**CONSUMERS' COGNITIONS WITH
REGARD TO GENETICALLY MODIFIED
FOODS – RESULTS OF A QUALITATIVE
STUDY IN FOUR COUNTRIES**

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PREFACE

This report is a task of the project *Consumer Attitudes and Decision-Making with Regard to Genetically Engineered Food Products*. The project is funded by the European Commission through contract number FAIR-PL96-1667. Co-ordinator of the project is Professor Klaus G. Grunert, The MAPP Centre at the Aarhus School of Business. Participating organisations are the Technical Research Centre of Finland; Oy Panimolaboratorio-Bryggerilaboratorium AB, Finland; Chr. Hansen A/S, Denmark; Universität Potsdam, Germany; ISIDA, Italy and Institute of Food Research, the United Kingdom.

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August 1998*

EXECUTIVE SUMMARY

1. Gene technology is increasingly used in the development of new foods and raw materials for food production. While food producers and food technologists largely support the application of gene technology in food production, consumers have been shown to be much more sceptical.

2. The objective of the research presented in this paper was to gain insight into consumers' cognitions with regard to genetically modified foods to obtain a better understanding of how consumers form attitudes to genetic engineering in food production. Perceived risks and benefits of applying genetic engineering in foods were investigated, with an emphasis on tracing cross-national differences, differences relating to different outcome groups, and differences relating to the presence or non-presence of genetically modified material in the product that is finally consumed. In addition, the impact of more general attitude domains on consumer belief structures was investigated.

3. Means-end chain theory served as the theoretical basis for conducting qualitative interviews – using the laddering method – with 400 consumers in Denmark, Germany, the United Kingdom and Italy, using beer and yoghurt as tangible product examples.

4. Initial rankings of different beer and yoghurt products showed consistently low preferences for the genetically modified product alternatives across countries and product categories. Both in the case of yoghurt and beer, more traditional product alternatives were preferred.

5. In all four countries, genetic engineering was associated with something unnatural, and feelings of unfamiliarity with the resulting products were voiced as well as moral considerations. Independently of whether the genetically modified material was present in the final product (yoghurt) or not (beer), the consumers perceived the products as unwholesome and untrustworthy, and a range of negative consequences were inferred, which would eventually prevent the attainment of individual life values such as happiness and inner harmony, a long and healthy life, quality of life and security, and more social life values such as responsibility for nature and responsibility for the welfare of other people.

6. More complex cognitions were generally found in Denmark and Germany than in the United Kingdom and Italy, and in Denmark and Germany the perceived attributes and consequences were also more tightly linked to central life values. In Italy, only few associations were derived from the application of genetic engineering to produce beer and yoghurt, whereas a large palette of consequences were perceived in the three other countries. The results revealed no substantive differences in beliefs relating to the different outcome groups considered.

7. Overall, the results also indicate that general attitude domains such as food neophobia and attitude to technology may influence consumers' belief structures and eventually attitudes towards applying gene technology in food production. The extent to which these domains play a significant role however, still remain to be investigated.

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INTRODUCTION

These years, still more advanced breeding and product modification techniques are developed based on gene technology and other kinds of modern biotechnology. Most scientists regard these new techniques simply as a natural extension of traditional breeding methods and regard the prospects of using gene technology to change product properties for financial, environmental, health- and quality-related reasons as practically unlimited. By arguing that genetic engineering is actually safer than traditional breeding techniques because of the tight control procedures imposed by the authorities specifically in this area, these people do not hesitate to advocate the use of gene technology in the food domain.

The success of using gene technology both in primary production and processing of food products is, however, contingent on consumer acceptance. While most technological experts celebrate the advantages of gene technology and reject the possibility of serious risks arising from its application (Scholderer, Balderjahn & Will, 1998), consumers seem to associate considerable risk with this technology (eg European Commission, 1997; Frewer & Shepherd, 1995).

The risk that consumers associate with a new technology affects the acceptance of the resulting products. The amount of risk perceived is based on individual psychological processes that can be expected to be influenced by the level of knowledge that the consumers have about the technology. However, since many consumers are still uncertain about the basic principles of genetic engineering and the consequences of its application (Hamstra, 1995), risk perception in this case becomes very emotional. The risks that experts perceive in a given technology are, on the other hand, based on scientific risk assessment which is evaluated by objective criteria. It therefore seems highly likely that consumers' risk perception with regard to genetic engineering differs fundamentally from experts' risk evaluation.

