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Creating a Mind Genomics Wiki for Non-Meat Analogs

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Abstract: In the past few decades, several negative aspects of excess meat consumption have been identified, ranging broadly from health to environment to consumer rejections of meat analogs. At the same time, however, several new meat alternatives have emerged such as algae, insects, and cultured meat, which all present a sustainable option to reduce meat consumption. The paper assesses the psychology of the "everyday" for meat-free products, focusing on how consumers in two specific markets in the USA (California, New York) respond to messages about four specific topics involving meat-free products. These four are sensory characteristics, possible usage in products, health aspects, and environmental aspects, respectively. Each study with 100 or more respondents used experimental design of messages (Mind Genomics) to understand the degree to which the respondents reacted positively or negatively to the 16 messages in each of the four studies. The data suggest that focusing on the Total Panel or on geography, gender, or age will not reveal the dramatically different mind-sets existing in each of the four topics. We introduce the notion of the PVI, personal viewpoint identifier, to help the researcher uncover these mind-sets, and help communicate effectively with each mind-set about meat analogs or help recruit these individuals to participate in further studies.

Keywords: Mind Genomics; mind-sets; cultured meat; meat alternatives; sustainable food production

1. Introduction

Meat consumption is considered to be part of a healthy diet. However, excess meat consumption raises several issues ranging from health problems [1] through animal welfare issues [2] to adverse environmental effects of meat production [3]. Due to these unwanted effects of meat consumption, several attempts are made to reduce the consumed amount of meat [4,5] or to substitute meat with a presumably more healthy, more sustainable protein source [6,7]. Different research groups have focused on a wide range of meat alternatives starting from the application of plant-based diets [8], algae [9], insects [10], cultured meat [11], or even using meat by-products and 3D printing [12].

Plant-based diets are well-known and are popular among vegetarians and vegans. Yet, a completely meat-free diet might be not universally acceptable. A possible strategy to promote the transition from meat-based diets to a more sustainable plant-based one blends plant-based ingredients into traditional meat-based foods. One study using a mushroom-meat blend-based product revealed that consumers would consume such a product mainly for its health benefits, and of interest to the food industry, would most strongly accept a mushroom-meat blend-based burger [13]. In turn, algae offer a viable, cost-effective option with which to create protein-rich products. Consumers from Germany, France, and the Netherlands preferred a blend of algae with eggs, peas, and milk, respectively. Since eggs and

milk have animal origin, as well as being implicated in food-allergies, the study suggested that algae and peas might achieve the necessary acceptance as protein sources for non-vegetarians. Additionally, it has been shown that consumers value the organic and local nature of meat substitutes [14]. At the other end of the spectrum, almost opposite to the desire for vegetable analogs, lies the potential use of insect protein. Consumer acceptance of insects as food is mainly limited by food neophobia (fear from new, unfamiliar food products) as well as food safety issues associated with insects [15]. However, product tests reveal that insect-enriched products are accepted, respectively, in pastas [16], breads [17], and biscuits [18].

Although cultured meat has been introduced in the past decade and continues to attract attention for its novelty and possibilities, the emerging studies suggest that proper messaging to enhance consumer awareness, understanding and acceptance needs to be discovered. When cultured meat is then featured, one needs a deeper understanding of how to convince consumers of the naturalness and thus perceived safety of products containing cultured meat [19]. Data has emerged which suggest that cultured meat has inferior sensory quality, questionable food safety, societal concerns, and is incorrectly priced, either too low or too high, but just "not right." [20,21]. The conclusions from these studies stress that the foregoing issues may be addressed and probably solved by providing appropriate information to the consumers regarding the benefits of cultured meat products, stressing the triumvirate of health, environment, and food safety [22–24]. Add to the benefit of familiarizing the consumer with the nature of cultured meat, and there may be an opportunity for an entirely new class of products [20].

Measuring consumer acceptance of meat-alternatives presents some difficulties. In many cases, real products are not available or difficult to produce. A promising method to address these issues comes from the emerging science of Mind Genomics® [25], a method using experimental design to construct test vignettes or concepts, present these to the consumer respondent for evaluation, and then deconstruct the response into the contribution of the different elements. In practice, Mind Genomics works in a Socratic fashion, defining the topic, creating four questions which "tell a story," creating four answers to each question, with these answers being in the form of a phrase. The respondent evaluates different concepts, systematically created combinations of these answers. The question never appears. The question is only used to "motivate" the answer.

