

Why consumers behave as they do with respect to food safety and risk information

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Abstract

In recent years, it seems that consumers are generally uncertain about the safety and quality of their food and their risk perception differs substantially from that of experts. Hormone and veterinary drug residues in meat persist to occupy a high position in European consumers' food concern rankings. The aim of this contribution is to provide a better understanding to food risk analysts of why consumers behave as they do with respect to food safety and risk information. This paper presents some cases of seemingly irrational and inconsistent consumer behaviour with respect to food safety and risk information and provides explanations for these behaviours based on the nature of the risk and individual psychological processes. Potential solutions for rebuilding consumer confidence in food safety and bridging between lay and expert opinions towards food risks are reviewed. These include traceability and labelling, segmented communication approaches and public involvement in risk management decision-making.

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1. Introduction

In a typical food consumer decision-making process, safety is usually a non-negotiable product attribute. There is evidence to suggest that consumers expect all food to be intrinsically safe and a well-informed and rational consumer would never knowingly purchase or consume unsafe food. There is an expectation throughout society that the food supplied for human consumption is safe and nutritious to eat [1,2]. Nevertheless, although under normal conditions the majority of consumers are not worried about food safety, the occurrence of a food safety incident may result in consumer concern and anxiety.

Risk assessors and risk managers are becoming increasingly aware that public perceptions of both risks and benefits are crucial for the future acceptance of a technology or product. It has also become clear that neither understanding of technical risk only will explain the risk-related behaviours of consumers, nor

will risk 'education' align public views to those of expert groups [3]. Specifically, in the absence of credible and understandable food safety signals or information, consumers face uncertainty and incur specific information search costs. Furthermore, consumers are individuals with highly variable psychological, attitudinal and cultural characteristics, which cause them to react in a specific manner when facing eventual food- or lifestyle-related hazards.

Risk analysis is typically subdivided into three interrelated components: risk assessment, risk management and risk communication [4]. Risk assessment is located in the area of natural sciences; risk management pertains mainly to politics and legislation; risk communication is typically considered within the domain of social sciences and is informed by consumer perceptions and behaviours as well as technical risk estimates. In this paper, the focus will be on risk perception and risk communication, i.e. the social sciences perspective with respect to risk analysis.

Be it hormone or veterinary drug residues, chemical environmental contaminants or microbial pathogens, their real or perceived presence in food results in increased risk perception

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and other consumer and public policy concerns, which make decision-making more uncertain for consumers. An illustration of this concern is the debate between Europe and the United States, Canada, on the import of meat from cattle treated with hormones. The United States and Canada consider the use of implants of certain hormones as safe for human health, while the competent authorities in the EU claim the reverse. Meat image has proven to be particularly vulnerable to safety issues, including Bovine Spongiform Encephalopathy (BSE), dioxin and hormone and veterinary drug residues [5]. Indeed, by the end of 1990s, meat has been described as the food item in which consumer confidence has decreased most [6]. Although major crises date back several years, the Eurobarometer survey from Autumn 2005 indicates that European consumers persist in expressing concerns about residues in meat, together with pesticide residues in fruits and vegetables, as well as new zoonoses such as avian influenza [7]. Furthermore, the Eurobarometer indicates that chemicals, pesticides and toxic substances in food rank second after food poisoning as things that come to consumers' minds when thinking about possible risks associated with food in general.

The objective of this contribution is to shed light on the question why consumers behave as they do with respect to food safety risks and food safety information. This contribution will first illustrate some specific behavioural characteristics of consumers with respect to food safety in general and meat safety in particular. Second, potential explanations for these behaviours will be provided. Third, potential strategies to cope with how consumers behave vis-à-vis food safety and risk information, e.g. aiming at rebuilding consumer confidence in food safety and bridging between lay and expert views towards food risks, will be reviewed.