MODELLING CONSUMER ATTITUDES AND DECISION-MAKING WITH REGARD TO GENETICALLY MODIFIED FOOD PRODUCTS¹

Previous research has shown public acceptance of genetic engineering to vary with the kind of organism involved and the field of application. Thus, public support for applying genetic engineering for medical purposes has repeatedly been shown to be higher than support for applications in the food domain (eg European Commission, 1997; Heijs & Midden, 1995). One explanation may be that pharmaceuticals are generally accepted as products that are of vital importance to restoring and maintaining human health and mental condition, whereas the individual food product as such is not, which reduces the support of advanced process technologies in food production because of less willingness to accept risk.

¹ For the sake of simplicity, the term 'genetically modified food products' is used in this paper as a general designation of foods and food ingredients which contain or consist of genetically modified material or which are produced from, but do not contain, genetically modified material.

A number of attempts have also been made to explain consumer attitudes towards genetic engineering, and part of these studies have looked specifically into the constituents of consumer attitudes towards genetic engineering in the food domain (for a review see Bredahl, Grunert & Frewer, 1998). Deriving general conclusions from this research is complicated by large variations in research methodology and level of abstraction, but it seems that the following factors can be expected to influence attitudes towards applying genetic engineering in food production.

Perceived risks and benefits of genetic engineering seem to be major determinants of attitudes towards genetic engineering in food production (Frewer & Shepherd, 1995; Hamstra, 1995). It is likely that the relationship between the two is compensatory, meaning that perceived risks of genetic engineering to a certain degree can be offset by greater perceived benefits of applying the technology in food production, as has been shown to be the case with other technological activities (Fischhoff, Slovic, Lichtenstein, Read & Combs, 1978). Furthermore, it seems that with genetic engineering, consumers not only consider the consequences of the technology for themselves, as is generally assumed in multi-attribute attitude models (eg Fishbein, 1963), but also take into account perceived consequences for other outcome groups such as their family or the environment. Consumers' attitudes towards genetic engineering in food production can also be expected to be influenced by more general attitudes held by consumers such as attitude towards technology or food neophobia (Hamstra, 1995; Sparks, Shepherd & Frewer, 1994), and by knowledge domains pertaining to gene technology or food production in general (Frewer, Howard & Shepherd, 1997). Considering that genetic engineering is sometimes simply used as a processing aid that does not change the product characteristics from those of a conventional product, and where the genetically modified material is perhaps not even present in the final product, it also makes sense to expect consumer attitudes to be influenced both by beliefs relating to the production process itself and by beliefs about the quality and consequences of consuming the resulting product.

Previous research has also addressed various aspects of the determinants of a person's purchase decision with regard to a genetically modified food product (reviewed in Bredahl, Grunert & Frewer, 1998).

In cognitive psychology, behavioural intentions are typically assumed to be predicted by attitudes towards the behaviour along with perceived social pressure and perceived control with regard to the behaviour (Ajzen, 1985). Speaking of purchase decisions with regard to a genetically modified food product, it seems reasonable, however, to expect the behavioural intention also to be influenced by the attitude that the person holds towards applying genetic engineering in food production in general, as discussed above, along with other perceived product-specific attributes and consequences of purchasing the product. Perceived social pressure with regard to purchasing or avoiding the product is also likely to influence the purchase decision significantly, as is the person's perceived control and perceived difficulty with regard to performing the behaviour, for instance whether the person perceives to have a choice at all of purchasing or avoiding the product (Sparks, Guthrie & Shepherd, 1997). Perceived moral obligation to avoid genetically modified foods, finally, is also a likely determinant that has previously been shown to have a significant impact on purchase decisions with regard to genetically modified food products (Sparks, Shepherd & Frewer, 1995).

As a consequence, information about consumer *beliefs* becomes essential in explaining both consumer attitudes and purchase intentions with regard to genetically modified food products. For the explanation of attitudes towards genetic engineering in food production, information about beliefs about the attributes or consequences of applying the technology is essential, whereas for predicting behavioural intentions, insight into beliefs about other product attributes are also important, along with insight into beliefs about attitudes of important reference groups to the behaviour, insight into beliefs about factors which are believed to inhibit or facilitate the behaviour and, finally, insight into moral beliefs.

Put generally, beliefs reflect the knowledge and subjective meanings that a person has about an object through associations to the object and its attributes. Beliefs are stored and organised in human memory in cognitive structures. Cognitive structures therefore represent the total amount of subjectively interpreted information in a person's memory, of which only some is relevant for explaining consumer behaviour.

Cognitive structures that deal with consumption-related aspects have been modelled in means-end chains theory, which explains consumer attitudes and product preferences by how consumers mentally link perceptions of product attributes to the attainment of basic life values through self-relevant consequences (Gutman, 1982; Olson, 1989). The theory models how different cognitive categories at different levels of abstraction are linked to each other in hierarchical structures with concrete attributes at the one extreme end and values at the other end of the chain. Values are therefore sometimes also referred to as consumers' abstract purchase motives.

