication, University of Chinese Academy of Social Sciences (UCASS), Beijing, China, [2]School of Journalism and Communication, Beijing Normal University, Beijing, China

Background: In China, controversy about genetically modified organisms (GMO) is ongoing and some regard GMO as a "product of a conspiracy," which affects people's attitudes (PAs) toward GMO. Beliefs in conspiracy theories (BCT) are formed from the information that people are exposed to. Information exposure not only constructs a pseudo-environment for individuals to perceive the world, but also generates external stimuli for their mental states and attitudes. People's objective knowledge and self-assessed knowledge play an important moderating role in this process.

Method: The study adopted the stimulus-organism-response (SOR) model, with conspiracy beliefs as mediating variables, to test the mechanism of the independent variable of information exposure on the dependent variable of PAs toward GMO. Objective knowledge and self-assessed knowledge were introduced as moderator variables to explore the different roles of knowledge. A survey of Chinese adults was conducted in February 2022, and partial least squares structural equation modeling (PLS-SEM) was employed to estimate the multi-construct relationships.

Results: Information exposure was significantly and directly connected with PAs toward GMO. BCT also played a significant mediating role. Unofficial information exposure reinforced beliefs in conspiracy theories. Stronger beliefs in conspiracy theories reduced people's willingness to consume GMO foods and made them pessimistic about the development prospects of GMO foods. In contrast, exposure to official information weakened people's beliefs in conspiracy theories and increased their willingness to consume GMO foods. In addition, the level of knowledge had a moderating role. Individual's objective knowledge can effectively reduce the negative relationship of conspiracy beliefs on attitudes toward GMO development. Conversely, individual's self-assessed knowledge can enhance the negative relationship of conspiracy beliefs on attitudes toward GMO development.

Conclusion: Based on psychological and cognitive dimensions, this study provides a new perspective on how information exposure and people's

attitudes toward GMO are related to each other and enriches the variable measurement dimension of knowledge. Simultaneously, it provides a localized explanation of the factors affecting people's attitudes toward GMO in China, providing a new theoretical basis for the subsequent development strategy of GMO foods.

KEYWORDS

attitudes, GMO (genetically modified organism), information exposure, conspiracy theories belief, knowledge

Introduction

As a technological innovation, genetically modified organism (GMO) is an important means of solving the global food shortage. China introduced the herbicide-resistant soyabeans in1996 and now GMO cultivation is a national policy (Chen, 2010). Although in the early 2000s, China was the third-largest global producer of GMO crops, following the United States and Argentina, GMO has become very controversial now. For example, the "golden rice" incident in late 2012 was so controversial that government officials avoided mentioning it at that time because it was too "sensitive" (Qiu, 2012). The dispute between Cui Yongyuan and Fang Zhouzi further sparked public backlash against GMO. Simultaneously, conspiracy theories have gradually spread among the Chinese people, including "Chinese children are being used in experiments on genetically modified rice" and "genetically modified food is being used as a biological weapon against China." This series of incidents and rumors exacerbated the perceived problem of GMO in China and hindered its development. As of 2018, China ranked the seventh regarding the global GMO crop-growing countries. More importantly, the Chinese attitude toward GMO has changed significantly. Tao and Chen (2016) compared Chinese netizens' attitude before and after the dispute between Cui and Fang to find that it changed from neutral to opposing GMO. In a sense, the advancement of genetic technology and GMO are dependent on public attitudes (PAs). Therefore, research on PAs toward GMO and the related factors should be examined further.

Western studies have investigated the factors influencing PAs toward GMO (House et al., 2001; Costa-Font and Gil, 2009), mainly focusing on advanced economies. Since consumers' attitudes toward GMO vary across cultures and geographic characteristics worldwide (Aleksejeva, 2014), it is crucial to study the formation mechanism of attitudes toward GMO among citizens from different cultures and geographical environments. Based on a non-Western context sample, this study investigates the factors that are related to Chinese consumers' attitudes toward GMO.

The stimulus-organism-response (SOR) model contends that external stimuli trigger the audience's attitude and has long been used to study attitude changes. Among the stimuli, information often plays a key role in attitude formation. According to the pseudo-environment theory, people live in a virtual environment constructed by information media, and perceive the world with the help of information media. Considering China's media system, cultural environment, and the media events related to GMO, this study aims to explore how varied information exposures affect individuals' attitudes toward GMO.

Roukis (2006) found that technological progress can lead to uncertainty and create an atmosphere conducive to conspiracy thinking. This has been demonstrated in China where beliefs in conspiracy theories shape perceptions of GMO and adversely affect the future applications of biotechnology. Therefore, this study incorporate beliefs in conspiracy theories into the research framework. Meanwhile, since the previous research have explored the importance of objective knowledge and self-assessed knowledge on public attitude in the topics of science and technology risk (Rozenblit and Keil, 2002; House et al., 2004; Knight, 2005; Fernbach et al., 2019), this paper also tries to discuss the role of objective knowledge and self-assessed knowledge in the relationship between conspiracy theory belief and PAs toward GMO.

This study focuses on three questions:

What role does different information exposure play in the formation of PAs toward GMO?

Does conspiracy theory belief mediate the relationship between information exposure and GMO attitudes?

What role does knowledge play in this process?

This study integrates information exposure and conspiracy beliefs into the SOR model to explain the formation of GMO attitudes among the Chinese public, and to reflect the relationship between the media environment, conspiracy theories, and controversial scientific issues in the Chinese context. It reveals the different roles that objective knowledge and self-assessed knowledge play in this process, and provides insights into the dissemination of GMO knowledge in China. In addition, this study may help westerners to better understand the information environment and the psychological and cognitive factors that shape the Chinese public's GMO attitudes.

Literature review and hypotheses

Although GMO has become public knowledge since the 1990s, debates about GMO foods and related technology have never stopped. Previous research showed that Americans generally have a more positive attitude toward GMO than Europeans (Robinson, 1997; Bredahl, 2001; Lusk et al., 2004). Curtis et al. (2004) found that consumers in developing countries had more positive views toward GMO foods than consumers in developed countries. However, public attitudes toward GMO are rather complicated in China. Huang et al. (2006) found that as many as 62% of respondents in China had a positive attitude toward GMO, which is significantly higher than in other countries. Conversely, a survey by Wang and Xue (2005) in Beijing showed that most people trust traditional products over GMO products. Deng and Hu (2019) showed that 55% of Chinese consumers oppose GMO. These results make it difficult to tell Chinese attitudes toward GMO and further research is needed.

The role of information exposure in the formation of GMO attitudes

Hovland (1959) developed the persuasion model based on the theory of information transition and social judgment. He regarded attitude change as a process during which outside information affects an individual's attitude. Previous research confirmed that information is closely related to the perception and acceptance of GMO (Lusk et al., 2004; Onyango and Nayga, 2004) and we believe that information plays a crucial role in the public's attitudes toward GMO. Previous research examined the influence of the nature of the words used in GMO reports on public GMO attitudes and showed that negative information can exacerbate negative public attitudes while positive information can stimulate positive attitudes (Nickerson, 1998; Lusk et al., 2004; Rousu et al., 2005; Huffman et al., 2007; Hu and Zhou, 2009). It should be emphasized that the public referred to in this study is the non-scientist group, because scientists and non-scientists may have completely different attitudes toward some issues.

Researchers have explored the influence of different information sources on attitudes toward GMO technology. Frewer et al. (1998) and Nisbet et al. (2002) contended that television, radio, and newspapers are the main channels of information for people to make biotechnological decisions. Previous studies have also showed the differences in people's access to GMO information. Pang (2020) found that public attitudes toward GMO correlate with their dependence on information channels. Zhang et al. (2016) and Deng and Hu (2019) pointed out that individual trust in sources is also an important factor affecting attitudes toward GMO and that trust in government agencies and GMO experts positively correlates with the public acceptance of GMO. However, people may present completely different, or even opposing, perceptions and attitudes while using the same media and different types of information are more accurate predictors. Therefore, this study explores whether different information exposure affects public attitudes toward GMO from the perspective of official vs. unofficial information.

In China, media dominated by the governments and conveying mainstream ideology and values are usually defined as mainstream media and are also regarded as an official source of information. Specifically, mainstream media mainly refers to the newspapers, radio, and television stations of the central, provincial, and municipal party committees. He et al. (2015) found that people who obtained GMO information through public channels had a more positive attitude toward GMO while information from official sources has played a positive role in the application of transgenic technology in China. Pang (2020) also found that authoritative information dissemination channels play important roles in influencing the public's knowledge and attitude toward GMO. Thus, we propose the following hypothesis:

> *H1a*: Official information exposure has a significant, positive relationship with public attitudes toward GMO development.

Previous research demonstrated that it is more effective to know how individuals feel about purchasing or using an item than simply understanding consumers' evaluation of the item itself (Azjen, 1980). Therefore, in addition to examining the public's perception of the development of GMO technology, the public's attitude toward the consumption of GMO foods is an important factor. Thus, we propose the following hypothesis:

> *H1b*: Official information exposure has a significant positive relationship with public attitudes toward GMO foods consumption.