In practice, therefore, the respondent evaluates mixtures of messages, each respondent evaluating a unique set of 24 such mixtures, incorporating 2–4 answers into a single vignette, and each vignette presented a unique stimulus to be evaluated in and of itself, on a rating scale provided by the researcher. The analysis, usually by OLS, ordinary least-squares, reveals the part-worth contribution of each element or answer to the rating. When applied to the topic of meat analogs, Mind Genomics immediately reveals the contribution of each element, viz., answer, providing a fountain of knowledge about how people respond to these different messages about food analogs. The combination of elements makes it impossible to "game" the system. The respondent is presented with a set of test concepts, the mixtures of elements, rating and rating these concepts (aka vignettes) in about 3–5 seconds each. The responses are thus provided not so much by intellectualized, considered judgment as they are by intuitive judgment, responses to a "blooming, buzzing confusion" of different messages, with only a few seconds to decide.

Mind Genomics®was created in the early 1990s, based upon work from the late 1970s and 1980s in the practical world of product marketing [25]. The science was then expanded to address problems in food product design [26,27]. The science has found wide application because of ongoing efforts to create a simple, fast, inexpensive system (do it yourself research), to address complex problems from food product development [26], to specific almost esoteric problems such as consumer concerns about indoor plant toxicity [28], and on to applications such as criteria involved in agriculture such as peach variety selection [29].

A recent study evaluated consumer's willingness to purchase different meat alternatives versus traditional meat products. The study was conducted in four countries. The authors reported that consumers attributed higher importance to meat characteristics such as healthiness, safety,

and nutritional content, and/or higher sustainability, taste, and lower price as compared to their own standard buying decisions or their own neophobia, fear of new things, when they compared meat alternatives to traditional meat products. Additionally, the study reports that " . . . *a one unit increase in the healthiness, safety and nutritional content of plant-based products might be associated with a 68.7% increase in the probability of willingness to purchase plant-based proteins in Spain. A one-unit stronger belief in the cultured meat healthiness, safety and nutritional content may be associated with an 86.8% increase in the probability of willingness to purchase cultured meat in Brazil. A one-unit stronger belief in the perception of the insect-based characteristics of healthiness, safety and nutritional content might be associated with a 68.7% increase in the probability of willingness to purchase insect-based products in the United Kingdom, a 72.1% in Brazil and a 58.6% in the Dominican Republic*" [6].

This paper focuses on the topic of the mind of the consumers related to meat alternatives. The paper expands the hitherto limited single-focus studies of Mind Genomics, exploring the possibility of creating a bank of knowledge through easily and inexpensively executed sets of related studies, a Wiki approach to the consumer mind. The four topics for this first "Wiki" are sensory expectations, food product development, health, and then environment.

2. Materials and Methods

2.1. Participants

A set of four parallel studies were done using the method of Mind Genomics and covering a range of alternative issues in the daily experience of a consumer faced with the evolving world of meat analogs. These were possible uses in different foods, sensory acceptance, health and wellness, and environmental impact, respectively. The four studies were run using the BimiLeap program, the DIY (do it yourself) version of Mind Genomics. A world-wide panel provider, Luc.id, Inc., was contracted to provide more than 50 respondents from California and more than 50 respondents from New York, generating more than 100 respondents for each study. This sample size is in accordance with the suggested number (100–300) of respondents [30]. The breakdown was specified to be half male, half female, between the ages of 16 and 53. The only information collected about the respondent was market, gender, age, and a question about attitude toward the meat analogues—that question was particularized to each study. Demographic data regarding the participants appear in presented in Table 1.

Table 1. Gender and age of participants completed the four studies. Genders are presented in percentages (%), whereas age is presented as mean ± st.dev.

		Male	Female	Age
Different foods	CA	54	46	29.9 ± 2.3
	NY	42	58	28.1 ± 2.4
Sensory acceptance	CA	48	52	29.5 ± 2.4
	NY	50	50	30.6 ± 2.3
Health & wellness	CA	46	54	27.8 ± 2.0
	NY	48	52	27.8 ± 2.5
Environmental impact	CA	44	56	27.2 ± 5.1
	NY	50	50	28.0 ± 5.1

CA: California, NY: New York.

No significant difference was found among the eight studies [F (7,392) = 0.971, $p = 0.452$]. Similarly, there was no significant association among genders and the studies [χ^2 (7, N = 400) = 2.63, $p = 0.92$].