For consumers, many food product choices are made in a situation of low involvement, but consumers may still realise ways in which food products and their characteristics are linked to the attainment of life values which are important to them. Since genetically modified foods are still only rarely found in the supermarkets, consumer familiarity with these products is generally low, but as has been demonstrated in several studies, risk perception is high. This gives reason to expect consumer attitude formation and decision-making with regard to genetically modified products to be particularly complex and closely related to basic life values. Means-end chain theory has previously proved a successful tool for explaining consumer behaviour in the food domain, and we regard it as a most suitable tool for providing an understanding of beliefs underlying consumer attitudes and purchase intentions with regard to genetically modified food products as well.

PURPOSE OF THE STUDY

The aim of the study reported here was to gain further insight into the cognitions which consumers have with regard to genetically modified food products, and specifically to generate information about:

- perceived risks and benefits, including the impact of tangible benefits on consumer belief structures
- possible differences in beliefs relating to different outcome groups

- beliefs held by consumers when a) the genetically modified material is part of the final product and b) when the genetically modified material is not present in the final product
- the impact of more general attitude domains on consumer belief structures
- cross-national differences in beliefs and attitudes

STUDY DESIGN AND DATA COLLECTION TECHNIQUE

The study employs a qualitative research design with respondents in four countries. Previous research has shown that measurements of consumer attitudes and belief structures with regard to genetic engineering become more reliable and predictive of consumer acceptance when the focus is on specific products rather than genetic engineering in general. The research was therefore based on exposure to 'real' genetically modified food products with explicit, but different consumer benefits.

Means-end chains can be measured by the laddering technique, which is a semi-structured qualitative interview method (Reynolds & Gutman, 1988). The technique takes its starting point in product attributes regarded as important by the respondent for choosing among a given set of products. For each relevant product attribute the interviewer uses a series of 'why is that important to you'-type of questions to get the respondent to reach increasingly abstract levels of explanation. As in means-end chain theory, the technique presupposes a hierarchical cognitive structure, and the idea is to uncover the entire chain from concrete and abstract attributes over functional and psychosocial consequences to instrumental and terminal values. These chains are also commonly referred to as 'ladders'.

Laddering data are usually analysed at the aggregate level in hierarchical value maps, which is a form of graphic representation of the data summarised across a group of respondents. A major force of hierarchical value maps is that they can provide the researcher with an overview of the collected data, and across homogeneous groups of respondents, hierarchical value maps may even be viewed as representations of cognitive structures.

Ideally, all cognitive categories and their mentioned interlinks should be shown in a hierarchical map, but clearly this conflicts with the basic reason for creating the map and the map would probably be uninterpretable. For the sake of simplicity, associations between categories are therefore usually only presented in hierarchical value maps if they have been mentioned, directly or indirectly, by some minimum number of respondents. Since most links between concepts are either not mentioned at all or mentioned by relatively many respondents, this principle makes it possible to create interpretable and still highly informative hierarchical value maps. Although this method of data representation also involves some technical problems for instance with regard to the basic principle of non-redundancy (Grunert & Grunert, 1995), it can still be regarded as a solid way of analysing means-end data.

DATA COLLECTION AND ANALYSIS

400 laddering interviews were carried out in Denmark, Germany, the United Kingdom and Italy, using beer and yoghurt as tangible product examples, with 50 interviews in each country for each product category.

Products

Four product profiles were developed for each product category, with varying characteristics and consumer benefits. The four yoghurt products varied on fat content, production method, presence of additives and texture as follows:

- traditional full-fat whole-milk yoghurt without additives, characterised by a nice taste and smooth texture
- traditional low-fat skim-milk yoghurt without additives, characterised by a nice taste and thin texture (owing to the low fat content)
- fat-free yoghurt produced with stabilisers and antioxidants, characterised by a nice taste and smooth texture
- fat-free yoghurt produced with genetically modified starter culture, characterised by a nice taste and smooth texture

The four beer products varied on production method, energy consumption/environmental friendliness, quality of raw materials and price, and were:

- beer produced in a traditional way from high quality raw materials, sold at a medium price
- beer produced in a traditional way from standard quality raw materials, sold at a low price
- beer produced by means of modern process technology (specified as not gene technology) which ensures that the production process becomes less time and energy consuming, and thus more environmentally friendly, sold at a high price
- beer produced by means of genetically modified yeast, which ensures that the production process becomes less time and energy consuming, and thus more environmentally friendly, sold at a low price

Thus, the consumer benefits of applying genetic engineering in the yoghurt example were absence of fat and a smooth texture without the use of artificial additives, whereas in the beer case the consumer benefits of applying genetic engineering were claimed to be an environmental benefit and a lower price.