2. How consumers behave

In recent years, it seems that consumers are generally uncertain about the safety and quality of their food, despite the fact that the food supply has never been safer and better controlled. From an expert point of view, the general public – in majority lay people who are in a role as citizen and food consumer at the same time [8] – appear 'rather deficient' in their understanding of hazards and associated risks. They display behavioural patterns and make choices that seem irrational or illogical or at least inconsistent with expert opinions and scientific knowledge [9].

First, consumers tend to systematically overestimate some risks relative to the technical probability of harm occurring, whereas others are largely underestimated. There is often little relationship between the perceived risk associated with a specific food safety concern and its actual risk. Consumers place much importance on factors that may not contribute to technical risk estimates, while apparently underestimating other factors, which potentially represent a substantial threat to human health [10]. Diet- and lifestyle-related heart and coronary diseases, as well as lung cancer from smoking, represent relatively large risks, which are, however, largely disregarded by some consumers. At the same time, emerging food-processing technologies or food-borne illnesses caused by chemical contamination are examples

of overestimations of relatively small actual risks. In previous research [11] as well as in the Autumn 2005 Eurobarometer, the results implied that people are more likely to worry about risks caused by external factors over which they feel to have no control, while being much less concerned about personal factors or factors linked to their own behaviour or lifestyle [7], although there are individual differences in the extent to which this holds true [12].

Second, although people distinguish between broad categories of risks, they do not differentiate greatly between various types of risk within a particular food group. For example, consumers perceived dioxins in poultry and antibiotic residues in pork as equivalent to hormone residues in beef and even 45% of the consumers sampled in 2001 in Belgium ($n = 625$) expressed concerns about BSE in poultry [5]. In a similar vein, findings from the SEAFOODplus pan-European fish consumer survey indicated that risk perceptions from chemical contaminants in fish are strongly correlated with risk perceptions from bacterial fish contamination (Pearson $r > 0.8$), indicating that consumers who feel at risk hardly differentiate between different hazards in the same product type. In the area of 'perceived technological risk', product evaluations and risk estimates appear to be pre-dominantly made through references to even more abstract attitude objects such as health, environment, animal welfare or producer power [10,13–15], where the particular relationship between one and the other is left unspecified [16]. Consistent with this, factor analyses of sets of beliefs or concerns usually find that a limited number of dimensions – often no more than two – are sufficient to represent the co-variation among consumer beliefs [17–20], suggesting a fairly high level of redundancy in consumer's belief or concern sets. In other words, the highly specific and measurable concepts on which technical food safety evaluations would normally focus are simply not used by consumers in their subjective evaluations of many food safety issues. Examples of such highly specific and measurable concepts in the analysis of hormone and veterinary drug residues are concepts such as no observable effect level (NOEL) and allowable daily intake (ADI), leading to limits in food expressed as maximum residue limit (MRL).

Third, in cases where concrete information aiming at reducing food safety uncertainty is made available, many consumers do not attend to or process this information [21,22]. For example, consumer information campaigns were initiated together with the introduction of the mandatory beef labelling regulation in Europe in 2000. The impact of the campaign on consumer interest in information cues was measured by a pre- and post-campaign survey in Belgium [23]. Whereas the advertisement succeeded in terms of attracting consumers' attention to specific information cues, the direct response component largely failed with only 304 calls for a free information leaflet received (as opposed to a target of 15,000). This case illustrates that it may be utopian to expect high direct response rates, even in cases where consumers are supposed to be uncertain. Instead of engaging in active information search, an alternative and much easier solution was to cut meat consumption and substitute it by another protein source in the diet. In contrast, consumer perceptions of food safety can drop dramatically when new adverse

information is provided even in cases without medical or scientific evidence [24]. Consumers seem to be much keener on receiving negative news than positive news, which is reflected by a stronger interest of the mass media in supplying negative press [25]. Institutions or individuals who are prepared to produce negative news (e.g. on the link between hormone residues and cancer or on the use of antibiotics in livestock production and its impact on human antibiotic resistance) are more likely to reach the public through mass media, as compared to those bringing positive news about food safety issues. Furthermore, negative news related to meat safety issues has been proven to have a far greater and faster impact on consumer behaviour, than does positive news [26].