Globally, many countries have reported the continued growth in social media as news sources (Newman et al., 2017) and most consumers obtain information about GMO *via* the internet (Cui and Shoemaker, 2018; Deng and Hu, 2019). Previous research examined the role of social media in news consumption and its potential impact on individual decision-making and behavior (Fletcher and Nielsen, 2018; Huber et al., 2019). On one hand, some scholars are excited about its positive impact, arguing that equal access and equality in information production and dissemination contribute to the formation and maturation of deliberative democracy (Rishel, 2011). On the other hand, scholars have shown that due to the lack of gatekeepers, fact-checking, and imperfect legal systems, social media has gradually become a hotbed of conspiracy theories and rumors (Bastani and Bahrami, 2020; Hameleers et al., 2020; Vraga et al., 2020, 2022). Thus, the dangers of unofficial sources of information began to emerge. Deng and Hu (2019) found that consumers who obtained information on GMO through the internet or WeChat were less likely to accept GMO than those who obtained information from other channels. Thus, we propose the following hypotheses:

> *H2a*: Unofficial information exposure has a significant negative relationship with public attitudes toward GMO development.

H2b: Unofficial information exposure has a significant negative relationship with public attitudes toward GMO food consumption.

The complexity of attitude formation: Belief in conspiracy theories as mediating variable

Since factors influencing audience attitudes are diverse and complex, it is impossible to examine the linear relationship between specific variables. Among the models that explore changes in audience attitudes, the stimulus–response (S-R) and knowledge-attitude-practice (KAP) models are the most popular. Based on the S-R model, the SOR model was proposed, which posits that the audience's attitude is triggered by external stimuli, directly or indirectly affecting the audience's physiological and psychological states (Woodworth and Schlosberg, 1954). This study adopts the SOR model to explore the complex mechanism how information exposure affects public attitudes and behaviors toward GMO since the KAP model ignores the influence of external environment on attitudes.

Extensive research found that the perceived safety perception of GMO (Huang et al., 2014), the level of knowledge about GMO (Simis et al., 2016), the level of social trust (Jennings and Russell, 2019; Zhao et al., 2020), and the conspiracy theory beliefs (Yang, 2013) are correlated with the formation of public attitudes toward GMO and the polarization of public GMO attitudes. Considering that conspiracy theories about GMO are very popular in China, we focus on the relationship between conspiracy beliefs and GMO attitudes.

Conspiracy theory is construed to explain major social and political events by a small group of people out of self-interest and against public interest (Goertzel, 1994; Douglas and Sutton, 2008; Uscinski and Parent, 2014; Green and Douglas, 2018). With the development of the internet and the rise of social media, conspiracy theories have developed into "a mainstream paradigm through which many people try to understand the world" (Bantimaroudis et al., 2020). Previous research has found conspiracism to be a largely consistent predictor of specific anti-science beliefs across various domains (Landrum and Olshansky, 2019). There are also many conspiracy theories regarding GMO. For example, GMO crops were used by Americans to conquer the world, making developing countries more dependent on United States weapons for agricultural inputs (Ermakova, 2005; Robin, 2014).In China, a study showed that 13.8% of respondents believed that GMO technology was a form of bioterrorism against China (Cui and Shoemaker, 2018). Furthermore, some GMO conspiracy theories use academic research to increase their validity (Seralini et al., 2012). Once conspiracy beliefs are solidified, regulatory measures to debunk them may not have the expected effect (Stojanov et al., 2015; Wood, 2016). The promotion and development of GMO technology will also be affected. The golden rice case is a typical example (Shan and Jin, 2012).

Oleksy et al. (2020) distinguished two types of conspiracy theories—general conspiracy theories and government-related conspiracy theories. Scholars found that individuals who believe in one specific conspiracy theory often believe in other conspiracy theories, even logically conflicting ones (Wood et al., 2012). This empirical evidence has led scholars to define belief in conspiracy theories as a distinct psychological characteristic (Jia and Luo, 2021; Yang et al., 2021). This means that people tend to achieve their interpretive goals by attributing significant political or social events to the secrete plans of powerful groups or individuals (Goertzel, 1994; Uscinski and Parent, 2014; Green and Douglas, 2018). This study tends to focus on the role of belief in conspiracy theories in the relationship between information exposure and PAs toward GMO.

Extreme attitudes are associated with conspiracy theory beliefs when it comes to issues such as vaccination (Jolley and Douglas, 2014a) and climate change (Jolley and Douglas, 2014b). Conspiracy theory beliefs stabilize the self and inner group by blaming others for adverse outcomes, thereby polarizing attitudes (Douglas et al., 2017). Yang (2013) found that the strength of beliefs in conspiracy theories was a significant predictor of intentions to consume GMO foods. Thus, we propose the following hypotheses:

H3a: Individual beliefs in conspiracy theories are significantly negatively related to public attitudes toward GMO development.

H3b: Individual beliefs in conspiracy theories have significant negative relationship with public attitudes toward GMO food consumption.

Existing studies have demonstrated significant associations between different information exposure and beliefs in conspiracy theories (Hollander, 2018; Mancosu and Vegetti, 2021; Xiao et al., 2021). Stempel et al. (2007) contended that individuals who access official and mainstream media are more reluctant to believe the conspiracy theories. Thus, we propose the following hypothesis:

H4a: Official information exposure is significantly negatively associated with public belief in conspiracy theories.

Many studies proved that most "famous" conspiracy theories were originally generated from and spread on social media (Pennycook et al., 2020). Allington et al. (2021) argued that individuals who use social media as a source of news or information have stronger beliefs about COVID-19-related conspiracy theories. Moreover, Hu (2016) showed that rumors about food safety accounted for 45% of all internet rumors, seriously affecting public trust. Thus, we propose the following hypothesis:

H4b: Unofficial information exposure has a significant positive relationship with public belief in conspiracy theories.

Objective knowledge and self-assessed knowledge as moderator variables

Knowledge has led to polarized attitudes toward scientific and policy issues (Van der Linden et al., 2017), and while relative strengths and weaknesses vary across issues (Drummond and Fischhoff, 2017), such polarization is evident in the case of GMO (Fernbach et al., 2019). The scientific community believes that scientific knowledge promotes public acceptance of new technologies (Simis et al., 2016). Many empirical studies have demonstrated that scientific knowledge is positively correlated with public support for science and learning scientific knowledge can compensate for information asymmetry in transgenic technology, thereby awakening individuals' attitudes toward transgenic technology based on objective cognition (Priest, 2000; Allum et al., 2008).

However, empirical evidence also suggests that the correlation or explanatory power between scientific knowledge and the perception and acceptability of GMO technology is weak and unstable (Gaskell et al., 2000; Brossard and Nisbet, 2007; Connor and Siegrist, 2010; Druckman and Bolsen, 2011; Mielby et al., 2013). In China, Lv (2009) found that education was significantly correlated with the acceptance of biotechnology applications in food or agriculture. This indirectly relates to the correlation between the level of GMO knowledge and respondents' acceptance of GMO. As China's GMO controversy intensifies, the Chinese public's attitude toward GMO also changes. Some research demonstrated that the role of knowledge levels in public support for GMO is unclear. Cui and Shoemaker (2018) found that more educated individuals are more skeptical of GMO, which contradicts previous studies. This contradiction may be explained by the fact that the knowledge examined in prior studies does not sufficiently reflect controversial scientific and technological issues.

Previous studies measured scientific knowledge only by asking about knowledge or by measuring knowledge questions directly related to GMO. However, scientific knowledge varies by "scientific issue" (Allum et al., 2008). Therefore, the scientific principles cannot be used to explain the audience's level of GMO knowledge directly and indiscriminately. As Miller (1996) pointed out that the scientific literacy scale has three dimensions: first, scientific knowledge, referring to the mastery of vocabulary and scientific terms sufficient to read different scientific viewpoints in the media; second, scientific method, referring to the process of scientific inquiry or reasoning and possessing a certain understanding of logic; third, understanding the relationship between science and society, which means that individuals have a certain degree of cognition about the impact of science and technology on individuals and society. Thus, the psychosocial elements that shape the knowledge-attitude link of GMO must be considered.

The research perspective on risk communication differs from that of scientific communication, in that it regards knowledge as the basis of "risk perception." When judging the impact of controversial technologies on themselves or on society, individuals often use knowledge as a reference to reduce cognitive risks and ultimately, affecting their attitudes (You and Jin, 2020). This is closer to the concept of social influence in the three dimensions of scientific literacy. You and Jin (2020) reconstructed the GMO knowledge scale from both perspectives of science communication and risk communication. The influence of GMO knowledge on attitude and behavior was investigated from three perspectives: scientific principles, GMO development, and social influence.

Considering that different knowledge levels are significantly correlated with beliefs in conspiracy theories (Van Prooijen, 2017), individuals with higher knowledge levels have lower beliefs in conspiracy theories. Thus, we propose the following hypotheses:

> *H5a*: Objective knowledge reduces the negative relationship between belief in conspiracy theories and attitudes toward GMO development.
>
> *H5b*: Objective knowledge reduces the negative relationship between belief in conspiracy theories and attitudes toward GMO foods consumption.