Tangible yoghurt products were created from new yoghurt cups, which were filled with a substance resembling yoghurt in weight and filling and provided with labels containing the relevant product information. The lids were glued on to the cups to avoid 'accidents'. Tangible beer products were created from existing bottled

beers that had their original labels removed before being equipped with new labels that contained the product information developed for this study. In this way, identical products were obtained for all beer and yoghurt alternatives, except for the contents of the label information. In order to make the product examples still more realistic, it was decided to supply the beer products with brand names ('Classic' for the traditional, medium price beer; 'Economy' for the traditional, low price beer; 'Green' for the genetically modified beer and 'Hi-tech' for the beer produced by unspecified modern process technology²). The yoghurts were kept as no-name products. The products were only used for visual presentation.

Respondents

Only regular consumers of beer and yoghurt were recruited. In the yoghurt sample all respondents were the main food shopper of their own household as well.

In the beer sample, quotas were put on consumption frequency (with extreme consumers excluded), education and gender, while in the yoghurt sample, quotas were put on consumption frequency, education and having children. The quotas were set to ensure sufficient variation in the data.

The interview

The interviews were divided into two parts. First, salient attributes were elicited by means of a ranking procedure. The four alternative yoghurts or beers were presented to the respondents, who were then asked to rank the products according to preference and give their reasons for the this ranking. In the second part of the interviews, the generated attributes were used as a starting point for the laddering procedure where consequences and eventually values were pursued. Reverse laddering was used first in cases in which abstract attributes or perhaps even consequences were mentioned by the respondent in the elicitation task. All resulting ladders were listed in ladder forms by the interviewer continuously during the interview, and all interviews were tape-recorded to allow subsequent quality checks.

All Danish and Italian interviews were carried out as personal in-home interviews, whereas the German and British interviews took place at central research facilities. The data were collected in late 1997.

Categorisation and coding of the results

After completion of the field work, the Danish laddering data were categorised into attributes, consequences and values, and by thorough meaning-based interpretation of all individually mentioned concepts the data were then coded into broader categories. The procedure was carried out separately for the beer and yoghurt data.

² In Germany and Denmark 'Standard' was used instead of 'Economy', and in Germany 'Nova' was used instead of 'Hi-tech'.

The resulting lists of categories were translated into English and used by bilingual researchers as a basis for categorising and coding the German, British and Italian data. Additional categories were added at this stage when necessary. To ensure that the same conceptual understanding was behind the coding of all data sets and to check for linguistic errors, all allocated codes were finally checked and synchronised across countries by one single researcher. In this way the laddering data from the interviews about yoghurt were coded into 60 broader categories, while the concepts that were extracted in the interviews about beer were coded into 61 categories. The categories can be seen in Appendix A.

The coded data were then analysed and interpreted at the aggregate level by means of hierarchical value maps. Separate value maps were produced for each product and country in order to take possible cross-national differences into account.

Each hierarchical value map was produced with cut-off levels ranging from three to five respondents, before a final solution was chosen by inspecting the interpretability of the produced maps. The hierarchical value maps presented here may therefore have different cut-off levels, which should be taken into account when interpreting the results and evaluating the complexity of the results.

RESULTS

Below, is a presentation of some general results concerning product preferences and response complexity before proceeding to results pertaining specifically to means-end structures with regard to the genetically modified product examples.

Product preferences

The initial ranking of the products can be used to investigate the relative preference for the products. The most and least preferred products are shown in figure 1.

Overall, the more traditional product alternatives were clearly preferred. More than half of the respondents in all four countries ranked the medium-priced traditional beer as the product they preferred most of the four beers. Similarly, the traditional full-fat whole-milk yoghurt was reported as the most preferred yoghurt by a majority of respondents in Denmark, Germany and Italy, while in the United Kingdom, the highest preference was for the fat-free yoghurt with artificial components to ensure a smooth texture.

As can be seen in the diagrams, preference for the genetically modified products was generally low, and more so in Denmark and Germany than in the United Kingdom and Italy. In the German sample, some three fourth of the respondents actually mentioned the genetically modified beer as the least preferred product of the four beers, which contrasts with the British and Italian samples where a considerable proportion of the respondents claimed to prefer the genetically modified product over the three other products. It is expected that the major reasons for these differences in product preferences in the subsequent analysis of the generated means-end chains can be identified.

Figure 1. Most and least preferred products

Response complexity

Overall, 2187 ladders were extracted in the interviews about yoghurt and 1874 in the interviews about beer. For both sets of products, the Danish interviews yielded by far the largest number of ladders of the four countries, whereas the smallest number of ladders was obtained in the British interviews. The distribution of the ladders per country can be seen in table 1.