The explanation for such behaviours is to be found in multiple inter-related factors, including the nature of the risk itself, combined with a number of psychological processes, which will be covered in the next section.

3. Why consumers behave as they do

3.1. The gap between lay and expert opinions

The gap between lay and expert opinions about risks is attributed to the existence of a so-called perception filter causing bias between reality or scientific evidence on the one hand and consumer perception of this reality on the other hand [3,27,28]. Scientific objectivity may pertain, for instance, to quantitative assessment or estimates of product properties like quality, safety or nutritional value. These attributes or characteristics are theoretically measurable, replicable and manageable throughout the agri-food chain, although these estimates are of course subject to variation and uncertainties associated with scientific measurement. Elements of analytical measurement uncertainty such as the accuracy, trueness and precision of an analysis are often terminologies having a different meaning in analytical (expert) versus in normal (lay) speaking language. The term precision for instance is equivalent to the reproducibility of an analysis, while in normal language precision is rather linked to trueness. Many consumers have problems with the terminology “measurement uncertainty” because they have the idea that a measurement is always certain.

Consumer perceptions relate to human subjectivity that ultimately determines preferences based on which purchasing and consumption decisions are made. The perception filter between reality and perception can be regarded as a kind of mirror that reflects, deflects or distorts factual information. The nature of the risk combined with individual psychological catalysts of risk perception determine the shape and size of the perception filter and explain differences in expert and lay opinion regarding specific risk issues.

A good starting point for understanding consumer risk perception is provided by the psychometric paradigm developed by Slovic and co-workers [29], which demonstrated that psychological factors determine a person's response to different hazards, including those in the area of food safety. Psychological factors of relevance include, for example, whether the risk is perceived to be involuntary (i.e. in terms of personal exposure),

catastrophic (i.e. affecting large numbers of people at the same time) or unnatural (i.e. technological in nature). These psychological factors increase or reduce the threat value of different hazards.

3.2. Pathway from risk to crisis

Another key to understanding food scares pertains to the theory of social amplification of risk [30], providing insight into the problem of why some relatively minor risks frequently elicit strong public reactions. A related key pertains to the pathway of crisis development, i.e. a classification of three types of factors that are crucial for any problem or risk to evolve into a crisis [31]. The classification includes psychological ‘fright’ factors and panic elements, as well as societal triggers. Fright factors pertain mainly to the individual's perception of the seriousness of a risk. Fright may result from experiencing a risk to which people are exposed on an involuntary basis. For example, consumers may be concerned about food contaminants or chemical residues which are not traceable and which they are exposed to beyond their knowledge. Furthermore, fright increases when the problem is perceived as inevitable, e.g. it cannot be avoided or eliminated through personal precautions. This is the case with BSE, dioxin and residues that cannot be ‘washed’ or ‘cooked’ from the product. Finally, fright increases when the problem is subject to contradictory messages from different stakeholders, e.g. opposing views held by scientists or risk assessors versus politicians or risk managers and also resulting from scientific problems in understanding the exact nature of the risk, including from the assessment or management perspectives.

Panic elements pertain to the nature of the risk itself, including whether the risk is universal, new, believable, uncertain or will eventually lead to dreaded illnesses or cause particular harm to vulnerable groups in society such as young children, pregnant women or the elderly. Universal does not necessarily refer to a global or worldwide exposure, but to a large potential exposure (probability), as is more frequently the case with generic or unbranded food products. For example, during the dioxin crisis in 1999, any Belgian poultry or egg was suspected to be contaminated. In contrast, risk perceptions were only triggered for the Coca-Cola soft drink brand during the Coca-Cola crisis in 1999, while other soft drink brands maintained their ‘safe’ image. Furthermore, newness, believability and uncertainty heightened the panic value of the crises at hand.