2.2. *BimiLeap®*

BimiLeap® [31], is the DIY software instantiation of Mind Genomics [25,27]. BimiLeap®is a freely available browser-based software which makes it straightforward to create, run, and automatically analyze small-scale studies in the Mind Genomics family. Mind Genomics itself is an offshoot of conjoint measurement [27], except that each respondent evaluates a unique set of 24 combinations or "vignettes" (space-filling, analogous to the way the MRI works) and the unique set of 24 combinations comprises a stand-alone experimental design.

BimiLeap®is based upon a Socratic method for exploring a topic. The researcher specifies the topic, formulates four questions which, in sequence, "tell a story," and provides four answers to each question, or a set of 16 answers. The answers are in the form of a declarative statement which should paint a "word picture." The BimiLeap®program allows the researcher to type the topic, the questions, and the answers directly into the program, formulate a rating question, a set of classification questions, and an open-ended question. Once the researcher finishes, it is a matter of "publishing" the study, paying for respondents through Luc.id (or sourcing the respondents in another, more indirect fashion.) The process is rapid, with set-up times to type in the materials and launching requiring about 1 hour, actual field work with Luc.id about 2–3 hours, and the completely analyzed results including a presentation ready report about an additional 1–2 minutes. The report and database are emailed virtually immediately. BimiLeap®uses rapidly presented ideas, therefore there is a limited time to think about the answers. These rapid, "gut" answers ensure the possible influence of any external factors, such as social expectations. Many scientific fields deal with the ever-changing opinion of consumers. It cannot be expected that the same respondent will have exactly the same opinion after repeated exposures. However, there are some techniques available to handle it. One is a sample number which was set to 200 in the presented study (100 from California and 100 from New York). When dealing with average results, the differences among the opinions of the respondents fade away. If the same 200 respondents would be interviewed again, their average results are not expected to be changed significantly since the individual differences would compensate each other. One thing, however, cannot be changed and these are the significant environmental effects; for example, media-hype of the analyzed topic or the effect of season when dealing with seasonal food products. When the study was run, there were no such external factors since there was no media-hype around meat alternatives and meat alternatives do not seem to have any seasonality. Four studies were created following the above-described process. Each of the four studies was run twice, once in New York, once in California. The topics, the questions, and the answer appear in Table 2.

BimiLeap®combines the answers into small vignettes, little "stories" about the given topic. The vignettes are created by a systematic design, permuted, so that each respondent sees a different permutation of the design. This creates different vignettes for each respondent. Each respondent evaluates the same formal set of 24 vignettes (structure is the same) but the specific combinations vary. All vignettes contain only one element from a silo, but not necessarily all silos are used. This means that a vignette can list one to four elements. This is required in order to provide the equal presentation of all the elements. So, with 50 people, the system creates 50×24 or 1200 different vignettes. The structure of the vignettes (e.g., the presence and absence of each of the 16 answers for each vignette) is stored in a binary table which is available to download once the study is closed [31].

The respondent reads the vignette, and rates the entire vignette on an anchored scale, with anchors 1 and 9, respectively. A rating of 1 denotes the fact the respondent does not agree with the specific combination of the statements in the vignette. A rating of 9 denotes the fact the respondent agrees completely with the specific combination of statements in the vignette. Respondents were instructed on the surface of the questionnaire about how to answer the questions.

Table 2. Study design of the four topics. The silos and the elements were created by the research team after a careful and throughout analysis of the scientific literature of the topic based on Scopus and Web of Knowledge searches.