Table 1. Number of ladders per country

	DK (n=51/50*)	D (n=50/50)	UK (n=53/50)	I (n=50/50)
Yoghurt	643	557	457	530
Beer	543	497	405	429

* interviews about yoghurt/interviews about beer

As can be seen in table 2, the average number of ladders per respondent about the two genetically modified products also shows the Danish data to be more

elaborate than the data from the other countries. Altogether, this suggests that Danish consumers have somewhat more complex cognitive structures with regard to the products, and that they are somewhat more involved with the two product categories employed and perhaps also in food issues in general than particularly the British consumers, as has been shown in other research (eg Brunsø, Grunert & Bredahl, 1996). In general, there is also a possibility that differences in response complexity can be attributed to an interviewer effect. In this study, however, we believe to have minimized this effect by thorough training of all interviewers and by using multiple interviewers in each country.

Table 2. Average number of ladders per respondent about genetically modified yoghurt and beer

	DK	D	UK	I
Genetically modified yoghurt	3.5	2.8	2.4	2.6
Genetically modified beer	3.1	2.6	2.4	2.2

Means-end structures with regard to genetically modified yoghurt

The fact that the one of the four yoghurt products was claimed to be genetically modified was mentioned as a salient product attribute in the elicitation task by most respondents, and as can be seen in the hierarchical value maps in figures 2-5, in all four countries this attribute was associated with quite negative consequences, which were believed to prevent the fulfilment of important life values.

The most dominant association seems to be the belief that the application of genetic engineering will turn yoghurt into an unwholesome and unnatural product, and, judging from the perceived consequences, the belief seems also to be tied up with the expressed feelings of unfamiliarity with the product. Thus, there were strong beliefs that ingestion of the product would reduce personal healthiness and that the product could not be trusted because of its perceived unknown long-term consequences on human health and the environment. These prevalent perceived consequences are crucial since they were generally believed to inhibit the achievement of important life values, such as long and healthy life, happiness and inner harmony, security and responsibility for nature and other people.

The belief that the application of genetic engineering would damage the environment was found primarily among Danish and German consumers, but as can be seen in the hierarchical value maps, there were no strong links from this belief to self-relevant psychosocial consequences or values, which indicates that perceived environmental impact was perhaps not of crucial importance.

In addition, respondents in Denmark and Germany perceived genetic engineering in yoghurt to be morally wrong, and a number of respondents in these two countries as well as in the United Kingdom also opposed the application of genetic engineering in yoghurt by claiming that there was no need for this technology in food production at all.

The hierarchical value maps also show that the consumers were in fact aware of the benefits that had been added to the hypothetical products by means of gene technology, and, judging from the perceived consequences, these benefits were highly appreciated. Thus, both the absence of additives and the absence of fat were mentioned as important product characteristics, and these attributes were believed to enhance a long and healthy life via perceived increased healthiness. The smooth texture, which was claimed to have been achieved by means of gene technology, was also seen as desirable, at least in Denmark and the United Kingdom. Here, respondents claimed that smooth texture would increase the enjoyment of consuming the product, and, in Denmark, the smooth texture was also linked to consuming the product without spilling, and increased usage possibilities (breakfast, dessert or snack). From the ranking procedure, we know, however, that these positive attributes and consequences could generally not outweigh the perceived negative and undesirable consequences of the application of genetic engineering.

As already indicated, the hierarchical value maps point to some interesting cross-national differences, though the basic pattern of the associations remains the same. In general, Danish, German and British consumers seem to perceive a far larger palette of consequences of the application of gene technology, and particularly in Denmark and Germany these consequences are closely related to personal values. This is apparently not quite so in the United Kingdom where the ladders of perceived consequences of genetic engineering generally do not reach the value level. In addition, security generally seems a more central value among Danish and Italian consumers than among British and German consumers, and the more social values, responsibility for nature and the welfare of other people, seem more central to Danish and German consumers.

The hierarchical value maps for the three other products are enclosed in Appendix B. Among other things, these maps leave no doubt about the significance of consumer familiarity with the product and of perceived naturalness of the product for the consumer product perceptions. Across countries, the fatfree yoghurt made with additives is perceived as an unfamiliar, unwholesome and unnatural product; this prevents the fulfilment of important life values. The whole milk yoghurt, on the other hand, is seen as a traditional, tasty and natural product (no additives, no genetic engineering) which, however, suffers from a high fat content. The skim milk yoghurt, finally, is mainly dismissed because of a thin texture, which is associated with a range of undesirable consequences.