Additionally, knowledge is not a one-dimensional structure. On the highly controversial issue of GMO, Previous research focuses on what people do know. However, it is also important to consider what they think they know (House et al., 2004; Knight, 2005), or the self-assessed knowledge. That is, existing research focuses on the relationship between objective knowledge and attitudes, while ignoring the self-assessed knowledge. When affected by the illusion of knowledge, people often cannot judge how much they do know, and thus overestimate their understanding of things (Sloman and Fernbach, 2018). The illusion is far stronger for explanatory knowledge than for many other kinds of knowledge (Rozenblit and Keil, 2002), such as facts, procedures, or narratives. The Dunning–Kruger effect shows that people who are relatively incompetent have the strongest tendency to overestimate their own competence (Van Prooijen and Krouwel, 2020). Fernbach et al. (2019) demonstrated that people with less knowledge of GMO believe that they know more about GMO. They examined the relationships between extremity of opposition to GM foods, objective knowledge, and self-assessed knowledge about GM foods, and found extremists will display low objective knowledge but high self-assessed knowledge, and that the gap between the two will grow with extremity. Thus, we propose the following hypotheses:

> *H6a*: Self-assessed knowledge can enhance the negative impact of belief in conspiracy theories on attitudes toward GMO development.
>
> *H6b*: Self-assessed knowledge can enhance the negative impact of belief in conspiracy theories on attitudes toward GMO foods consumption.

In summary, information exposure, beliefs in conspiracy theories, objective knowledge, and self-assessed knowledge are important variables that affect public attitudes toward GMO. These

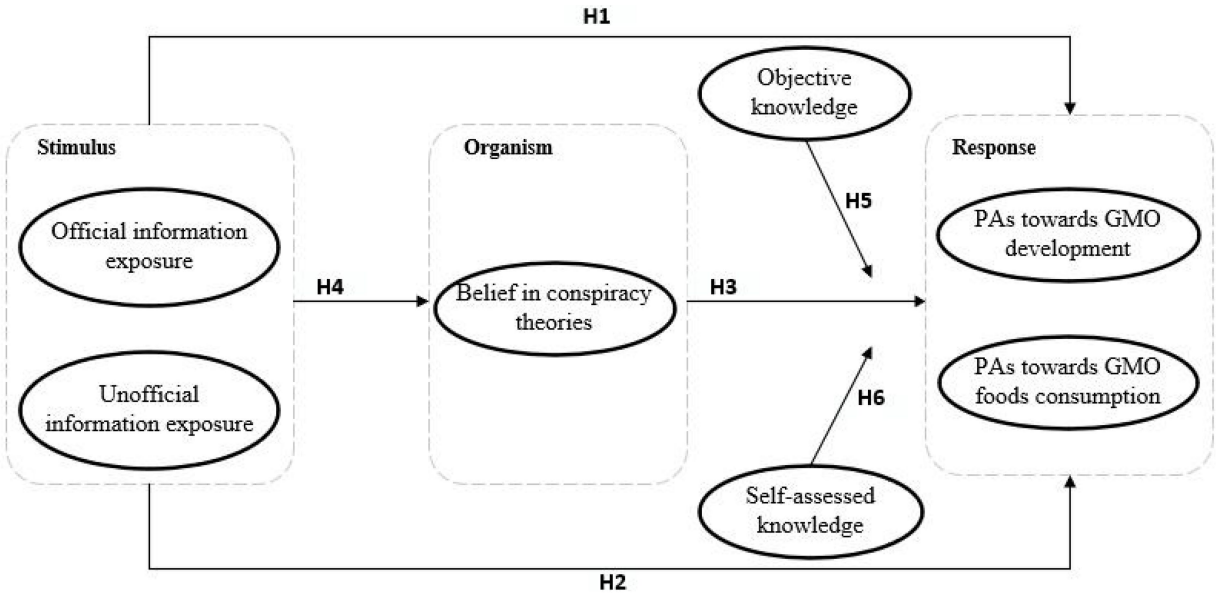


FIGURE 1
Research framework.

variables were integrated into the analytical framework and conceptual model of this study, as shown in Figure 1.

Materials and methods

Participants and procedures

This study conducted a cross-sectional online survey among Chinese adults from February 13, 2022, to March 25, 2022, using Sojump, a top Chinese professional online survey provider with a sampling service of 2.6 million registered users. In order to ensure the quality, we added screener questions and reverse questions. A total of 689 survey invitations to answer questionnaires were randomly sent out. We excluded unqualified questionnaires (those with less than 3 min to answer and those that did not pass the screener and reverse questions) and finally obtained a valid sample of 518, with an effective response rate of 75.2%. Upon completion, respondents received a gift of approximately one dollar as an incentive. Back-translation and pilot tests were conducted before the survey started. This study was approved by the Social Science Ethics Committee of a research university in Beijing, China (approval number: UCASS202201).

Measurement

Information exposure

This study divides information exposure into official information exposure and unofficial information exposure by combining the research of Chu (2020) and Wang and Jin (2019). When investigating official information exposure, respondents were asked about the frequency of information they obtain on a daily basis from the following sources: (1) central media and their websites and APPs, including central-level media such as China Central Radio and Television, People's Daily, Xinhua News Agency, and their accounts on social media; (2) local media and their websites and APPs, including provincial-, municipal-, and county-level radio and television stations, newspapers, and their accounts on social media. When investigating unofficial information exposure, respondents were asked through which of the following channels they primarily obtained unofficial information: (1) commercial and market-oriented news websites and their APPs; (2) WeChat; (3) Weibo; (4) relatives and friends; (5) online video/short video platforms; and (6) online forums communities. Each question was rated on a five-point Likert scale (1 = never, 2 = occasionally, 3 = sometimes, 4 = often, 5 = always).

Belief in conspiracy theories

The scale of belief in conspiracy theories (BCT) adopts the Universal Conspiracy Theory Mindset.

Scale by Imhoff and Bruder (2014). The questionnaire used a seven-point Likert scale (1 = completely disagree to 7 = strongly agree). There were 12 questions in this item, three of which had factor loadings below 0.7 and were removed from the model. The remaining 9 items included the following: "Those at the top can do whatever they want," "A few powerful groups of people determine the destiny of millions," "There are secret organizations that greatly influence political decisions," "Politicians and other leaders are just string puppets of covert powers," "Most people do not recognize the extent to which our life is determined by conspiracies that are concocted secretly," "International intelligence agencies are involved

in our everyday life to a much larger degree than people assume," "Secret organizations can manipulate people psychologically so that they do not notice how their life is being controlled by others," "There are certain political circles with secret agendas that are very influential," "Most people do not see how much our lives are determined by plots hatched in secret," and so forth. In the model, the seven-level scale was transformed into a five-level scale, and the conversion formula was $4 \times (m - 1)/6 + 1$, where m is the original value on the seven-level scale.

Knowledge

The knowledge dimension included two measurement variables: objective knowledge (OK) and self-assessed knowledge (SK). Self-assessed knowledge was measured by the question "How much do you think you know about genetically modified foods and related knowledge?" Responses were rated on a 5-point scale (1 = completely understand to 5 = completely unknown/I do not know). As mentioned above, the article draws on the research of You and Jin (2020) to measure the objective knowledge of GMO from three dimensions: "scientific principle," "transgenic development status," and "social impact." First, "Scientific Principles" measured the audience's understanding of the basic principles of GMO. The item consisted of four questions, including the understanding of hybrid breeding technology, genetic modification, agricultural biotechnology, and genetically modified food. Second, the "Current situation of genetic modification development" measured participants' understanding of the current situation of genetically modified development. The topics included "China allows the cultivation of genetically modified food," "China has mandatory regulations on the genetically modified food sold on the market, and must have a genetically modified label," "The genetically modified crops approved for commercial planting in China include corn, soybeans, and potatoes," and "China allows the seeds of genetically modified food crops to be imported for cultivation." Third, "Social impact" assessed participants' knowledge of the impact of genetic modification on society and the purpose of the development of genetically modified technology. The items included "GMO technology can improve crop yield," "Eating genetically modified crops will seriously affect health," "Growing genetically modified crops is harmful to the environment," and "GMO technology can reduce the use of pesticides." Each question of objective knowledge received 1 point, and the total score of objective knowledge was calculated. The following formula was used to convert the score into a 5-point system: $4 \times (n - 1)/11 + 1$, where n is the original score of objective knowledge.

Public attitudes toward GMO

The measurement of GMO attitude was divided into two variables: public attitude toward GMO development (PAGMD) and public attitude toward GMO food consumption (PAGMC). The questionnaire used a 5-point scale (1 = completely accepted, 5 = completely not accepted) to measure public attitudes toward GMO development based on the research of Xiang et al. (2005) and You and Jin (2020). The measurement questions included: "Do you support the research and development of GMO technology in China?" "Do you support the commercialization of GMO-related products in China?" and "Do you support the government's use of GMO technology in the biomedical field?" Regarding assessing the variable of public attitude toward genetically modified food consumption, the questions were designed based on related questions in research questionnaires, such as INRA (2000) and Brossard and Nisbet (2007). Items included "Bread processed with genetically modified wheat resistant to diseases and insect pests." "Rice produced from genetically modified rice resistant to pests and diseases." "Rice produced from genetically modified rice providing improved nutrition." "Will you accept eating genetically modified food?"

Data analysis

Information on the demographic characteristics of the respondents was collected. The sample distribution was relatively balanced as shown in Table 1. The ratio of males to females was 44.6:55.4, which is roughly representative of the ratio of males to females in the overall population of China. Of the participants, 68.7% were between the ages of 25 and 35 years, and most had bachelor degrees, accounting for 78%. Occupationally, 78.4% of participants were enterprise managers and employees. At the same time, there were no university or research institution staff in the sample, which ensured that the study population was limited to non-scientists.

TABLE 1 The detailed demographic distribution.