Finally, media information may be important in the development of a crisis. Some elements like the presence of culpable individuals (whether or not this has been proven), a link with personalities (e.g. ministers), individuals or institutions acting to promote or protect their own interests [1,32] and a strong visual impact attract mass media. BSE provides a good example in terms of visual impact, whereas the Belgian government and the accused animal feed component suppliers acted as foci of media attention during the dioxin crisis in 1999. In the case of hormone and veterinary drug residues, images from slaughterhouses, syringes and associations with the mafia triggered anxiety among consumers. As a result, consumers often associate the meat industry with murder and crime.

3.3. Lifestyle versus technological hazard

When trying to understand risk perception, it is useful to distinguish between two broad categories of potential hazard: those related to technology and its applications and those related to lifestyle choices [33]. People are frequently over-optimistic about their own risks from lifestyle hazards [34] and they tend to rate their own personal risks from a particular lifestyle hazard as being less when they compare themselves to an 'average' member of society, even when the comparison is made with someone with similar demographic characteristics [35]. In the area of food risks, optimistic biases are much greater for lifestyle hazards, such as food poisoning contracted in the home or illness experienced as a consequence of inappropriate dietary choices, compared to technologies applied to food production. At the same time, people perceive that they know more about the risks associated with different lifestyle hazards when compared to other people and are in greater control of their personal exposure to these lifestyle hazards [36].

In contrast, this does not occur for perceptions of personal knowledge about and control over, technology-related food risks such as food irradiation, genetic modification of food or the prophylactic use of veterinary drugs and growth hormones. Perceptions of technological risks are shaped by beliefs that the risks are out of control, are unnatural or artificial and are somehow adding to the already existing risk environment, which all contribute to explaining their greater perceived harmful- and seriousness. Furthermore, as has been demonstrated particularly in the case of gene technology, attitudes towards technological issues are strongly related to other, more general socio-political attitudes, including attitudes towards the environment and nature [37], attitudes towards science and modern technology [38] and social (dis)trust, i.e. the willingness to rely on institutions that regulate technologies and manage their risks [39]. It appears that consumers perceive the very process of applying a technology to be in conflict with their basic attitudes and values and that this perceived conflict is simply re-expressed by consumers when they perceive foods as 'unsafe' or 'risky'.

3.4. Reluctance to information processing

Multiple factors contribute to explaining consumers' reluctance towards information processing and rational decision-making. Information may be irrelevant or useless to consumers since it fails to target particular needs or interests [40]. In some cases, it may even be perfectly rational for consumers to remain imperfectly informed about food safety issues. This idea has been referred to as the rationally ignorant consumer hypothesis [41], in that even when information is free, consumers may refrain from acquiring more information. The explanation is that the price of information and/or the opportunity cost of information processing are too high compared to the marginal expected benefits from information, hence constraining people's motivation to process information. The differential impact of negative versus positive news also relates to consumers' expected value of additional information, which is higher when it concerns an issue with potential negative welfare effects (e.g. risks) than with

positive welfare effects (e.g. benefits). This links with prospect theory [42] and more specifically the endowment effect [43], which explains why economic agents attach a higher value to losses than gains. In a similar vein, consumers evaluate the consequences of food quality and safety information about potential health risks at higher prices than what could be expected from risk neutral or health benefit information.

However, people may also decide based upon a simple interpretation of risks as 'feelings' rather than behaving 'rationally', which would mean deciding only after careful weighing of perceived risks and benefits [44]. In this case, emotions or feelings are used as heuristics or simple decision rules, which allow consumers making fast and effective decisions in complex situations, in situations of uncertainty or when their involvement and motivation to process information and think of potential consequences is low.