	Study Name: Food Types	**Study Name: Sensory**
	Question A: Type	**Question A: Appearance**
A1	Processed meat product (sausage, meat patty, etc.)	Looks exactly like real meat
A2	Sliced meat (steak-like)	Minor differences to meat in appearance
A3	Pasta (spaghetti pasta, noodle, etc.)	Visible meat like chunks
A4	Pastry (bread, meat pie etc.)	Looks processed and synthetic
	Question B: Meat type	**Question B: Smell**
B1	Contains cultured-meat	Aroma of any normal meat
B2	Contains plant-based meat	Slight but mostly neutral aroma
B3	Contains insect-based protein	Strong but not unpleasant aroma
B4	Contains algae	No apparent aroma
	Question C: Where to consume	**Question C: Texture**
C1	As fast food	Similar texture to ground meat
C2	Consumed home with family	Similar texture to traditional sliced meat
C3	Consumed in a fancy restaurant	Soft, juicy and succulent texture
C4	Consumed on a business lunch	Firmer and drier texture
	Question D: Price	**Question D: Taste**
D1	Slightly higher price compared to traditional meat	Exact flavor as any meat
D2	Slightly lower price compared to traditional meat	Similar flavor but obvious differences to meat
D3	Same price as traditional meat	Major but not unpleasant flavor differences to meat
D4	Lower price compared to traditional meat	Contains vegetable flavors
	Study Name: Health aspects	**Study Name: Environmental aspects**
	Question A: Lower rates of diseases	**Question A: Climate change**
A1	A meat-free diet reduces the risk of cardiovascular diseases	Meat substitutes help to decrease greenhouse gas emissions
A2	Meat-free diet provides more energy	Meat production is one of the leading causes of climate change
A3	Meat-free diet reduces the risk of type-II diabetes	Meat production has little or no effect on climate change
A4	Children should not follow a 100% meat-free diet	Although meat production contributes to climate change, it is not the main cause
	Question B: Weight loss	**Question B: Local benefits**
B1	Meat-free diet helps in losing weight	Meat substitutes can be produced by local farmers also
B2	It is easier to exercise when not consuming meat	By eating meat-free, the local environment will be saved
B3	Lower fat intake helps in diet	Locally produced meat is better than meat substitutes
B4	High calorie meat substitutes hinder weight loss	Local meat producers lose their living if we substitute meat
	Question C: Healthier life	**Question C: Land/energy**
C1	Meat-free diet is part of a healthier lifestyle	Meat substitutes require less land, therefore reducing deforestation
C2	Consuming no meat fits in with regular exercise	When eating meat substitutes, no animals are harmed
C3	Non-meat eaters are healthier than meat eaters	The increased meat demand contributes to significant biodiversity loss
C4	Non meat eaters show no difference in their lifestyles than meat-eaters	With proper regulations, meat production would have no effect on our environment
	Question D: Nutrients	**Question D: Values**
D1	Meat-free diet increases fiber intake; hence your stomach becomes healthier	Meat substitutes are not cruel to animals
D2	Meat substitutes are rich in vitamins and minerals	Meat substitutes are less harmful to the planet
D3	Eggs and milks should not be discarded completely	Consuming no meat is better for my conscience
D4	Meat-free diet lacks essential nutrients, such as iron and calcium	Humans are carnivores, our body needs meat to work properly

2.3. Data Analysis

The Mind Genomics program BimiLeap®runs straightforward ordinary least squares regression (OLS) of the type found in most statistical analysis packages. In the first step, the rating scale is transformed into a binary scale, e.g., low/weak feeling and high/strong feeling. For the 9-point sale used here, ratings of 1–6 on the scale transformed to 0 (i.e., low/weak feeling), while ratings of 7–9 on the scale transformed to 100 (e.g., high/strong feeling). This transformation follows the conventions of consumer market research where the focus is on yes/no, even though the information collected is metric, from a Likert scale. After the transformation, a small random number between 0.01 and 0.1 is added to each binary rating to make the data immune to "crashing" in the OLS regression in the

event that the respondent rates all vignettes 1–6, or 7–9, respectively, and thus generates data with no variation. That lack of variation would cause the OLS to crash.

The binary table of the present/absent value (codes as 0 for absent, 1 for present) constitutes the set of independent variables. The transformed rating scale is used as a dependent variable. OLS is run on an individual level, e.g., on the 24 vignettes the participants evaluated. For these studies the regression models were estimated without the presence of an additive constant in the model, viz., "forced through the origin." The 16 regression coefficients for each respondent were used as the data for the respondent. The respondents were then clustered using k-means cluster, with the measure of distance between pairs of respondents defined as the quantity (1-R), where R is the Pearson correlation, computed by using the 16 correlation coefficients of each respondent. The respondents were clustered into two groups, and then into three groups, these groups called "mind-sets" because they represent different patterns of thinking about the same topic [31].

Once each respondent was defined by age and gender (self-definition in the classification portion of the Mind Genomics experiment) and assigned to one of three mind-sets (clusters) by the above-mentioned procedures, the entire array of data was reanalyzed by OLS regression (through the origin) for all respondents (total), all respondents from California versus all from New York, all males, all females, all younger, all older, and then those respondents falling into Mind-Set1 (Cluster 1), Mind-Set2 (Cluster 2), and Mind-Set3 (Cluster 3). The foregoing analysis was done separately for each of the four studies. Data analysis was done using R project (version R-3.6.0) and lm.beta package [32].