	Characteristics	Frequency	Percent(%)
Gender	Male	231	44.6
	Female	287	55.4
Age	18–24	68	13.1
	25–30	216	41.7
	31–35	140	27.0
	36–40	45	8.7
	41–45	27	5.2
	46–50	14	2.7
	>51	8	1.6
Education level	Primary school or below	2	0.4
	Junior high school	2	0.4
	Senior high school	17	3.3
	Junior college	42	8.1
	Undergraduate degree	404	78.0
	Masters or higher	51	9.8
Occupation	Government	46	8.9
	Enterprise manager	117	22.6
	Employee	291	56.2
	Self-employed	40	7.7
	Peasant	7	1.4
	Other	17	3.3

Partial least squares structural equation modeling (PLS-SEM) was employed using SmartPLS 3.0 to estimate the simultaneous relationships among multiple constructs in this study. The model included both reflective constructs (PAs toward GMO development, PAs toward GMO food consumption, belief in conspiracy theories) and formative constructs (official information exposure and unofficial information exposure). PLS, a variance-based SEM, is preferred over the traditional covariance-based SEM for the current analysis.

Since the results may be susceptible to common method bias (CMB) when one respondent answers the questions in each questionnaire (Podsakoff et al., 2003), we created a common method factor (method construct) in the PLS model, including all indicators of the three principal constructs in the model (Liang et al., 2007). We then calculated the variances of each indicator, which were substantially explained by the corresponding principal and method constructs. The average substantive factor loading was 0.758, whereas the average method factor loading was 0.008, resulting in a ratio (substantive variance to method variance) of approximately 97:1. The loadings of the principal constructs were all significant ($p < 0.01$), while most loadings for the method were not significant ($p < 0.05$). In summary, the relatively small values of loadings and insignificance of the method variance suggest that CMB was not serious.

Results

Measurement model

The evaluation of the measurement model involved the assessment of reliability and validity for each reflective scale. Firstly, a reliability assessment was conducted. As shown in Table 2, Cronbach's alpha and composition reliability (CR) values were both greater than 0.9, indicating good reliability.

Secondly, convergent validity was examined. Table 2 shows that the factor loadings based on confirmatory factor analysis (CFA) were above 0.7 and below 0.95, and the p values were all less than 0.05. Simultaneously, the average variance extraction (AVE) was greater than 0.7. Thus, the scale has convergent validity, according to the criteria proposed by Fornell and Larcker (1981).

Thirdly, we examined the discriminant validity. We first tested the cross-loading. Table 3 shows that the correlation coefficient between each measured variable and its latent variable (i.e., loading) was greater than the correlation coefficient between the measured variable and other latent variables (i.e., cross-loadings), indicating that the measurement model had good discriminant validity. We then compared the square root of the AVE and the correlation coefficient of each latent variable proposed by Fornell and Larcker (1981). As shown in Table 4, the value on the diagonal line is the square root of the AVE, and the value on the off-diagonal line represents the correlation coefficient of the latent variable. The former was larger than the latter. This description has good discriminant validity. We then used the HTMT.85 standard proposed by Henseler et al. (2015) to test the values in the obtained matrix to find that they were all less than 0.75, which indicates that each dimension had better discriminant validity.

The test results of the formative variables are listed in Table 5. For official information exposure, only the weight of official information exposure in Central media and their websites and APPs and their accounts on social media was more than 0.2 and significant. The weight of official information exposure in local media and their websites and APPs and their accounts on social media was less than 0.2 and was not significant. This indicates that

TABLE 2 The convergent validity and reliability of reflective scales.

Constructs	Indicators	means	Standard deviations	Factor loading	Cronbach's alpha	CR	AVE
BCT: belief in	BCT2	3.256	0.914	0.805***	0.947	0.955	0.701
conspiracy theories	BCT3	3.355	0.965	0.830***			
	BCT4	3.450	0.896	0.857***			
	BCT6	3.069	0.854	0.840***			
	BCT7	3.149	0.860	0.855***			
	BCT9	3.534	0.811	0.800***			
	BCT10	3.187	0.882	0.849***			
	BCT11	3.432	0.859	0.857***			
	BCT12	3.325	0.904	0.837***			
PAGMD: PAs toward	PAGMD1	2.971	1.333	0.932***	0.928	0.954	0.875
GM development	PAGMD2	3.083	1.410	0.940***			
	PAGMD3	3.089	1.424	0.934***			
PAGMC: PAs toward	PAGMC1	2.959	1.039	0.805***	0.914	0.940	0.798
GM foods	PAGMC2	2.450	1.444	0.912***			
consumption	PAGMC3	2.631	1.369	0.923***			
	PAGMC4	2.537	1.505	0.927***			

***$p < 0.001$.
CR, composite reliability; AVE, average variance extracted.

TABLE 3 Loads and cross-loads of reflective variables.

	PAGMD	PAGMC	BCT
BCT2	−0.575	−0.474	0.805
BCT3	−0.573	−0.498	0.830
BCT4	−0.569	−0.474	0.857
BCT6	−0.633	−0.499	0.840
BCT7	−0.626	−0.504	0.855
BCT9	−0.512	−0.471	0.800
BCT10	−0.653	−0.531	0.849
BCT11	−0.587	−0.491	0.857
BCT12	−0.607	−0.502	0.837
PAGMD1	0.932	0.632	−0.666
PAGMD2	0.940	0.671	−0.674
PAGMD3	0.934	0.619	−0.651
PAGMC1	0.622	0.805	−0.477
PAGMC2	0.619	0.927	−0.550
PAGMC3	0.617	0.912	−0.522
PAGMC4	0.592	0.923	−0.557

TABLE 4 Correlation matrix of the reflective constructs.

	PAGMD	PAGMC	BCT
PAGMD	**0.935**		
PAGMC	0.686	**0.893**	
BCT	−0.710	−0.590	**0.837**

The numbers in bold on the matrix of correlation are the square roots of The AVE.

the central media is the main channel for Chinese people to obtain information. The weights of unofficial information exposure in WeChat, Weibo, and online video/short video platforms were more than 0.2 and were significant. In this study, indicators with weights greater than 0.2 and significant were included in the model. In addition, the VIF value of each index was less than 5, indicating that the collinearity problem was negligible.

Structural model

In PLS analysis, the path relationship formed by the constructs constitutes the structural model. PLS uses the bootstrap method to test the significance of the path relationships. Based on Chin and Newsted (1999), this study set the number of subsamples to 5,000 to achieve a stable estimation of the parameters.

Direct effect analysis

In Table 6, Model 1 shows that official information exposure had a significant positive relationship with.

PAs toward GMO development ($\beta = 0.354$, $p < 0.001$). Moreover, there was a significant positive relationship between official information exposure and PAs toward GMO food consumption ($\beta = 0.346$, $p < 0.001$), validating hypotheses H1 (a) and H1 (b). Unofficial information exposure had a significant negative relationship with PAs toward GMO development

TABLE 5 Assessment of formative constructs.

Constructs	Indicators	Means	Standard deviations	Weights
OI: official information	Central media and their websites and apps and their accounts on social media	2.595	1.569	0.836***
	Local media and their websites and apps and their accounts on social media	2.560	1.579	0.180
UI: unofficial Information	Commercial and market-oriented news websites and their apps	3.145	1.349	−0.275
	WeChat	3.259	1.964	0.582***
	Weibo	3.438	1.191	0.331**
	Relatives and friends	3.102	1.001	−0.127
	Online video/short video platforms	2.956	1.072	0.303**
	Online forums communities	3.263	1.221	0.042

**$p < 0.001$; ***$p < 0.001$.

($\beta = -0.310$, $p < 0.01$). Additionally, there was a significant negative relationship between unofficial information exposure and PAs toward GMO food development ($\beta = -0.258$, $p < 0.001$), validating hypotheses H2 (a) and H2 (b). Official information exposure had a positive relationship with people's attitude toward the development and consumption of GMO foods. Furthermore, unofficial information exposure had a negative relationship with people's attitude toward the development and consumption of GMO foods.

Mediating effect analysis

To explore the impact mechanism of information exposure on PAs toward GMO, it is necessary to analyze the indirect effects by mediating variables. Therefore, this study added belief in conspiracy theories as an intermediary variable in Model 1, as shown in Model 2 in Table 6. Belief in conspiracy theories on public GMO development attitude ($\beta = -0.596$, $p < 0.001$) and public GMO food consumption attitudes ($\beta = -0.454$, $p < 0.001$) had a significant negative relationship, which verified hypotheses H3 (a) and H3 (b). In addition, there was a significant negative relationship between official information exposure and beliefs in conspiracy theories ($\beta = -0.413$, $p < 0.001$). Moreover, unofficial information exposure and beliefs in conspiracy theories showed a significant positive relationship ($\beta = 0.308$, $p < 0.001$).

This study used the bootstrap method to test the mediation effects. As shown in Table 7, beliefs in conspiracy theories played a significant mediating role in the relationship between official information exposure and GMO food consumption attitudes. The indirect effect on the relationship between official information

TABLE 6 Path coefficients of the structural model.