4. Coping with how consumers behave

4.1. Traceability and labelling

The meat crises and subsequent decline in beef consumption, particularly in Europe, have forced governments and the meat industry to react and to work towards restoring consumer confidence in meat as a safe and wholesome product [45,46]. Traceability systems and subsequent quality and origin labelling schemes were considered as major instruments for addressing the problem [5]. The systems are fully operational and traceability information has been placed mandatorily on meat labels. Nevertheless, consumer interest in this kind of information cannot be taken for granted, as has been shown in a number of studies [47,48]. Communication efforts aimed at informing consumers about the existence and meaning of beef traceability failed to evoke active information search by consumers [23] and demonstrated that consumers are not really interested in traceability cues on beef labels [48]. It seems that consumer interest remained low in cues directly related to traceability and product identification, despite uncertainty following a number of meat safety crises. Direct indications of traceability, such as bar codes and licence numbers were not attracting consumer attention, which is not surprising given the low quality or safety inference potential of such information cues. However, interest has been shown to be much higher for other information cues like readily interpretable indications of quality such as certified quality marks or seals of guarantee, as well as for mandatory standard information like expiry date. Hence, although traceability has to be in place for legal purposes and in order to help guarantee product safety or origin, consumers have no interest in the traceability information per se. The conclusion is that quality labels or safety guarantees accompanied by a single cue referring to traceability (rather than a massive amount of cues and codes) stand the best chance of being valued by (at least some) consumers. Furthermore, a quality label can function as a cue to easy decision-making, reducing consumer uncertainty and facilitating decision-making, including potential product avoidance in cases of heightened risk perception.

4.2. Segmented communication approach

One approach to risk communication, which is likely to be an effective way to change consumer behaviours, is to focus on segmenting the population according to their information needs and developing information with high levels of personal relevance to specific groups of respondents, who may be at greater risk than the rest of the population. Strategies for reducing uncertainty through the provision of vast amounts of information to consumers have a limited chance of success, simply because a lot of this information does not target a particular need and is not attended to by consumers as a consequence.

A generic approach, involving the provision of massive amounts of information to the general public, stands a real risk of information overload, leading to confusion and lack of interest among the majority of consumers. Information is more likely to result in attitude change and subsequent behaviour change if the perceived personal relevance is high [49]. The problem with such an approach is that it is resource intensive, as research firstly needs to be conducted in order to identify individual differences with respect to people's perceptions and behaviours and then tailored information has to be designed and delivered. The particular challenge lies in identifying and effectively reaching market segments. In many cases this is feasible, though it may be problematic when variables such as involvement, personality, motivation or attitudes come into play.

4.3. Transparency and public involvement

In response to growing consumer uncertainty about food safety and the perceived decline in consumer trust, regulatory bodies have increasingly stressed the importance of transparency in policy decision-making processes, as well as developing mechanisms in order to understand the concerns, attitudes and values of the general public [1]. Current risk management effort tries to restore public confidence by involving lay people early in decision processes when policy options include human or environmental exposure to potential risks. Proactive participatory processes that engage citizens in a debate prior to the development of technologies and products for which public acceptance is questionable are a potential solution [50]. Frequently used participatory tools are citizen panels, focus groups or consensus conferences, in which popular input to the parliamentary political system and a broader debate and reflection on technological change and technology applications is sought. Although short-term effects of participatory democracy as trust-building activity are scarce [51], it is assumed by many decision-makers that this approach will have a positive effect on consumer confidence in the long term.

5. Conclusions

Risk perception differs between consumers-citizens and experts. Lay persons weigh risks and benefits differently, may have other implicit definitions of risks and arrive at conclusions through another mechanism of risk estimation as compared to experts. As a result, consumers often behave in a way that seems

irrational, illogical or inconsistent to scientists and policy makers involved in risk analysis. This contribution has attempted to provide explanations for why consumers behave as they do with respect to food safety and risk information. These explanations relate mainly to the nature of the risk and individual psychological processes.

Hormone and veterinary drug residues persist to occupy a high ranking in European consumers' concern polls about food. It concerns a risk that is manmade, technological in nature and adding to the natural risk environment. Furthermore, it is a risk that pertains mainly to livestock and meat production, i.e. the agriculture sector and food category in which consumer confidence was probably most damaged during the last decade. Each of these factors makes hormone and veterinary drug residues in food in general and meat in particular, a highly topical case for the full spectrum of risk analysis.

