

Everyday beliefs about food and health

Marieke Saher

Department of Psychology
University of Helsinki

Doctoral dissertation to be publicly examined,
by due permission of the Faculty of Behavioural Sciences
at the University of Helsinki in auditorium XII
on the 4th of August, 2006, at 12 o'clock

Helsinki 2006

Supervisor Marjaana Lindeman, PhD
 Department of Psychology
 University of Helsinki
 Finland

Reviewers Professor Pekka Niemi
 Department of Psychology
 University of Turku
 Finland

 Professor Stuart Vyse
 Department of Psychology
 Connecticut College
 USA

Opponent Timo Kaitaro, PhD
 Department of Law
 University of Joensuu
 Finland

ISBN 952-10-3286-3 (paperback)

ISBN 952-10-3287-1 (PDF)

ISSN 0781-8254

Yliopistopaino, Helsinki 2006

Table of contents

Abstract.....	4
Acknowledgements	5
List of original publications.....	7
1. Introduction	9
1.1. Categories in the mind.....	11
1.2. Paranormal beliefs	13
1.3. Food cognitions	15
1.4. Food-based impression formation	19
1.5. Everyday reasoning and alternative medicine.....	21
1.6. Similitude of belief in alternative medicine and paranormal beliefs.....	23
1.7. Dual-processing of information.....	25
1.8. Food and health beliefs from a dual-processing perspective.....	29
2. Summary of the research questions	32
3. Method.....	33
3.1. Participants	33
3.2. Procedures	34
3.3. Measures	35
4. Results	40
5. Discussion.....	45
References	56

Abstract

The series of studies addresses several everyday beliefs about food and health from the perspective of everyday thinking and paranormal beliefs. They are 'you are what you eat'-beliefs, attitudes towards genetically modified and organic foods, and belief in alternative medicine. The survey studies included from 239 to 3261 Finnish participants. It was found that food consumption can have far-reaching consequences for the impressions of the eater in a 'you are what you eat' manner. The results also demonstrated that belief in alternative medicine was related to belief in the paranormal, as were to a lesser degree attitudes towards genetically modified and organic foods. The study also addressed paranormal beliefs and belief in alternative medicine from the perspective of category observance. Paranormal believers as well as believers in alternative medicine were much more liberal than skeptics in violating categorical boundaries and attributed, for example, intentionality (mental) to body growth (biological) and life (biological) to energy (physical). In addition, the study addressed the relation of these attitudes and beliefs with preferred thinking style. The results demonstrated that belief in alternative medicine was especially appealing to intuitive thinkers, while rational thinking was unrelated to it. The same pattern was demonstrated for negative attitudes towards genetically modified food and positive attitudes towards organic food. In addition, it was demonstrated, however, that such unscientific notions may exist not instead of but parallel with "better knowledge". In sum, the present thesis contributes to the understanding of superstitious elements in various everyday attitudes and beliefs, and investigates their relationship with general inclinations towards belief in the paranormal. It appears that some very common everyday beliefs and attitudes about food and health contain elements of a superstitious nature. Involving conceptual enmeshment they go beyond mere associations, and can coincide with scientifically valid views on the same topic.

List of original publications

- Study I** Saher, M., & Lindeman, M. (in press). Attitudes towards genetically modified and organic foods. *Appetite*.
- Study II** Saher, M., Arvola, A., Lindeman, M., & Lähteenmäki, L. (2004). Impressions of functional food consumers. *Appetite*, 42, 79-89.
- Study III** Saher, M., & Lindeman, M. (2005). Alternative medicine: A psychological perspective. *Personality and Individual Differences*, 39, 1169-1178.
- Study IV** Lindeman, M., & Saher, M. (in press). Vitalism, purpose and superstition. *British Journal of Psychology*.

1. Introduction

In everyday life, people think, reason, judge, decide and conclude regarding an enormous amount of objects and situations. Participation in for example traffic, social and professional life, and activities from cooking to career planning and from shopping to playing cards require a host of cognitive operations to bring them to a good end. The sheer impossibility to gather and appropriately weigh all relevant information before any decision is made, as well as the time demands on decision makers, create a need to simplify the task. A range of heuristics and biases do just this, serving as shortcuts that apply structure to the multitude of information that surrounds us in everyday life (see, e.g., Gilovich, Griffin & Kahneman, 2002; Tversky & Kahneman, 1973, 1974).