	Model 1		Model 2		Model3		Model 4	
	PAGMD	**PAGMC**	**PAGMD**	**PAGMC**	**PAGMD**	**PAGMC**	**PAGMD**	**PAGMC**
	$R^2 = 0.306$, $Q^2 = 0.264$	**$R^2 = 0.256$, $Q^2 = 0.200$**	**$R^2 = 0.527$, $Q^2 = 0.457$**	**$R^2 = 0.381$, $Q^2 = 0.300$**	**$R^2 = 0.752$, $Q^2 = 0.651$**	**$R^2 = 0.511$, $Q^2 = 0.400$**	**$R^2 = 0.647$, $Q^2 = 0.552$**	**$R^2 = 0.523$, $Q^2 = 0.412$**
OI	0.354***(0.039)	0.346***(0.042)	0.105**(0.035)	0.155***(0.043)	0.139***(0.024)	0.185***(0.040)	0.105**(0.031)	0.145***(0.041)
UI	−0.310**(0.040)	−0.258***(0.043)	−0.121**(0.038)	−0.112**(0.040)	−0.099***(0.026)	−0.094*(0.038)	−0.105**(0.032)	−0.081*(0.036)
BCT			−0.596***(0.032)	−0.454***(0.038)	−0.284***(0.034)	−0.219***(0.052)	−0.492***(0.037)	−0.243***(0.041)
OK					0.538***(0.031)	0.417***(0.051)		
OK × BCT					0.097**(0.032)	0.027 (0.045)		
SK							−0.308***(0.032)	−0.438***(0.038)
SK × BCT							−0.214***(0.032)	−0.036 (0.030)
			BCT		**BCT**		**BCT**	
			$R^2 = 0.368$, $Q^2 = 0.255$		$R^2 = 0.511$, $Q^2 = 0.353$		$R^2 = 0.486$, $Q^2 = 0.334$	
OI			−0.413*** (0.037)		−0.332***(0.036)		−0.321***(0.035)	
UI			0.308*** (0.039)		0.220***(0.041)		0.224***(0.036)	
OK					−0.408***(0.041)			
SK							0.356***(0.031)	

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

The numbers in brackets are standard deviations. EF(f^2) is in the acceptable range. The data in parentheses after the path coefficients are bootstrap standard errors. OI, official information exposure; UI, unofficial information exposure; BCT, belief in conspiracy theories; PAGMD, PAs toward GMO development; PAGMC, PAs toward GMO food consumption.

10.3389/fpsyg.2022.955541

TABLE 7 Significance analysis of the mediation effects.

Path	Indirect effect	Direct effect	Total effect	Indirect effect/ total effect
OI → BCT	0.246***	0.105**	0.351***	70.0%
→ PAGMD	$t = 10.222$;	$t = 2.974$;	$t = 8.904$;	
	$p = 0.000$;	$p = 0.003$;	$p = 0.000$;	
	[0.194,0.287]	[0.042,0.178]	[0.272,0.428]	
OI → BCT	0.188***	0.155***	0.343***	54.8%
→ PAGMC	$t = 8.055$;	$t = 3.633$;	$t = 7.380$;	
	$p = 0.000$;	$p = 0.000$;	$p = 0.000$;	
	[0.141,0.231]	[0.073,0.263]	[0.244,0.426]	
UI → BCT	−0.183***	−0.121**	−0.304***	60.2%
→ PAGMD	$t = 7.172$;	$t = 3.155$;	$t = 7.194$;	
	$p = 0.000$;	$p = 0.002$;	$p = 0.000$;	
	[−0.239,-0.141]	[−0.200,-0.052]	[−0.387,-0.229]	
UI → BCT	−0.140***	−0.112**	−0.252***	55.6%
→ PAGMC	$t = 6.407$;	$t = 2.798$;	$t = 5.612$;	
	$p = 0.000$;	$p = 0.005$;	$p = 0.000$;	
	[−0.184,-0.102]	[−0.199,-0.043]	[−0.355,-0.175]	

**$p < 0.001$; ***$p < 0.001$.
OI, official information exposure; UI, unofficial information exposure; BCT, belief in conspiracy theories; PAGMD, PAs toward GMO development; PAGMC, PAs toward GMO food consumption.

exposure and GMO development attitudes was 0.246, accounting for 70% of the total effect. The indirect effect on the relationship between official information exposure and GMO food consumption attitudes was 0.188, accounting for 54.8% of the total effect.

Beliefs in conspiracy theories also played a significant mediating role between unofficial information exposure and attitudes toward GMO foods consumption. The indirect effect on the relationship between unofficial information exposure and attitudes toward GMO development was −0.183, accounting for 60.2% of the total effect. The indirect effect on the relationship between unofficial information exposure and GMO food consumption attitude was −0.140, accounting for 55.6% of the total effect.

Moderating effect analysis

Based on the mediation model (Model 2), objective knowledge and self-assessed knowledge were added as moderating variables. First, when the moderating variable of objective knowledge was added to Model 2 as shown in Model 3 in Table 6, there was a significant positive relationship between objective knowledge and PAs toward GMO development ($\beta = 0.538$, $p < 0.001$). There was also a significant positive relationship between PAs toward GMO foods consumption ($\beta = 0.417$, $p < 0.001$). The interaction term between objective knowledge and belief in conspiracy theories had a significant positive effect on PAs toward GMO development ($\beta = 0.097$, $p < 0.01$). This indicates that higher objective knowledge can effectively reduce beliefs in the negative relationship of conspiracy theories on PAs toward GMO development. This confirmed hypothesis H5 (a). However, the same interaction term had no significant relationship on PAs toward GMO food consumption, and Hypothesis H5 (b) was not confirmed.

Second, when the moderating variable of self-assessed knowledge was added to Model 2 as shown in Model 4 in Table 6, self-assessed knowledge had a significant negative relationship with PAs toward GMO development ($\beta = -0.308$, $p < 0.001$). Simultaneously, there was also a significant negative relationship with PAs toward GMO foods consumption ($\beta = -0.438$, $p < 0.001$). The interaction term between self-assessed knowledge and belief in conspiracy theories had a significant negative relationship on PAs toward GMO food development ($\beta = -0.214$, $p < 0.01$). This indicates that higher self-assessed knowledge enhanced beliefs in conspiracy theories on the negative relationship of PAs toward GMO food development. This confirmed hypothesis H6 (a). However, the same interaction term had no significant relationship on PAs toward GMO food consumption, and Hypothesis H6 (b) was not confirmed.

Conclusion and discussion

Based on the SOR model, this study explored the structural relationship between information exposure, beliefs in conspiracy theories, and Chinese consumers' attitudes toward GMO. In addition, objective knowledge and self-assessed knowledge were introduced as moderator variables to explore the different influences formed by knowledge differences.

First, different types of information exposure have significantly different relationships with public attitudes toward GMO. The SOR model emphasizes that external stimuli trigger audience attitudes, and information as an important stimulus has been widely discussed in previous studies on GMO attitudes. However, previous studies have rarely compared the effects of different information exposure on GMO attitudes, and their research objects either focused on traditional media channels (Frewer et al., 1998; Pang, 2020) or social media (Zhu et al., 2018; Deng and Hu, 2019). Thus, there was a lack of integrated discussion of different information exposure. This study focused on exploring the differences in the influence of different types of information exposure on the formation of people's attitudes. Moreover, we divided information exposure into official and unofficial information exposure and examined the role of different types of information exposure in the formation of attitudes toward GMO. Our results showed that official information exposure had a significant positive relationship and played a leading role in the development and consumption attitudes of the public toward GMO foods. This shows that in China, more individuals who obtain GMO information from official channels tend to have a more positive attitude toward GMO foods. This is consistent with our research hypothesis and confirms prior research which

concluded that traditional media is the source of people's acquisition of GMO information. Sources with high authority and reliability, and public channels, play an active and important role in influencing public attitudes toward GMO (Nisbet et al., 2002; He et al., 2015; Pang, 2020).

In China, central and local media such as radio, television, newspapers and their websites, APPs, and accounts on social media are spokespersons of government discourse and are responsible for publicizing policies, guiding ideology, establishing the national image, and maintaining social stability (Gan, 1994). Although there are disputes about GMO, promoting GMO development is a basic policy for the long-term development planned by the Chinese government. Since 2021, the 20th Meeting of the Central Committee for Comprehensively Deepening Reform and the Ministry of Agriculture and Rural Affairs of China have put forward guiding opinions and evaluations of the GMO issue. The official media will naturally guide the public to recognize and support GMO foods and the public will have a positive attitude toward the development and consumption of GMO foods.

In contrast, unofficial information in WeChat, Weibo, online videos, and short videos were negatively correlated with the development and consumption attitudes of the public toward GMO foods. This is consistent with the finding of Deng and Hu (2019) that consumers who obtained information through social media were less likely to accept GMO foods than those who obtained information from other channels.

Second, belief in conspiracy theories played an important mediating role in the relationship between information exposure and the GMO attitudes. This study incorporated into the SOR model, the belief in conspiracy theories regarding GMO, an important variable that is often mentioned but rarely studied, as a mediating variable in the research framework. This study found that beliefs in conspiracy theories were significantly negatively correlated with public attitudes toward GMO. This validated our hypothesis that the stronger the individual beliefs in conspiracy theories, the more negative their attitudes toward GMO. This corroborates the finding of Shan and Jin (2012) that beliefs in conspiracy theories have hindered the promotion of golden rice and provides additional empirical evidence. As an important predictor of public attitudes toward GMO, beliefs in conspiracy theories must be considered in subsequent studies.

Thus, individuals who were exposed to more official information decreased their beliefs in conspiracy theories and, consequently, had more positive attitudes toward GMO foods. Conversely, individuals who were exposed to more unofficial information strengthened their beliefs in conspiracy theories and, subsequently, had more negative attitudes toward GMO foods. This is consistent with our research assumptions and with previous research findings on the relationship between media exposure and beliefs in conspiracy theories (Hollander, 2018; Mancosu and Vegetti, 2021; Xiao et al., 2021).