3. Results and Discussion

3.1. Food Types

The results from the total panel shows that respondents accepted the idea of meat alternatives (Table 3.) The coefficients are high, especially for elements such as "Contains plant-based meat" and "Contains cultured-meat." Based on the coefficients, the most accepted meat-alternative would be:

A processed meat product (sausage, meat patty, etc.))
Containing plant-based meat
Consumed home with family
Having lightly lower price compared to traditional meat

Table 3. Regression coefficients for models relating the presence/absence of the elements to the rating of disagree/agree, after binary transformation. Bold numbers show significant difference among clusters based on the given element. The highest four coefficients of each mind-set (MS) are colored as gray.

Code	Elements	Total	Male	Female	MS1	MS2	MS3
A1	Processed meat product (sausage, meat patty, etc.)	18	19	16	**22**	**27**	**3**
A2	Sliced meat (steak-like)	15	16	15	**25**	**18**	**1**
A3	Pasta (spaghetti pasta, noodle, etc.)	14	16	11	**22**	**31**	**−14**
A4	Pastry (bread, meat pie, etc.)	16	20	12	**23**	**21**	**1**
B1	Contains cultured meat	18	20	16	**30**	**5**	**16**
B2	Contains plant-based meat	21	24	19	**38**	**2**	**18**
B3	Contains insect-based protein	14	18	11	**33**	**−3**	**6**
B4	Contains algae	14	13	14	**33**	**−8**	**10**
C1	As fast food	13	18	8	**5**	**3**	**31**
C2	Consumed home with family	13	17	10	**5**	**0**	**38**
C3	Consumed in a fancy restaurant	13	20	6	**17**	**−6**	**25**
C4	Consumed on a business lunch	12	20	4	**14**	**−14**	**34**
D1	Slightly higher price compared to traditional meat	6	4	8	**−10**	**29**	**4**
D2	Slightly lower price compared to traditional meat	8	4	12	**−11**	**22**	**19**
D3	Same price as traditional meat	6	4	7	**−10**	**28**	**4**
D4	Lower price compared to traditional meat	5	1	9	**−16**	**23**	**15**

When comparing males and females, the most obvious differences arise in the case of the location of consumption. Men proved to be more open to the different locations and gave the highest ratings to

fancy restaurant, while women were less open and would consume meat alternatives during a family event. The other significant difference was price. Women show more price sensitivity; they would accept a slightly lower price of meat alternatives, while men showed generally low interest in prices.

The emergent mind-sets showed three distinct groups (Table 2). Mind-Set 1 appears to be more open to alternatives, Mind-Set 2 appears to focus on the price, whereas Mind-Set 3 appears to focus on the consumption venue. Thee three mind-sets showed completely different picture about their expectations of meat-free food products:

Mind-set 1 (Foodies):

Sliced meat (steak-like) product
Made of plant-based meat
Consumed on a business lunch
Same price as traditional meat

Mind-set 2 (Price sensitives):

Pasta (spaghetti pasta, noodle, etc.) product
Made of cultured meat
Consumed as fast food
Slightly higher price compared to traditional meat

Mind-set 3 (Diners):

A processed meat product (sausage, meat patty, etc)
Made of plant-based meat
Consumed home with family
Lower price compared to traditional meat

3.2. Sensory Aspects

Sensory aspects of meat-free products resulted in three distinct clusters. Table 4 presents the regression coefficients for total panel, genders, and mind-sets, respectively. The coefficients from the Total Panel suggest that respondents would buy meat-free products having similar sensory aspects as traditional meat. If we construct the product features greatest for each sensory input, we would emerge with this product:

Looks exactly like real meat (element A1);
Has strong but not unpleasant aroma (element B3);
Has soft, juicy, and succulent texture (element C3) and
Has exact flavor as any meat (D1).

When gender differences are considered, the data suggest that males place more emphasis on appearance since their highest coefficient occur for the element "Looks exactly like real meat." In contrast, women agree most with the element "Similar flavor but obvious differences to meat" the most.

The generally higher coefficients of men, a higher willingness to buy, are in accordance with the literature. For example, in the case of cultured meat, men proved to be more accepting compared to women in the US [33]. Along with this, female participants showed significantly higher willingness to change their meat consumption patterns compared to the expressed willingness of men, respectively [4].