Figure 2. Genetically modified yoghurt, Danish respondents, cut-off=4

Figure 3. Genetically modified yoghurt, German respondents, cut-off=5

Figure 4. Genetically modified yoghurt, British respondents, cut-off=4

Figure 5. Genetically modified yoghurt, Italian respondents, cut-off=4

Means-end structures with regard to genetically modified beer

The hierarchical value maps for the genetically modified beer product basically resemble the ones for the genetically modified yoghurt, despite the fact that here the genetically modified material, yeast, is filtered out during the production process leaving the final product free from genetically modified micro organisms. This is in contrast to the yoghurt example where the genetically modified material was part of the yoghurt culture contained in the final product. The maps are shown in figures 6-9.

Again, the application of genetic engineering was an important attribute, and a range of undesirable consequences was inferred from its application. The central associations were unwholesomeness and unnaturalness and low trustworthiness of the resulting product, which were typically believed to prevent the fulfilment of the important life values long and healthy life, happiness and inner harmony and security. Again, some also perceived genetic engineering as morally wrong and basically superfluous in food production. Notably, undesirable side effects of the application of gene technology on personal healthiness were also commonly perceived drawbacks, despite the absence of genetically modified material in the product.

The maps also indicate that the fact that a product is based on a modern and intensive production method in itself triggers significant negative perceptions of the product. Thus, the intensive brewing method was associated with poor quality and taste in all four countries, and these associations were then subjectively linked to less enjoyment and the prevention of happiness and personal well-being.

Interestingly, environmental friendliness, which was one of the benefits attributed to the product by means of genetic engineering, was noted and valued in Denmark, the United Kingdom and Italy, but not in Germany. In these three countries there seems to be no doubt about the significance of this perceived attribute for consumer choice as the perceived consequences eventually also reach the value level, the crucial values being responsibility for and unity with nature in Denmark and the United Kingdom and improved quality of life in Italy. The German respondents generally believed that the application of gene technology in this case did not benefit anyone but the producer. The relevance of the low price of the product as a consumer benefit is even more doubtful, as the respondents in all four countries generally associated the low price with lower quality and taste, while on the other hand they also pointed out a desirable money aspect.

Again, the widest range of associations arising from the application of gene technology was found among Danish and German respondents, while there were particularly few associations to this attribute among the Italian respondents (note the higher cut-off levels in the Danish and German maps). In this case, the associations arising from this attribute reached value level in the United Kingdom sample as well. This can probably be attributed to the fact that the British respondents, as the only ones, explicitly linked the application of gene technology with environmental friendliness, which was perceived to lead to desirable consequences that were closely linked to life values.

The hierarchical value maps for the three other beer products are enclosed in Appendix C. From these maps, it is obvious that the traditional medium-priced

beer alternative is generally the most preferred product because of its perceived naturalness, familiarity and a value for money aspect. The economy beer is also seen as a traditional beer, but the perception of its low price is ambiguous, except in Italy where the association to the low price is entirely negative. The beer produced by means of modern process technology other than genetic engineering, finally, is dismissed for many of the same reasons as the genetically modified beer, primarily owing to the intensive production method.

Figure 6. Genetically modified beer; Danish respondents, cut-off=4

Figure 7. Genetically modified beer; German respondents, cut-off=4

Figure 8. Genetically modified beer; British respondents, cut-off=3

Figure 9. Genetically modified beer; Italian respondents, cut-off=3

Taken together, the hierarchical value maps for the genetically modified products leave no doubt about the significance of genetic engineering and its perceived consequences for the reported low preference for these respondents. However, as we have seen, there were some respondents who ranked the genetically modified product as their first preference. An interesting question is what has motivated these first preferences. To investigate the means-end structures underlying these preferences, hierarchical value maps for the two products were therefore produced, based solely on respondents that quoted these products as their first preferences.

Means-end structures for consumers with genetically modified product alternatives as first preferences

In total, 28 respondents claimed to prefer the genetically modified yoghurt of the four yoghurts and 24 reported highest preference for the genetically modified beer alternative. The hierarchical value maps based on the means-end chains elicited from these respondents are shown in figures 10 and 11.

As can be seen in the maps, a decisive factor for these groups of consumers is clearly the lack of negative associations stemming from the genetic modification of the products. Instead, these respondents linked the application of genetic modification to good quality and taste for both products, and this was again associated with entirely favourable consequences. In the case of the genetically modified yoghurt it also turned out that some respondents regarded the application of genetic engineering simply as a welcome opportunity to try out something new and get a new consumption experience.

In addition, the low fat content of the yoghurt product and the low price of the beer product were perceived less ambiguously among these respondents, and this also clearly contributed to the favourable evaluations of the two products. Finally, the high preferences are apparently also related to the benefits which were inferred from the smooth texture of the yoghurt and environmental friendliness of the genetically modified beer.