Third, citizens' objective knowledge and their self-assessed knowledge had different relationships with attitudes toward GMO. This study found that objective knowledge restrained the negative attitudes of beliefs in conspiracy theories toward GMO development. However, this inhibitory effect was not significant regarding the negative attitudes of beliefs in conspiracy theories toward GMO food consumption. This conclusion partially confirms our hypothesis and echoes the results of previous studies (Hudson et al., 2015; Vecchione et al., 2015; Van Prooijen, 2017). Compared with the attitude toward GMO technology, when people consume GMO foods, they will consider their own economic situation and many other factors. Siegrist and Cvetkovich (2000) argued that with limited personal knowledge, non-professionals mainly rely on social trust when judging the risks and benefits of new technology. This finding suggests that trust reduces the cost and complexity of making rational judgments based on knowledge. Many studies have proven that trust in the government, research institutions, scientific research institutions, and even media institutions have played an important role in accelerating people's acceptance of GMO food (Lobb et al., 2007; Zhang et al., 2016) and this will be our direction of research in the future.

Zhu et al. (2018) indicated that, in China, objective knowledge rather than self-assessed knowledge plays a decisive role in the process of forming attitudes toward GMO foods. This study found that the role of self-assessed knowledge in the influence of beliefs in conspiracy theories on GMO food consumption attitudes is not significant. However, it plays a reinforcing role in the negative impact of beliefs in conspiracy theories on GMO development attitudes. This is especially true among individuals with higher self-assessed knowledge, whose beliefs in conspiracy theories have a greater negative impact on attitudes toward GMO development. This supports our research hypothesis and confirms previous findings that individuals' extreme attitudes toward GMO development are not only related to their lower objective knowledge, but also to their higher self-assessed knowledge. Specifically, people who think that they have more knowledge are more likely to believe in conspiracy theories and are more negative toward the GMO development.

Instead of reducing the cognitive differences among people with different attitudes toward GMO crops, educating the public about GMO crops will lead to greater differences in attitudes between those who are extremely opposed to GMO crops and those who support them. Therefore, it is necessary to promote IH (Intellectual Humility) literacy (Davis et al., 2016), based on scientific communication to the general public, so as to enhance individual self-awareness, including openness, curiosity, and inclusiveness, and to reduce the emergence of extreme views (Leary et al., 2017).

This study had several limitations. First, considering the difficulty of data collection, the survey data had a cross-sectional

design, which was insufficient to determine causality. Future studies should adopt a longitudinal design. Second, the context of this study is in China. Thus, researchers should be cautious when applying the conclusions to other contexts. In addition, variables such as income, education, social trust and Nationalism are important factors affecting individuals' attitudes toward GMO, but we could not exhaust them all in one study.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

This study was approved by the Social Science Ethics Committee of a research university in Beijing, China (approval number: UCASS202201).

Author contributions

ZD: manuscript writing, data analysis, and manuscript revision. YX: literature review and manuscript writing and manuscript revision. JX: conceptualization and survey execution. All authors contributed to the article and approved the submitted version.

Funding

This study was funded by the National Social Science Fund of China with the grant number of 20VYJ014 and Foundation of Chinese Academy of Social Science for Marxist Theory Discipline Construction and Theoretical Research with the grant number of 2018mgczd002.

Acknowledgments

We thank Linsen Su for his valuable comments.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

References

Aleksejeva, I. (2014). Eu experts' attitude towards use of gmo in food and feed and other industries. *Procedia. Soc. Behav. Sci.* 110, 494–501. doi: 10.1016/j.sbspro.2013.12.893

Allington, D., Duffy, B., Wessely, S., Dhavan, N., and Rubin, J. (2021). Health-protective behaviour, social media usage and conspiracy belief during the covid-19 public health emergency. *Psychol. Med.* 51, 1763–1769. doi: 10.1017/S003329172000224X

Allum, N., Sturgis, P., Tabourazi, D., and Brunton-Smith, I. (2008). Science knowledge and attitudes across cultures: a meta-analysis. *Public Underst. Sci.* 17, 35–54. doi: 10.1177/0963662506070159

Azjen, I. (1980). *Understanding Attitudes and Predicting social Behavior*. Englewood Cliffs, NJ: Prentice-Hall.

Bantimaroudis, P., Sideri, M., Ballas, D., Panagiotidis, T., and Ziogas, T. (2020). Conspiracism on social media: An agenda melding of group-mediated deceptions. *Int. J. Media Cult. Politics* 16, 115–138. doi: 10.1386/macp_00020_1

Bastani, P., and Bahrami, M. (2020). COVID-19 related misinformation on social media: A qualitative study from Iran. *J. Med. Internet Res.* 3. doi: 10.2196/18932

Bredahl, L. (2001). Determinants of consumer attitudes and purchase intentions with regard to genetically modified food–results of a cross-national survey. *J. Consum. Policy* 24, 23–61. doi: 10.1023/A:1010950406128

Brossard, D., and Nisbet, M. C. (2007). Deference to scientific authority among a low information public: understanding us opinion on agricultural biotechnology. *Int. J. Public Opin. Res.* 19, 24–52. doi: 10.1093/ijpor/edl003

Chen, J. (2010). Commercialization of genetically modified crops:Impacts,challenges and countermeasures–building of a general research framework and a primary analysis. *China Soft Sci.* 6, 1–14. doi: 10.3969/j.issn.1002-9753.2010.06.001

Chin, W. W., and Newsted, P. R. (1999). Structural equation modeling analysis with small samples using partial least squares. *Stat. Strateg. Small Sample Res.* 1, 307–341.

Chu, Y. (2020). Why people believe false information: a study of cognitive bias and information discrimination from the perspective of science communication, *Vol. 11* University of Journalism 66-82+127.

Connor, M., and Siegrist, M. (2010). Factors influencing people's acceptance of gene technology: the role of knowledge, health expectations, naturalness, and social trust. *Sci. Commun.* 32, 514–538. doi: 10.1177/1075547009358919

Costa-Font, M., and Gil, J. M. (2009). Structural equation modelling of consumer acceptance of genetically modified (gm) food in the mediterranean europe: a cross country study. *Food Qual. Prefer.* 20, 399–409. doi: 10.1016/j.foodqual.2009.02.011

Cui, K., and Shoemaker, S. P. (2018). Public perception of genetically-modified (GM) food: A Nationwide Chinese consumer study. *NPJ Sci. Food* 2, 1–8. doi: 10.1038/s41538-018-0018-4

Curtis, K. R., McCluskey, J. J., and Wahl, T. I. (2004). Consumer acceptance of genetically modified food products in the developing world. *AgBioforum* 17, 69–74.

Davis, D. E., Rice, K., McElroy, S., DeBlaere, C., Choe, E., Van Tongeren, D. R., et al. (2016). Distinguishing intellectual humility and general humility. *J. Posit. Psychol.* 11, 215–224. doi: 10.1080/17439760.2015.1048818

Deng, H., and Hu, R. (2019). A crisis of consumers' trust in scientists and its influence on consumer attitude toward genetically modified foods. *Br. Food J.* 121, 2454–2476. doi: 10.1108/BFJ-07-2018-0476

Douglas, K. M., and Sutton, R. M. (2008). The hidden impact of conspiracy theories: perceived and actual influence of theories surrounding the death of princess diana. *J. Soc. Psychol.* 148, 210–222. doi: 10.3200/SOCP.148.2.210-222

Douglas, K. M., Sutton, R. M., and Cichocka, A. (2017). The psychology of conspiracy theories. *Curr. Dir. Psychol. Sci.* 26, 538–542. doi: 10.1177/0963721417718261

Druckman, J. N., and Bolsen, T. (2011). Framing, motivated reasoning, and opinions about emergent technologies. *J. Commun.* 61, 659–688. doi: 10.1111/j.1460-2466.2011.01562.x

Drummond, C., and Fischhoff, B. (2017). Individuals with greater science literacy and education have more polarized beliefs on controversial science topics. *Proc. Natl. Acad. Sci. U. S. A.* 114, 9587–9592. doi: 10.1073/pnas.1704882114

Ermakova, I. (2005). *Influence of genetically modified-soya on the birth-weight and survival of rat pups: preliminary study*. Institute of Higher Nervous Activity and Neurophysicology Russian Academy of Science(Europe), Europe.