Shortcuts are probably applied to all areas on which people perform cognitive operations, including that of food and health. Examples of simplifications in the latter realm are ‘natural foods are healthy’, ‘high-calorie food makes you fat’ and ‘technology poses a health threat’. Surely, they are not perfect: Not all natural foods are healthy, it is quite possible to lose weight on high-calorie food, and technology has both health-promoting and health-threatening applications. Still, as rough guidelines such rules may work quite well.

Shortcuts frequently make use of abstract representations of objects, for example, of the "average" bird or the "average" chair (Rosch, 1973; Rosch & Mervis, 1975).

These representations suggest a great deal of information about the object, including its properties as well as a suitable strategy of interaction. Using category information, people expect birds to fly, but not cats (let alone chairs), eat the offerings of their vegetable garden but not those of the ornamental garden, make sense of family conflict by assigning such roles as the "guilty" and the "victim" (e.g., Barker, 2000); and attribute the movements of a vehicle to intentionality of the driver, not of the vehicle.

Also unfamiliar objects can be related to using existing representations. For example, one may have no experience whatsoever with genetically modified foods but relate to them through associated categories, for example of technology, (un)naturalness, foods, or even strangeness. Similar classification occurs in social perception. We may not know most of the passers-by we see, but among them we easily – and automatically - recognize such categories as men and women, adults and children, sporty- and not sporty-looking individuals, friendly and unfriendly-looking people, and many more.

Knowledge of these and other categories develops as one interacts with the outside world. At infant age the coherence of the world may resemble that of a bee swarm, but it gradually turns out to have a meaningful, comprehensible organization. Much of this cognitive structuring happens spontaneously, for example, as infants acquire their mother tongue (reviewed in Kuhl, 2004). In other instances formal training either initiates or accelerates the process, for example when children are taught in

school about the properties belonging to physical or biological objects (Inagaki & Hatano, 1999; Miller, 1997).

1.1. Categories in the mind

Semantic models of human memory (e.g., Collins & Quillian, 1969; Collins & Loftus, 1975, see also Kunda & Thagard 1996; Smith & DeCosterm 1998) hold that information is organized in meaningful clusters of associations in the mind. People quite aptly observe patterns in the environment (e.g., Kimchi, Berhmann & Olson, 2003) and store this information such that the more often objects or events coincide, the stronger gets the mental association between them. Consequently, activation of a knowledge item immediately spreads to neighbouring items, in proportion to the degree of association. Thus, identification of a person as overweight is likely to activate pieces of information somehow associated with obesity, like ‘overeating’, ‘hamburger chains’, ‘diets’, ‘Weight Watchers’, ‘low exercise’, ‘type II diabetes’, ‘heart disease’, but also affective reactions, which in this particular case are likely to be negative (Hebl & Heatherton, 1997), at least in modern western societies.

As related pieces of information activate each other, the relevant concepts are likely to be at hand when needed. It also means that virtually any piece of information about an object, even if seemingly trivial, can be thought of as informative and therefore influence people’s daily judgments and decision making. These factors

greatly enhance the quality of decision-making processes (Blascovich, Ernst, Tomaka, Kelsey, Salomon, & Fazio, 1993; Fazio, Blascovich, & Driscoll, 1992; Pratkanis, 1988; 1989).

However, there are also downsides to this process. Categorical knowledge is like a grand mean, stressing commonalities among category members (Rosch, 1973; Rosch & Mervis, 1975). As a consequence, it only works to the degree that the world is consistent and coherent, which is far from always the case. It does not do justice to individual category members, and the fallibilities of human perception and memory (Evans, 1989; Nisbett & Ross, 1980) are prone to introduce biases and distortions to mental representations. They may, for example, lead to believe that obese people lack in cognitive ability, or that homicide is among the leading causes of death in the US.

An important pitfall is to confuse coincidence with causality. In essence, associations have neither direction nor causality: Just as 'obesity' may activate the concept 'overeating', so may the concept 'overeating' activate 'obesity', and the relation says nothing about causation. However, from infant age on, people are especially prone to look for causal relationships (Gibson & Spelke, 1983). Often, perceived relations may in fact adequately represent true causal relationships, as in the associations with overeating and obesity. Moreover, also in reality the cause-and-effect relationship may work both ways. For example, overeating as a (poor) coping method with one's obesity is quite plausible. Also self-fulfilling prophecies are an example of real life

inversion of cause and consequence, as when an obese person believes to be fated to be obese and consequently might as well overeat. However, this is not to say that all causal attributions are justified – far from it (see, e.g., Gilovich, 1993).