As the total panel and gender results suggest, participants expect meat alternatives having similar characteristics to the mean products with which they are familiar. The three emergent mind-sets tell a different story, however, or more appropriately, tell three different stories. The created clusters show characteristic differences and completely different patterns of highly rated elements.

Table 4. Mean regression coefficients of total panel, males, females, and the three mind-sets. Bold represents significant difference among clusters based on the given element. The highest four coefficients of each mind-set (MS) are colored as gray.

Code	Elements	Total	Male	Female	MS1	MS2	MS3
A1	Looks exactly like real meat	16	24	9	**−5**	**19**	**34**
A2	Minor differences to meat in appearance	11	11	11	**−7**	**13**	**26**
A3	Visible meat like chunks	11	15	7	**−8**	**15**	**25**
A4	Looks processed and synthetic	13	18	9	**−10**	**19**	**30**
B1	Aroma of any normal meat	14	14	14	**28**	**20**	**−6**
B2	Slight but mostly neutral aroma	13	13	13	**19**	**22**	**−1**
B3	Strong but not unpleasant aroma	19	19	19	**27**	**28**	**1**
B4	No apparent aroma	15	17	14	**14**	**34**	**−1**
C1	Similar texture to ground meat	10	9	10	**5**	**28**	**−4**
C2	Similar texture to traditional sliced meat	4	7	1	**−1**	**15**	**−2**
C3	Soft, juicy and succulent texture	11	14	7	5	17	10
C4	Firmer and drier texture	9	11	7	**0**	**27**	**−1**
D1	Exact flavor as any meat	18	19	16	**37**	**−3**	**18**
D2	Similar flavor but obvious differences to meat	14	9	19	**39**	**−13**	**17**
D3	Major but not unpleasant flavor differences to meat	14	14	15	**34**	**−21**	**30**
D4	Contains vegetable flavors	15	17	13	**30**	**−9**	**23**

Mind-Set 1 is the "Flavor-oriented" cluster, since they would buy meat alternatives which have positive flavor notes, whether or not these notes show similarity or difference compared to traditional meat products. Consequently, Mind-Set 1 places a great emphasis on aroma notes. They would buy a meat alternative which has:

Aroma of any normal meat and
Similar flavor but obvious differences to meat.

Mind-Set 2 focuses on aroma and texture attributes since these elements received the highest ratings, therefore have the highest positive coefficients. Mind-Set 2 can be labelled Texture-Oriented. They want:

No apparent aroma and
Similar texture to ground meat.

Mind-Set 3 is more responsive to appearance and flavor attributes, and so can be labelled "Appearance-Oriented." They want a meat alternative which

Looks exactly like real meat and
Has major but not unpleasant flavor differences to meat.

Based on the pattern of the answers, cultured meat should be introduced to Mind-Set 1 since cultured meat has the most similar sensory attributes to traditional meats. On the other hand, plant-based proteins should meet the requirements of Mind-Set 2 since they have no apparent aroma and can be formed to have similar texture to ground meat [13]. Insect-based proteins could be a good alternative for Mind-Set 3 since insects have major but not unpleasant flavor differences to meat and they can also be formed to look like real meat [33].

3.3. Health Aspects

Total panel analysis of health aspects of consumption of meat-free products (Table 5) revealed a number of noteworthy patterns. Among the total panel, the highest coefficient is "*Meat-Free Diet Helps in Losing Weight*" (element B1), which suggests that meat-free diets are associated with weight loss. Yet, respondents do not consider a meat-free lifestyle and meat-free diets as a healthier life style, since they agree with the element "Eggs and milks should not be discarded completely" (D3). Furthermore, elements in Question C (meat-free lifestyle) received the lowest agreement ratings. These patterns accord with the literature. It has been shown that regardless of being semi-vegetarian or omnivore,

the leading motive to eat less meat was "my health" [34]. In the Netherlands, it has been shown that vegetarians reported two key reasons of not eating meat: they do not like it at all and they think animal welfare is important [35]. Another study from the United States found that flexitarians turn into full vegetarians due to social identity aspects of meat avoidance [36].