The establishment of traceability and labelling, segmented communication approaches and public involvement in risk management decision-making are selected noteworthy examples of strategies to restore consumer confidence, though leaving substantial room for improvement as regards their effectiveness. Taking benefit of this room for improvement remains a particular challenge for those who are involved in risk analysis. A better understanding of 'how and why consumers behave as they do' should be a good starting point for meeting the challenge.

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References

- [1] L.J. Frewer, A. Fischer, J. Scholderer, W. Verbeke, in: W.M.F. Jongen, M.T.G. Meulenberg (Eds.), *Innovation in Agri-Food Systems*, Wageningen Academic Publishers, Wageningen, 2005, p. 125.
- [2] J. De Jonge, L.J. Frewer, H. Van Trijp, R.J. Renes, W. De Wit, J. Timmers, *Br. Food J.* 106 (2004) 837.
- [3] E. Van Kleef, L.J. Frewer, G. Chrysoschoidis, J.R. Houghton, S. Korzen-Bohr, T. Krystallis, J. Lassen, U. Pfenning, G. Rowe, *Appetite* 47 (2006) 46.
- [4] Codex Alimentarius Commission, *Principles and guidelines for the conduct of microbiological risk assessment*, CAC/GL-30, FAO/WHO, Rome, 1999.
- [5] W. Verbeke, *Food Qual. Prefer.* 12 (2001) 489.
- [6] T. Becker, *Brit. Food J.* 102 (2000) 158.
- [7] European Commission, *Special Eurobarometer 238*, Office for Official Publications of the European Communities, Luxembourg, 2006.
- [8] M. Korthals, in: L.J. Frewer, H. Van Trijp (Eds.), *Understanding Consumers of Food Products*, Woodhead Publishing, Cambridge, in press.
- [9] S. Hilgartner, *Soc. Stud. Sci.* 20 (1990) 519.
- [10] S. Miles, L.J. Frewer, *Food Qual. Prefer.* 12 (2001) 47.
- [11] C. Fife-Schaw, G. Rowe, *J. Risk Res.* 3 (2000) 167.
- [12] A. Fischer, L.J. Frewer, M. Nauta, *Risk Anal.* 26 (2006), in press.
- [13] K.G. Grunert, L. Lähteenmäki, N.A. Nielsen, J.B. Poulsen, O. Ueland, A. Åström, *Food Qual. Prefer.* 12 (2001) 527.
- [14] K. Hagemann, J. Scholderer, MAPP Project Paper 06/2004, MAPP, Aarhus, 2004.
- [15] J. Scholderer, I. Balderjahn, L. Bredahl, K.G. Grunert, *Eur. Adv. Consum. Res.* 4 (1999) 123.