Figure 10. Hierarchical value map for respondents with genetically modified yoghurt as first preference, cut-off=3

Figure 11 . Hierarchical value map for respondents with genetically modified beer as first preference, cut-off=3

Cross-national differences

As shown, the laddering data point to a number of cross-national differences with regard to the type and number of associations as well as their subjective links and the abstraction level of the associations. The analysis of the data by means of hierarchical value maps does, however, not allow us to assess these cross-national differences in a very systematic way. The pooled data were therefore subjected to multiple correspondence analysis, which can provide a joint display of concepts and countries on the same dimensionality. It was decided to use the CGS scaling technique, which has been developed as a way of presenting results of correspondence analysis in maps where categories can be analysed by their proximities not only within but also across rows and columns (Carroll, Green and Schaffer, 1986).

The analysis was carried out separately for yoghurt and beer across the four product alternatives and used a contingency table with the number of respondents who had mentioned a given concept in each country as input data. Only concepts that were mentioned by at least 20 respondents in at least one country were included in the analysis. The Varimax-rotated solutions are shown in figures 12 and 13.

78% of the variance in the input data was accounted for in the analysis on yoghurt, while 79% of the variance in the beer data was accounted for. In both plots, some two-thirds of the variance explained is due to the x-axis, while the y-axis accounts for about one-third of the variance explained.

In the plot of the yoghurt data, the four countries are clearly located in different areas of the chart, with the United Kingdom and Germany slightly closer to each other. The British and German consumers seem to be more involved with the quality and taste and the enjoyment of eating the product than the Italian and Danish consumers, whereas aspects of familiarity and trust in the product are located more on the right hand side of the map where also Denmark and Italy are found. The third major group of concepts, the health-related aspects, is

located right in the middle of the plot and therefore seems to be relevant for the consumers in all four countries. This goes for the attribute *genetically modified* as well.

In the beer-data plot, the four countries are again placed in four different parts of the map. In general, attributes and consequences concerning financial aspects are located closer to the United Kingdom and Germany than to Denmark and Italy. The represented values are all located closer to Denmark than to any of the other countries, while the category *genetically modified* is located at the very bottom of the map, closest to Germany and farthest from the United Kingdom and Italy. Aspects of quality and taste are apparently more characteristic of British and Italian consumers. Concepts relating to traditionality and trust do in this case not seem to be restricted to some countries rather than to others, but the value *security* is, however, found closer to Denmark and Italy than the United Kingdom and Germany. The categories *wholesome and natural product* and *can be served to guests*, finally, were identified as outliers and were excluded from the plot, but both are apparently very characteristic of the Italian consumers.

Figure 12. Plot of multiple correspondence analysis of yoghurt data

Figure 13. Plot of multiple correspondence analysis of beer data

CONCLUDING REMARKS

This study has employed means-end chain theory and the laddering technique to investigate consumers' cognitions with regard to genetically modified beer and yoghurt in four countries. As expected, the study has given valuable insight into consumers' motivational structures and subjective meanings with regard to genetically modified foods.

The associations made with regard to the application of gene technology were generally found to focus more on perceived risks than benefits. Across countries, a whole range of perceived unfavourable consequences of genetic engineering were identified, with the main focus on beliefs relating to perceived unhealthiness and low trustworthiness of the resulting products. These beliefs were generally seen to inhibit the attainment of individual life values such as *happiness and inner harmony*, *long and healthy life*, *quality of life* and *security*, and the more social life values *responsibility for nature* and *responsibility for the welfare of other people*.

The results also indicate that consumers consider risks and benefits of genetic engineering in the light of perceived consequences for themselves, as well as for

other people and for the environment, where “other people” primarily refers to one’s family and future generations. At present, no differences can be identified in beliefs depending on which outcome group is considered, however.

At the same time, the importance of *relevant* consumer benefits for consumer acceptance of genetic engineering in food production was verified, and particularly the benefits which were attributed to the genetically modified beer could not compensate for the perceived undesirable consequences of the application of gene technology.

Unlike our expectations, absence of genetically modified material in the end product (the beer case) did not seem to affect the associations arising from the fact that gene technology was applied in the production process compared to the instance where the material was still present in the final product (the yoghurt case). Any effect of this circumstance presupposes some basic knowledge about food production and, in this case, specifically about beer production, which the consumers may not have. It therefore seems unlikely that significant differences in attitudes towards process and product can be traced at present.