Sometimes causal inferences in general, or inversion of a true causal relationship between two instances, yields remarkable results to say the least. For example, shaping a piece of fudge like a dog dropping does not cause the ‘droppiness’ to spoil the fudge – yet many react as if it did (Rozin, Millman & Nemeroff, 1986). Relating to such associations as if they involved causality has been reason for some to equate it with magical or paranormal thinking (Frazer, 1922/1963; Rozin et al., 1986; Rozin & Nemeroff, 1990).

1.2. Paranormal beliefs

The term paranormal, in this thesis used interchangeably with the terms magical and superstitious, here refers to ‘at odds with the laws of nature’, for example when objects affect each other through mere similarity, consequences precede causes, or mental acts defeat gravity, all of which go counter to empirically well-based truths about the natural world. Paranormal phenomena often involve unconventional notions of causality, for example numbers causing bad luck, thoughts causing an object to move (telekinesis) or another person to think the same (telepathy), ghosts causing furniture to rock, dances causing rain, and violence inflicted on a voodoo doll causing harm to the person it represents.

Paranormal beliefs seem to have a number of factors in common. First, many of them introduce (illusionary) insight, certainty, or control in situations in which these are naturally limited, like sports, games of chance, navigation, love, health, death, and the course of life (Malinowski, 1972/1948; Vyse, 1997).

Second, they tend to appeal to the same audience, a typical profile of whom is summarized in Vyse (1997, p. 55). Research on paranormal believers suggests that they tend to believe in a range of paranormal phenomena, not just a chosen few (Grimmer & White, 1990; Peltzer, 2003; Tobacyk, 1988). In accordance, forums dedicated to paranormal phenomena tend to cover a wide spectrum of subjects. For example, the internet directory www.ufoseek.com (retrieved on Jan. 12, 2006) features no less than 96 headers, including astronomy, UFOs, antigravity, ghosts, near death experiences, alternative energy, alternative health, predictions, and time travel.

Third, many paranormal beliefs are associated with occult practice. Examples are the aforementioned voodoo, ghosts, and telekinesis, but also such practices as fortune telling from crystal balls, spirits rapping tables, and out-of-body travel. However, besides occult or "alternative" ones, there are also much more commonplace examples of superstitious beliefs and behaviours involving odd notions of causal relationships. Examples are varying the vigour of a throw to influence dice, and always wearing the same sports gear 'for good luck' (Vyse, 1997).

Also in the area of food and health a variety of non-occult but certainly peculiar beliefs occur, for example the aforementioned notion that visual resemblance with dog droppings renders otherwise attractive fudge inedible (Rozin et al., 1986). An example in relation to health is the idea that clothing of an HIV patient is unsuitable for use even after disinfection (Rozin, Markwith & McCauley, 1994). In these magical food and health beliefs essential qualities of objects are construed as mystically and more or less permanently transferable from one object to another, for example through mere resemblance or through temporary contact (Frazer, 1922/1963). A variety of such beliefs, some of them surprisingly common, have been documented in everyday thinking about food and health (Hunter, 1989; Lindeman, Keskiavaara & Roschier, 2000; Rozin et al., 1986; Rozin et al., 1994; Rozin, Ashmore & Markwith, 1996; Toyama, 2000).

1.3. Food cognitions

Magical thinking is but one way to relate to foods. Probably a much more common way of relating to food is through the categories they represent. For example, the rule to combine vegetables, a source of carbohydrates, and a source of protein is a very common, category-based strategy to compose a balanced meal. The categories in this example are based on intrinsic properties of the foods, but there are also more subjective categories to be distinguished, such as good and bad foods. Interestingly, these labels need not necessarily refer to the desirability of a food's taste, but may be a reference to its perceived inherent qualities (Oakes, 2004; Rozin et al., 1996).

People appear to have rather clear-cut notions about which foods are healthy and which are not, in line with the clear-cut messages that so frequently appear in popular health education. For example, in a study by Oakes and Slotterback (2001) participants rated the healthfulness of individual food items (e.g., rice cakes, lettuce, donuts) as well as of more general food descriptors (e.g., low calorie, high cholesterol, high protein). Ratings of the individual foods were bipolar: Fruits, vegetables, and low-fat foods were considered good, and fatty and high-sugar foods bad. When these same foods were presented not by their name but by an account of their nutritional values, ratings were less bimodal and covered also the range in between.