- [16] H. Schütz, P.M. Wiedemann, P.C.R. Gray, in: J. Hampel, O. Renn (Eds.), *Gentechnik in der Öffentlichkeit*, Campus, Frankfurt/Main, 1999, p. 133.
- [17] L. Bredahl, *J. Consum. Policy* 24 (2001) 23.
- [18] C. Midden, D. Boy, E. Einsiedel, B. Fjæstad, M. Liakopoulos, in: M.W. Bauer, G. Gaskell (Eds.), *Biotechnology*, Cambridge University Press, Cambridge, 2002, p. 203.
- [19] A. Saba, M. Vassallo, *Food Qual. Prefer.* 13 (2002) 13.
- [20] J. Scholderer, T. Bech-Larsen, K.G. Grunert, in: F. Van Raaij (Ed.), *Marketing Communications in the New Millennium*, Erasmus University, Rotterdam, 2000, p. 129.
- [21] K.G. Grunert, *Eur. Rev. Agric. Econ.* 32 (2005) 369.
- [22] M. Kornelis, J. De Jonge, L.J. Frewer, H. Dagevos, *Risk Anal.*, in press.
- [23] W. Verbeke, R.W. Ward, T. Avermaete, *Food Policy* 27 (2002) 339.
- [24] W. Verbeke, P. Van Kenhove, *J. Health Commun.* 7 (2002) 455.
- [25] J.F.M. Swinnen, J.J. McCluskey, N. Francken, in: D. Colman, N. Vinck (Eds.), *Reshaping Agriculture's Contribution to Society*, Blackwell, Oxford, 2005, p. 175.
- [26] W. Verbeke, R.W. Ward, *Agric. Econ.* 25 (2001) 359.
- [27] B. Wierenga, *J. Food Qual.* 48 (1983) 119.
- [28] J. Hansen, L. Holm, L.J. Frewer, P. Sandoe, *Appetite* 41 (2003) 111.
- [29] B. Fischhoff, P. Slovic, S. Lichtenstein, *Policy Sci.* 9 (1978) 127.
- [30] R. Kasperon, O. Renn, P. Slovic, H. Brown, J. Emel, R. Globe, J. Kasperon, S. Ratick, *Risk Anal.* 8 (1988) 177.
- [31] P. Bennett, K. Calman (Eds.), *Risk communication and public health*, Oxford University Press, Oxford, 1999.
- [32] L.J. Frewer, C. Howard, D. Hedderley, R. Shepherd, *Risk Anal.* 16 (1996) 473.
- [33] S. Miles, S. Brennan, S. Kuzesnof, M. Ness, C. Ritson, L.J. Frewer, *Brit. Food J.* 106 (2004) 9.
- [34] N.D. Weinstein, *J. Pers. Soc. Psychol.* 36 (1980) 806.
- [35] S. Miles, V. Scaife, *Nutr. Res. Rev.* 16 (2003) 3.
- [36] L.J. Frewer, R. Shepherd, P. Sparks, *J. Food Safety* 14 (1994) 19.
- [37] L.J. Frewer, C. Howard, R. Shepherd, *Sci. Technol. Hum. Val.* 22 (1997) 98.
- [38] M. McCarthy, S. Vilie, in: J.H. Trienekens, S.W.F. Omta (Eds.), *Paradoxes in Chains and Networks*, Wageningen Academic Publishers, Wageningen, 2002, p. 176.
- [39] M. Siegrist, *Risk Anal.* 20 (2000) 195.
- [40] W. Verbeke, *Eur. Rev. Agric. Econ.* 32 (2005) 347.
- [41] J.J. McCluskey, J.F.M. Swinnen, *Am. J. Agric. Econ.* 86 (2004) 1230.
- [42] D. Kahneman, A. Tversky, *Econometrica* 47 (1979) 263.
- [43] D. Kahneman, J.L. Knetsch, R.H. Thaler, *J. Econ. Perspect.* 5 (1991) 193.
- [44] G.F. Loewenstein, E.U. Weber, C.K. Hsee, N. Welch, *Psychol. Bull.* 127 (2001) 267.
- [45] G. Brambilla, S. De Filippis, *Anal. Chim. Acta* 529 (2005) 7.
- [46] A. Boenke, *Anal. Chim. Acta* 473 (2002) 83.
- [47] J.E. Hobbs, D. Bailey, D.L. Dickinson, M. Haghiri, *Can. J. Agric. Econ.* 53 (2005) 47.
- [48] W. Verbeke, R.W. Ward, *Food Qual. Prefer.* 17 (2006) 453.
- [49] R.E. Petty, J.T. Cacioppo, *Communication and persuasion: central and peripheral routes to attitude change*, New York, Springer, 1996.
- [50] L.J. Frewer, J. Lassen, B. Kettlitz, J. Scholderer, V. Beekman, K.G. Berdalf, *Food Chem. Toxicol.* 42 (2004) 1181.
- [51] E. Einsiedel, E. Jelsøe, T. Breck, *Public Underst. Sci.* 10 (2001) 1.