For genders, men agree more with statements related to weight loss and benefits during exercises compared. In contrast, women are more open to messages about health benefits such as lower risks of diseases, and messages about better nutrient intake of meat-free diets. These results were also supported by a recent study from the United States examining gender differences in vegetarian identity. Major differences between vegetarian identities of men and women were found as dietary motivation and dietary adherence. Women were reported as more motivated and willing to keep their diet stricter [37].

Our total panel and gender results are well supported by other, different authors and different, other methods from the literature. The most interesting results emerge from clustering into "mind-sets" based upon the patterns of coefficients of the individual respondent.

Table 5. Mean regression coefficients of total panel, males, females, and the three mind-sets. Bold represents significant difference among clusters based on the given element. The highest four coefficients of each mind-set (MS) are colored as gray.

Code.	Elements	Total	Male	Female	MS1	MS2	MS3
A1	A meat-free diet reduces the risk of cardiovascular diseases	8	5	9	**−20**	**32**	**12**
A2	A meat-free diet provides more energy	10	8	13	**−8**	**30**	**11**
A3	A meat-free diet reduces the risk of type-II diabetes	13	12	13	**−10**	**40**	**11**
A4	Children should not follow a 100% meat-free diet	5	−2	11	**−25**	**33**	**9**
B1	Meat-free diet helps in losing weight	21	33	10	**31**	**10**	**21**
B2	It is easier to exercise when not consuming meat	13	18	9	18	4	16
B3	Lower fat intake helps in diet	14	18	10	**29**	**−5**	**17**
B4	High calorie meat substitutes hinder weight loss	13	14	11	**22**	**0**	**15**
C1	Meat-free diet is part of a healthier lifestyle	10	11	9	**14**	**−3**	**18**
C2	Consuming no meat fits in with regular exercise	8	11	5	**12**	**−8**	**17**
C3	Non-meat eaters are healthier than meat eaters	10	14	6	**14**	**−12**	**25**
C4	Non meat-eaters show no difference in their lifestyles than meat-eaters	8	9	7	**8**	**−3**	**17**
D1	A meat-free diet increases fiber intake; hence your stomach becomes healthier	13	8	17	**35**	**19**	**−14**
D2	Meat substitutes are rich in vitamins and minerals	9	4	14	**37**	**12**	**−20**
D3	Eggs and milks should not be discarded completely	13	7	19	**38**	**21**	**−18**
D4	A meat-free diet lacks essential nutrients, such as iron and calcium	11	6	16	**33**	**22**	**−20**

Mind-Set 1, which we label nutrition-minded group, showed coefficients for elements highlighting the nutrient intake benefits of meat-free diets. *They agree with the statements of eggs should not be discarded and that a meat-free diet lacks some essential nutrients, such as iron and calcium.* Perhaps paradoxically, Mind-Set 1 has strong negative coefficients for elements in silo *A which are about the lower risks of diseases.*

Mind-Set 2, which we label disease-avoiders, agree with all the elements of Question A, meaning that they see the *lower risks of diseases as the major health benefit of a meat-free diet.*

Mind-Set 3, which we label sports enthusiasts, see the benefits of a meat-free diet *in helping them losing weight and getting into better shape.*

3.4. Environmental Aspects

Total panel results presented by Table 6 highlight the most important elements regarding environmental aspects of meat-free products. The highest coefficients, viz. those driving the greatest agreement by the respondent to the proposition embedded in the element, are *fear of biodiversity loss (element C3), positive effects on conscience (D3) and animal welfare (C2), as well as the general agreement that people need meat to maintain our normal functions (D4).* Previously published data suggest that respondents agree that a meat-free diet exerts positive effects on the environment and on animal welfare, respectively [34,35].

Table 6. Regression coefficients of total panel, males, females, and the three mind-sets. Bold represents significant difference among clusters based on the given element. The highest four coefficients of each mind-set (MS) are shaded in gray.