An extreme consequence of categorical thinking about foods is dose insensitivity, such that food image weighs more than true energy contents. For example, “sinning” in dieting may refer to eating not beyond a certain caloric limit but simply to the consumption of a negatively viewed food (Knight & Boland, 1989). Also, there is a tendency in lay beliefs about food that so-called bad foods are always more fattening or unhealthy than “good” foods, regardless of the quantity (Oakes, 2005; Rozin et al., 1996). Notably, for a food to be bad, it is not necessary to be predominantly composed of, for example, sugar or chocolate; the presence of negatively viewed ingredients is enough to lower the perceived overall status of a food (Oakes, 2004).

Of course, it is not healthiness or fatteningness alone that determine the image of a food. Taste is the most obvious determinant of food image, but also a number of

other dimensions, including cultural notions about what is edible (Rozin, 1996), novelty versus familiarity (Hobden & Pliner, 1995; Pliner & Hobden, 1992), as well as naturalness versus degree of processing (Cardello, 2003) affect food images.

Naturalness is a dimension that appears to be perceived strongly categorically, such that what is natural is generally believed to be good and healthy, while what is unnatural is thought of as bad and unhealthy. In food attitudes it shows as clearly positive attitudes towards pure, unprocessed foods that become more negative as the degree of processing increases (Cardello, 2003; Rozin, 2005).

The image of naturalness seems to culminate in organic foods. Organic foods are produced without the use of synthetic fertilizers and pesticides, genetic engineering, growth hormones, irradiation and antibiotics. All this evokes an association of naturalness, as is also reflected in lay conceptions of organic foods as healthy, safe, tasty, and good for the environment (Magnusson, Arvola, Koivisto Hursti, Åberg & Sjöden, 2003; Schifferstein & Oude Ophuis, 1998), and in the belief that this can somehow be transferred to the eater (Harper & Makatouni, 2002; Makatouni, 2002).

On the other extreme of the natural-processed dimension are genetically modified (GM) foods. GM foods are produced using recombinant DNA techniques, meaning they contain DNA from foreign sources. This DNA was introduced via a technical intervention, therewith distinguishing the technique from conventional plant breeding methods in which DNA transfer is limited to cross-fertile species. Widespread public resistance to GM is motivated by, among others, the belief that

genetic manipulation is unnatural, the fear of environmental risks, as well as concerns related to human health (Bredahl, 2001; Gaskell et al., 2000; Priest, 2000) as if the products were polluted by the technique (Trewavas, 1999) and somehow contagious (Gaskell et al., 2000; Rozin et al., 2004).

However, experts deny that either of these food groups is qualitatively distinguishable from conventionally grown produce; Nutrition scientists do not underwrite the belief that organic food is notably healthier nor systematically tastier than non-organic food, plant biologists do not recognize any dangers exclusively related to GM, and the ecological effects of GM and organic foods have even been argued to run counter to popular beliefs (Conner & Jacobs, 1999; Trewavas, 1999, 2001).

Consequently, attitudes towards GM and organic food could be argued to contain elements of magical beliefs of pollution and contagion (Frazer, 1922/1963; Nemeroff & Rozin, 1989; Rozin & Nemeroff, 1990), as if the production method has somehow affected these foods in manners not governed by any ordinary principle of transmission of properties and that is not scientifically detectable. Thus, the first purpose of Study I was to assess the relationship between attitudes towards genetically modified and organic foods on the one hand, and magical thinking about food and health on the other. We expected magical food and health beliefs to predispose to negative GM attitudes and to positive attitudes towards organic food.

1.4. Food-based impression formation

Attitudes and beliefs about food and eating are not restricted to the foods alone but reverberate to images of the eaters as well. Both quality (Mooney, DeTore & Malloy, 1994; Stein & Nemeroff, 1995) and quantity (Basow & Kobrynowicz, 1993; Bock & Kanarek, 1995; Chaiken & Pliner, 1987; Martins, Pliner & Lee, 2004) of consumed food influence impression formed of the eater, a fact that is also exploited in impression management (Chaiken & Pliner, 1987; Mori, Chaiken & Pliner, 1987; Pliner & Chaiken, 1990).