Fernbach, P. M., Light, N., Scott, S. E., Inbar, Y., and Rozin, P. (2019). Extreme opponents of genetically modified foods know the least but think they know the most. *Nat. Hum. Behav.* 3, 251–256. doi: 10.1038/s41562-018-0520-3

Fletcher, R., and Nielsen, R. K. (2018). Are people incidentally exposed to news on social media? A comparative analysis. *New Media Soc.* 20, 2450–2468. doi: 10.1177/1461444817724170

Fornell, C., and Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *J. Market. Res.* 18, 39–50. doi: 10.1177/002224378101800104

Frewer, L. J., Howard, C., and Shepherd, R. (1998). The influence of initial attitudes on responses to communication about genetic engineering in food production. *Agric. Hum. Values* 15, 15–30. doi: 10.1023/A:1007465730039

Gan, X. (1994). Debates contribute to the development of the journalistic science. *J. Commun.* 44, 38–51. doi: 10.1111/j.1460-2466.1994.tb00687.x

Gaskell, G., Allum, N., Bauer, M., Durant, J., Allansdottir, A., Bonfadelli, H., et al. (2000). Biotechnology and the european public. *Nat. Biotechnol.* 18, 935–938. doi: 10.1038/79403

Goertzel, T. (1994). Belief in conspiracy theories. *Polit. Psychol.* 15, 731–742. doi: 10.2307/3791630

Green, R., and Douglas, K. M. (2018). Anxious attachment and belief in conspiracy theories. *Personal. Individ. Differ.* 125, 30–37. doi: 10.1016/j.paid.2017.12.023

Hameleers, M., Powell, T. E., Van Der Meer, T. G., and Bos, L. (2020). A picture paints a thousand lies? The effects and mechanisms of multimodal disinformation and rebuttals disseminated via social media. *Polit. Commun.* 37, 281–301. doi: 10.1080/10584609.2019.1674979

He, G., Zhao, Y., Zhang, W., Xue, P. (2015). Public acceptance of genetically modified crops and its influencing factors based on sociological analysis of survey data in six cities. *Society*, 35, 121–142. doi: 10.15992/j.cnki.31-1123/c.2015.01.006 (in Chinese).

Henseler, J., Ringle, C. M., and Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *J. Acad. Market Sci.* 43, 115–135. doi: 10.1007/s11747-014-0403-8

Hollander, B. A. (2018). Partisanship, individual differences, and news media exposure as predictors of conspiracy beliefs. *Journal. Mass Commun. Q.* 95, 691–713. doi: 10.1177/1077699017728919

House, L. O., Lusk, J., Jaeger, S. R., Traill, B., Moore, M., Valli, C., et al. (2004). *Objective and Subjective Knowledge: Impacts on Consumer demand for Genetically Modified Foods in the United states and the European union. AgBioForum* 7, 113–123.

House, L., Morrow, B., Lusk, J., and Moore, M. (2001). Modeling consumer acceptance of and willingness to pay for genetically modified foods in the United States and the european union. In *International Food and Agribusiness Management Association Annual Meeting-The World Food and Agribusiness Symposium,* Sydney.

Hovland, C. I. (1959). Reconciling conflicting results derived from experimental and survey studies of attitude change. *Am. Psychol.* 14, 8–17. doi: 10.1037/h0042210

Hu, Y. (2016). *Why Rumors of Food Security have the Market?* (Beijing: Beijing Youth Daily). 45. (in Chinese).

Hu, W., and Zhou, H. (2009). Consumer attitudes and guiding strategies for transgenic animals. *Chin. J. Anim. Sci*, 28–30. (in Chinese).

Huang, J., Qi, Z., Feng, L., Dong, Y., Li, W. (2014). An empirical study on consumers' perseived risk on GMF: The case of Wuhan. *J. China Agric. Univ.* 19, 217–226. doi: 10.11841/j.issn.1007-4333.2014.05.31

Huang, J., Qiu, H., and Bai, J. (2006). Cognition, acceptance and purchase intention of chinese urban consumers on genetically modified foods. *China Soft Sci.*, 61–67. doi: 10.3969/j.issn.1002-9753.2006.02.009 (in Chinese).

Huber, B., Barnidge, M., Gil de Zu'niga, H., and Liu, J. (2019). Fostering public trust in science: The role of social media. *Public Underst. Sci.* 28, 759–777. doi: 10.1177/0963662519869097

Hudson, J., Caplanova, A., and Novak, M. (2015). Public attitudes to gm foods. The balancing of risks and gains. *Appetite* 92, 303–313. doi: 10.1016/j.appet.2015.05.031

Huffman, W. E., Rousu, M., Shogren, J. F., and Tegene, A. (2007). The effects of prior beliefs and learning on consumers' acceptance of genetically modified foods. *J. Econ. Behav. Organ.* 63, 193–206. doi: 10.1016/j.jebo.2005.04.019

Imhoff, R., and Bruder, M. (2014). Speaking (un-) truth to power: conspiracy mentality as a generalised political attitude. *Eur. J. Pers.* 28, 25–43. doi: 10.1002/per.1930

INRA. (2000). The Europeans and Biotechnology: Eurobarometer 52.1. Luxembourg: European Commission.

Jennings, F., and Russell, F. M. (2019). Civility, credibility, and health information: the impact of uncivil comments and source credibility on attitudes about vaccines. *Public Underst. Sci.* 28, 417–432. doi: 10.1177/0963662519837901

Jia, H., and Luo, X. (2021). I Wear a mask for my country: conspiracy theories, nationalism, and intention to adopt Covid-19 prevention behaviors at the later stage of pandemic control in China. *Health Commun.* 1, 1–9. doi: 10.1080/10410236.2021.1958982

Jolley, D., and Douglas, K. M. (2014a). The effects of antivaccine conspiracy theories on vaccination intentions. *PLoS One* 9:e89177. doi: 10.1371/journal.pone.0089177

Jolley, D., and Douglas, K. M. (2014b). The social consequences of conspiracism: exposure to conspiracy theories decreases the intention to engage in politics and to reduce one's carbon footprint. *Br. J. Psychol.* 105, 35–56. doi: 10.1111/bjop.12018

Knight, A. J. (2005). Differential effects of perceived and objective knowledge measures on perceptions of biotechnology. *AgBioForum* 8, 221–227.

Landrum, A. R., and Olshansky, A. (2019). The role of conspiracy mentality in denial of science and susceptibility to viral deception about science. *Politics Life Sci.* 38, 193–209. doi: 10.1017/pls.2019.9

Leary, M. R., Diebels, K. J., Davisson, E. K., Jongman-Sereno, K. P., Isherwood, J. C., Raimi, K. T., et al. (2017). Cognitive and interpersonal features of intellectual humility. *Pers. Soc. Psychol. Bull.* 43, 793–813. doi: 10.1177/0146167217697695

Liang, H., Saraf, N., Hu, Q., and Xue, Y. (2007). Assimilation of enterprise systems: the effect of institutional pressures and the mediating role of top management. *MIS Q.* 31, 59–87. doi: 10.2307/25148781

Lobb, A. E., Mazzocchi, M., and Traill, W. (2007). Modelling risk perception and trust in food safety information within the theory of planned behaviour. *Food Qual. Prefer.* 18, 384–395. doi: 10.1016/j.foodqual.2006.04.004

Lusk, J. L., House, L. O., Valli, C., Jaeger, S. R., Moore, M., Morrow, J. L., et al. (2004). Effect of information about benefits of biotechnology on consumer acceptance of genetically modified food evidence from experimental auctions in the United States, England, and France. *Eur. Rev. Agric. Econ.* 31, 179–204. doi: 10.1093/erae/31.2.179

Lv, L. (2009). A chinese perspective on biotechnology—2003-2007 research report. *Natural Dialect. Newslett.* 31, 41–49.

Mancosu, M., and Vegetti, F. (2021). "Is it the message or the messenger?": conspiracy endorsement and media sources. *Soc. Sci. Comput. Rev.* 39, 1203–1217. doi: 10.1177/0894439320965107

Mielby, H., Sandøe, P., and Lassen, J. (2013). The role of scientific knowledge in shaping public attitudes to gm technologies. *Public Underst. Sci.* 22, 155–168. doi: 10.1177/0963662511430577

Miller, J. D. (1996). "Scientific literacy for effective citizenship," in *Science/Technology/ Society as Reform in Science Education*, ed. Robert E. Yager. Albany, New York: SUNY Press.

Newman, N., Fletcher, R., Kalogeropoulos, A., Levy, D., and Nielsen, R. K. (2017). Reuters Institute digital news Report 2018 (Report of the Reuters Institute for the Study of Journalism).

Nickerson, R. S. (1998). Confirmation bias: A ubiquitous phenomenon in many guises. *Rev. Gen. Psychol.* 2, 175–220. doi: 10.1037/1089-2680.2.2.175

Nisbet, M. C., Scheufele, D. A., Shanahan, J., Moy, P., Brossard, D., and Lewenstein, B. V. (2002). Knowledge, reservations, or promise? A media effects model for public perceptions of science and technology. *Commun. Res.* 29, 584–608. doi: 10.1177/009365002236196

Oleksy, T., Wnuk, A., Maison, D., and Ły's, A. (2020). Content matters. Different predictors and social consequences of general and government-related conspiracy theories on COVID-19. *Personal. Individ. Differ.* 168:110289. doi: 10.1016/j.paid.2020.110289

Onyango, B. M., and Nayga, R. M. (2004). Consumer acceptance of nutritionally enhanced genetically modified food: relevance of gene transfer technology. *Agric. Resour. Econ. Rev.*, 567–583.

Pang, Z. (2020). How does information dependence affect public attitudes towards genetically modified technology in China? *Sci. Public Policy* 47, 125–136. doi: 10.1093/scipol/scz052

Pennycook, G., McPhetres, J., Zhang, Y., Lu, J. G., and Rand, D. G. (2020). Fighting covid-19 misinformation on social media: experimental evidence for a scalable accuracy-nudge intervention. *Psychol. Sci.* 31, 770–780. doi: 10.1177/0956797620939054

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., and Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *J. Appl. Psychol.* 88, 879–903. doi: 10.1037/0021-9010.88.5.879

Priest, S. H. (2000). Us public opinion divided over biotechnology? *Nat. Biotechnol.* 18, 939–942. doi: 10.1038/79412

Qiu, J. (2012). China sacks officials over golden rice controversy. *Nature* 10. doi: 10.1038/nature.2012.11998

Rishel, N. M. (2011). Digitizing deliberation: normative concerns for the use of social media in deliberative democracy. *Admin. Theory Praxis* 33, 411–432. doi: 10.2753/ATP1084-1806330305

Robin, M.-M. (2014). *The World According to Monsanto: Pollution, Corruption, and the Control of Ourfood Supply.* NewYork: The New Press.