Code	Elements	Total	Male	Female	MS1	MS2	MS3
A1	Meat substitutes help to decrease greenhouse gas emissions	11	11	8	**25**	**18**	**−20**
A2	Meat production is one of the leading causes of climate change	9	13	8	**20**	**20**	**−12**
A3	Meat production has little or no effect on climate change	10	12	11	**26**	**26**	**−25**
A4	Although meat production contributes to climate change, it is not the main cause	7	3	4	**14**	**20**	**−31**
B1	Meat substitutes can be produced by local farmers also	10	17	8	**32**	**−6**	**16**
B2	By eating meat-free, the local environment will be saved	10	16	6	**29**	**−8**	**18**
B3	Locally produced meat is better than meat substitutes	12	8	15	**29**	**−11**	**23**
B4	Local meat producers lose their living if we substitute meat	12	11	11	16	3	15
C1	Meat substitutes require less land, therefore reducing deforestation	13	9	16	**−11**	**25**	**20**
C2	When eating meat substitutes, no animals are harmed	13	8	16	**−23**	**28**	**30**
C3	The increased meat demand contributes to significant biodiversity loss	13	5	20	**−13**	**25**	**23**
C4	With proper regulations, meat production would have no effect on our environment	11	7	19	**−12**	**24**	**24**
D1	Meat substitutes are not cruel to animals	11	7	9	**17**	**−3**	**13**
D2	Meat substitutes are less harmful to the planet	12	14	16	**23**	**2**	**22**
D3	Consuming no meat is better for my conscience	13	15	15	**28**	**−2**	**23**
D4	Humans are carnivores, our body needs meat to work properly	13	19	14	23	9	22

Patterns of response by gender show some interpretable patterns. Whereas men uprated elements about climate change higher, women uprated elements dealing with local production and land/energy aspects. Women gave their highest rating to element "*The increased meat demand contributes to significant biodiversity loss.*" Additionally, compared to men, women agree more with the proposition about the positive effects of meat-free diets on animal welfare.

Men gave the highest coefficient of both genders for *"Humans are carnivores, our body needs meat to work properly"* (D4), possibly hinting that men might be less willing to follow a meat-free diet. These results are in accordance with those found in the literature; compared to men, women express a greater support for animal rights and environmental benefits of meat-free diets [37].

The emergent mind-sets suggest three clearly different ways of thinking, a result which characterizes clusters created on the basis of responses to specifics (relevant messages), rather than clusters created on the basis of a person is, or how a person thinks in general about a topic. *Mind-Set 1 suggests local patriots who value local products and support the production of meat and meat substitutes by local farmers. Additionally, they consider eating meat as good for their consciousness and their local environment. They may be similar to the emerging group called "locavores." Mind-Set 2 suggests environmentalists, who decry the fact that that meat production contributes to deforestation, animal abuse, and the loss of biodiversity. Mind-Set 3 appears to be practicals, who care about both local values and land/energy aspects of meat production. They are not idealists, who blame climate change on the activities involved with meat product.*

4. Conclusions

The four integrated studies with comparable coefficients and interrelated elements reveal the possibility of creating a Wiki of a topic area in a short time (1–2 weeks), with the studies conducted among the desired target population, and with the cost and time parameters so low and fast that one can do several iterations. Our goal here is to explore the topic of the new meat analogs or replacements, showing what can be created in terms both of experimentation and about data-based hypothesis generation to guide subsequent explorations of the topic.

The importance of the studies is their integration into a database, the aforementioned "wiki," as well as the importance of emergent mind-sets, with these mind-sets relevant to the particulars of the topic. Researches know that data from the "many," from total panels, might give overgeneralized, and seeming irrelevant, "bland" results which do not teach or advance science, and simply "do not work in practice." Some improvement could be achieved by splitting the participants based on gender and/or age; however, these can result in misleading results, too.

Besides the speed, low cost, and sheer interactivity of Mind Genomics experiments, the contribution of Mind Genomics may be most important in terms of its ability to reveal specific, granular mind-sets, groups of individuals emerging from the pattern of responses to a particular localized topic. It is the granularity of knowledge, and the ability to test specific, concrete suggestions of what to say and what to do, that allows Mind Genomics to contribute both to science and to practice.

The mind-sets created in these studies did not show any significant differences neither by gender nor by age groups, meaning that the mind-sets may be explained and described better by categorized "thinking styles" that crosswise the different demographic variables. This confirms the 30–40-year science of Mind Genomics as a powerful discovery and application tool for sensory and consumer scientists. The presented results enable food companies and policy makers to get a clearer overview of US participants' attitudes toward meat-free products and some related aspects. Future studies are needed to uncover how to classify newly recruited participants into the defined mind-sets by developing a fast, simple, powerful, and cost-effective method to classify. A good analogy is color science. Mind Genomics provides the "theory of colors" in a day or two for any defined or even hypothesized set of topics and questions. The next step is to create a "personal viewpoint identifier" to assign new people to the just-uncovered mind-sets, a discovery that may have taken simply one morning or one afternoon to make.

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