The results indicate that food neophobia may play a significant role for the formation of consumer attitudes and, eventually, acceptance of genetically modified foods. Thus, low familiarity with the product and gene technology was often mentioned and subjectively linked to low trustworthiness of the product and eventually less security or less happiness and inner harmony. Therefore, it also seems likely that demystification of the technique by more knowledge of the basic principles of gene technology and its likely impact on self and the environment will significantly affect consumer beliefs and attitudes. Having said this, it is, however, also important to mention that many consumers apparently oppose genetically modified foods also for ethical reasons which are not highly likely to be affected by increased knowledge of gene technology and its risks and benefits.

A number of cross-national differences in cognitions of gene technology were also identified. In Denmark and Germany, more complex cognitions were found, and these were quite closely linked to central life values. In the United Kingdom, there were also quite a large variety of associations, but only with weak links to values, which is likely to reflect a lower degree of involvement with food issues as has also been found in other studies, and possibly with the gene technology issue as well. In Italy, finally, only a small range of associations were found, which may be due to the fact that the public debate on genetic engineering is not as advanced as in Northern European countries.

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APPENDIX A. LISTS OF CATEGORIES

Yoghurt interviews

Attributes

Genetically modified
 Not genetically modified
 Additives
 No additives
 Skim milk
 Whole milk
 High fat content
 Low fat content
 Smooth texture
 Thin texture
 Good quality and taste
 Poor quality and taste
 Wholesome and natural product
 Unwholesome and artificial product
 Traditional product
 Modern product
 Familiar product
 Unfamiliar product
 Not environmentally friendly
 High sugar content
 Low sugar content
 Contains fruit
 Expensive
 Inexpensive
 Unnecessary in food production

Consequences

Healthiness
 Less healthiness
 Enjoyment
 Less enjoyment
 Can trust product
 Cannot trust product
 More energy
 Less energy
 Easy to handle and use
 Difficult to handle and use
 Family welfare
 Less family welfare
 Benefits nature
 Harms nature
 Morally wrong
 Morally right
 Look good
 Cannot look good
 More resources to other things
 Fewer resources to other things
 Good work performance
 Poor work performance
 Long shelf-life
 Short shelf-life
 New experience
 No new experience
 Benefits the producer only
 Benefits consumers

Beer interviews

Genetically modified
 Not genetically modified
 Expensive
 Inexpensive
 Middle price
 Modern, intensive brewing method
 Traditional, slow brewing method
 Modern/special product
 Traditional product
 Good quality and taste
 Poor quality and taste
 Wholesome and natural product
 Unwholesome and artificial product
 Familiar product
 Unfamiliar product
 Environmentally friendly
 Not environmentally friendly
 High alcohol content
 Low alcohol content
 Short product description
 Long product description
 Unnecessary in food production

Healthiness
 Less healthiness
 Enjoyment
 Less enjoyment
 Can trust product
 Cannot trust product
 Benefits nature
 Harms nature
 Morally wrong
 Morally right
 Drink more
 Drink less
 Can be served to guests
 Cannot be served to guests
 Get intoxicated and can relax
 Do not get intoxicated and cannot relax
 Value for money
 No value for money
 More resources to other things
 Fewer resources to other things
 New experience
 No new experience
 Status
 Less status
 Good conscience
 Bad conscience
 Benefits the producer only
 Benefits consumers

Values

Happiness and inner harmony
Long and healthy life
Quality of life
Security
Responsibility for other people
Responsibility for nature
Self-confidence
Self-direction and ambitions

Happiness and inner harmony
Long and healthy life
Quality of life
Security
Responsibility for other people
Responsibility for nature
Social togetherness
Self-confidence
Self-direction and ambitions
Equality

APPENDIX B. HIERARCHICAL VALUE MAPS – YOGHURT

Whole milk yoghurt – Denmark

Whole milk yoghurt – Germany

Whole milk yoghurt – UK

cut-off=4

Whole milk yoghurt – Italy

cut-off=6

Skim milk yoghurt – Denmark

cut-off=4

Skim milk yoghurt – Germany

cut-off=4

Skim milk yoghurt – UK

Skim milk yoghurt – Italy

Fatfree yoghurt with additives – Denmark

Fatfree yoghurt with additives — Germany

Fatfree yoghurt with additives – UK

Fatfree yoghurt with additives – Italy

APPENDIX C. HIERARCHICAL VALUE MAPS – BEER

Traditional beer – Denmark

cut-off=5

Traditional beer – Germany

cut-off=4

Traditional beer — UK

cut-off=3

Traditional beer — Italy

cut-off=3

Economy beer — Denmark

Economy beer — Germany

Economy beer — UK

Economy beer — Italy

Modern technology beer — Denmark

cut-off=4

Modern technology beer — Germany

cut-off=3

Modern technology beer — UK

cut-off=3

Modern technology beer — Italy

cut-off=3