Robinson, C. (1997). Genetically modified foods and consumer choice. *Trends Food Sci. Technol.* 8, 84–88. doi: 10.1016/S0924-2244(97)01019-4

Roukis, G. S. (2006). Globalization, organizational opaqueness and conspiracy. *J. Manag. Dev.* 25, 970–980. doi: 10.1108/02621710610708595

Rousu, M. C., Monchuk, D. C., Shogren, J. F., and Kosa, K. M. (2005). Consumer willingness to pay for "second-generation" genetically engineered products and the role of marketing information. *J. Agric. Appl. Econ.* 37, 647–657. doi: 10.1017/S1074070800027140

Rozenblit, L., and Keil, F. (2002). The misunderstood limits of folk science: An illusion of explanatory depth. *Cognit. Sci.* 26, 521–562. doi: 10.1207/s15516709cog2605_1

Seralini, G.-E., Clair, E., Mesnage, R., Gress, S., Defarge, N., Malatesta, M., et al. (2012). Retracted: long term toxicity of a roundup herbicide and a roundup-tolerant genetically modified maize. *Food Chem. Toxicol.* 50, 4221–4231. doi: 10.1016/j.fct.2012.08.005

Shan, J., and Jin, H. (2012). China denies kids used in genetically modified rice test. Available at: http://www.asianewsnet.net/home/news.php?id=35896&sec=1. (in Chinese).

Siegrist, M., and Cvetkovich, G. (2000). Perception of hazards: The role of social trust and knowledge. *Risk Anal.* 20, 713–720. doi: 10.1111/0272-4332.205064

Simis, M. J., Madden, H., Cacciatore, M. A., and Yeo, S. K. (2016). The lure of rationality: why does the deficit model persist in science communication? *Public Underst. Sci.* 25, 400–414. doi: 10.1177/0963662516629749

Sloman, S., and Fernbach, P. (2018). *The Knowledge Illusion: Why we never Think alone* (New York: Penguin).

Stempel, C., Hargrove, T., and Stempel, G. H. (2007). Media use, social structure, and belief in 9/11 conspiracy theories. *Journal. Mass Commun. Q.* 84, 353–372. doi: 10.1177/107769900708400210

Stojanov, A. (2015). Reducing conspiracy theory beliefs. *Psihologija* 48, 251–266. doi: 10.2298/PSI1503251S

Tao, X., and Chen, M. (2016). The changes of internet users comprehension on the science debate based on the content analysis about genetically modified food between Zhouzi fang and Cui Yongyuan in Tencent micro-blog. *Stud. Sci. Sci.* 34, 496–502. doi: 10.16192/j.cnki.1003-2053.2016.04.003

Uscinski, J. E., and Parent, J. M. (2014). *American Conspiracy Theories.* Oxford: Oxford University Press.

Van der Linden, S., Maibach, E., Cook, J., Leiserowitz, A., Ranney, M., Lewandowsky, S., et al. (2017). Culture versus cognition is a false dilemma. *Nat. Clim. Change* 7:457. doi: 10.1038/nclimate3323

Van Prooijen, J.-W. (2017). Why education predicts decreased belief in conspiracy theories. *Appl. Cogn. Psychol.* 31, 50–58. doi: 10.1002/acp.3301

Van Prooijen, J.-W., and Krouwel, A. P. (2020). Overclaiming knowledge predicts anti-establishment voting. *Soc. Psychol. Personal. Sci.* 11, 356–363. doi: 10.1177/1948550619862260

Vecchione, M., Feldman, C., and Wunderlich, S. (2015). Consumer knowledge and attitudes about genetically modified food products and labelling policy. *Int. J. Food Sci. Nutr.* 66, 329–335. doi: 10.3109/09637486.2014.986072

Vraga, E. K., Bode, L., and Tully, M. (2022). Creating news literacy messages to enhance expert corrections of misinformation on twitter. *Commun. Res.* 49, 245–267. doi: 10.1177/0093650219898094

Vraga, E. K., Tully, M., and Bode, L. (2020). Empowering users to respond to misinformation about covid-19. *Media Commun.* 8, 475–479. doi: 10.17645/mac.v8i2.3200

Wang, H., and Jin, J. (2019). Contact and subjective well-being: An empirical study with political trust as the mediating variable. University of Journalism, 7, 1–15. (in Chinese).

Wang, Y.and Xue, D. (2005). Investigation and analysis of consumers'cognitive attitudes towards genetically modified foods. *Environ. Prot.*, 46–51. doi: 10.3969/j.issn.0253-9705.2005.03.010 (in Chinese).

Wood, M. J. (2016). Some dare call it conspiracy: labeling something a conspiracy theory does not reduce belief in it. *Polit. Psychol.* 37, 695–705. doi: 10.1111/pops.12285

Wood, M. J., Douglas, K. M., and Sutton, R. M. (2012). Dead and alive: beliefs in contradictory conspiracy theories. *Soc. Psychol. Personal. Sci.* 3, 767–773. doi: 10.1177/1948550611434786

Woodworth, R. S., and Schlosberg, H. (1954). *Experimental Psychology.* New York: Holt, Rinehart and Winston.

Xiang, X., Zhang, Z., and Pang, X. (2005). Knowledge, attitude, behavior and influencing factors of gm food in urban residents of Beijing element analysis. *Chin. J. Food Hygiene* 17, 217–220. doi: 10.13590/j.cjfh.2005.03.003 (in Chinese).

Xiao, X., Borah, P., and Su, Y. (2021). The dangers of blind trust: examining the interplay among social media news use, misinformation identification, and news trust on conspiracy beliefs. *Public Underst. Sci.* 30, 977–992. doi: 10.1177/0963662521998025

Yang, J. (2013). A Comparative Study of American and Chinese College Students' social Trust, Conspiracy Beliefs, and Attitudes toward Genetically Modified crops. Ph.D. thesis.

Yang, Z., Luo, X., and Jia, H. (2021). Is it All a conspiracy? Conspiracy theories and People's attitude to COVID-19 vaccination. *Vaccine* 9:1051. doi: 10.3390/vaccines9101051

You, C., and Jin, J. (2020). The influence of scientific knowledge on controversial attitudes towards science and technology in the new media environment: the case of genetic modification. *Int. J. Press*, 42, 81–98. doi: 10.13495/j.cnki.cjjc.2020.05.006 (in Chinese).

Zhang, M., Chen, C., Hu, W., Chen, L., and Zhan, J. (2016). Influence of source credibility on consumer acceptance of genetically modified foods in China. *Sustainability* 8:899. doi: 10.3390/su8090899

Zhao, E., Wu, Q., Crimmins, E. M., and Ailshire, J. A. (2020). Media trust and infection mitigating Behaviours During the COVID-19 pandemic in the USA. *Br. Med. J. Glob. Health* 5, 1–10. doi: 10.1136/bmjgh-2020-003323

Zhu, W., Yao, N. C., Ma, B., and Wang, F. (2018). Consumers' risk perception, information seeking, and intention to purchase genetically modified food: An empirical study in China. *Br. Food J.* 120, 2182–2194. doi: 10.1108/BFJ-11-2017-0622

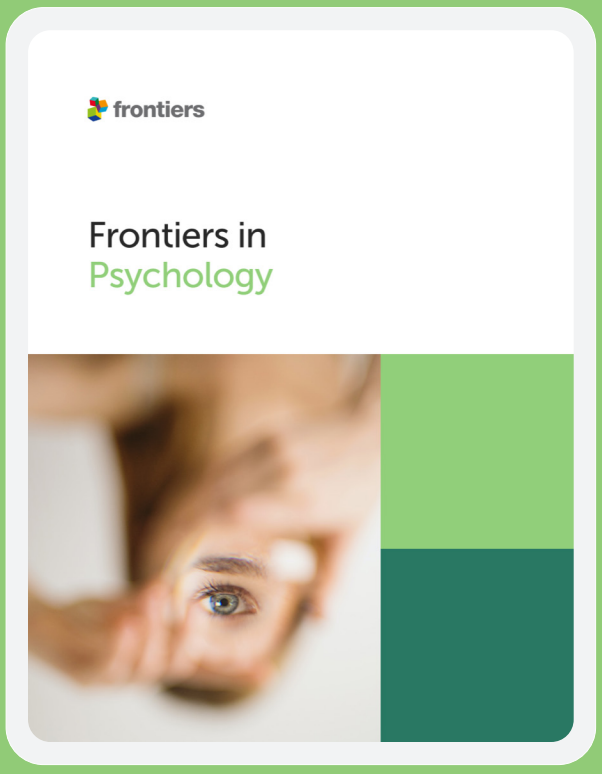
Frontiers in Psychology

Paving the way for a greater understanding of human behavior

The most cited journal in its field, exploring psychological sciences - from clinical research to cognitive science, from imaging studies to human factors, and from animal cognition to social psychology.

Discover the latest Research Topics

See more →



Frontiers

Avenue du Tribunal-Fédéral 34
1005 Lausanne, Switzerland
frontiersin.org

Contact us

+41 (0)21 510 17 00
frontiersin.org/about/contact