As could be expected, impressions of healthy eaters tend to be positive, while those of unhealthy eaters are generally negative. Typically, eaters of healthy meals are thought of in more positive terms than eaters of unhealthy meals. Among the perceived assets of the former are good health, thinness, attractiveness, sportiness, likeability, intelligence, kindness, and understanding of others. Unhealthy eaters, in turn, are described in such terms as unhealthy, overweight, unattractive, inactive, lazy, unintelligent and less socially appealing (Barker, Tandy & Stookey, 1999; Basow & Kobrynowicz, 1993; Chaiken & Pliner, 1987), and even immoral (Stein & Nemeroff, 1995). Some studies, however, have found somewhat ambivalent attitudes towards healthy eating patterns, associating healthy eaters also with negative attributes like being picky and self-centred (Fries & Croyle, 1993), and unhealthy eaters with positive ones like being fun-loving and happy (Barker et al., 1999).

There is a group of foods in which healthiness and naturalness run counter to each other: the so-called designer or functional foods. The term refers to a range of products whose health properties are artificially enhanced. Examples are milk with added vitamins and bread spreads containing stanol esters, which lower blood cholesterol. On the one hand, these products are refined to enhance their health-promoting properties. On the other hand, they are in conflict with the traditional association of health and naturalness, for the very reason of being artificially enhanced. Study II aimed at exploring the images people form of functional food consumers.

In earlier research, it was noted that the image evoked by a product is related to the overall consumption pattern of which it is part. For example, in one study consumers of instant coffee were thought to be lazy. However, adding instant coffee to a shopping list already containing instant pie fill mix, a labour-saver apparently suggesting the same consumer qualities as instant coffee, did not add to the inferred laziness (Haire, 1950). Thus, although it is possible that their combination lead to a stronger impression, it did not lead to a more extreme one. Study II addressed the question how impressions of functional food consumers depend on the health image of other products they consume.

1.5. Everyday reasoning and alternative medicine

The idea that an ingested substance can change the qualities of the eater is frequently met in traditional and alternative medicine, too. Of these, the former refers to medical practice from before modern, science-based medical practice. The latter, in turn, refers to the true blend of non-scientific treatments existing side by side with regular, science-based medicine, including homeopathy, reiki therapy, naturopathy, and iridology.

Belief in transfer of properties through ingestion goes back to early stages of civilization. Properties of animals and their body parts were long held to be transferable to the eater upon consumption of the animal. Traditional medicine abounds with such teachings, for example that eating bear meat would make one strong, or that consumption of animal sexual organs could relieve problems related to human sexuality.

Not only traditional medicine, but also present-day alternative medicine contains this type of associative beliefs. For example, the popularity of shark cartilage pills, available in many so-called health stores, has its origin in a book from 1992 (Lane & Comac, 1992) promoting the (false) belief that sharks do not get cancer and that the consumption of shark cartilage *thus* could prevent this disease in humans. Also just a decade old is the idea that people should eat according to their blood type (D'Adamo, 1996), because the different blood types would stem from ages associated with

different eating habits (e.g., fatty and protein-rich food for hunter-gatherers, grains and carbohydrates for farmers). Also homeopathy, a treatment stemming from the 19th century, encompasses these types of ideas. One of its central principles is that ailments should be treated by a substance causing similar symptoms, like snake venom for paralyses or a nausea-causing herb to treat this very same condition.

Alternative medicine includes also a host of claims that are not based on similarity, including the claim that energy blocks can obstruct normal body functioning, alleged healing properties of all types of herbs and plant extracts, and the claimed healing powers of crystals and pyramids. It appears that the only commonality to the wide scope of alternative treatments is that the claims are scientifically unsubstantiated.

However, not all unsubstantiated claims are equal. Some of them are quite thinkable, like for instance the belief that plant extracts can have pharmaceutical properties. Many medications contain substances derived from plants, including acetylsalicylic acid (aspirin) from willow bark and morphine from poppy seeds, and it is quite plausible that the healing potentials of many plant substances are yet to be discovered.

However, this possibility is essentially different from that of, say, ("unmeasurable") energy travelling through the air, in a direction guided by the mind of a reiki healer, for the physical properties of energy as well as the properties of the mind will simply not allow this to happen. Another example is the homeopathic notion that dilution

adds to, instead of depletes, the pharmaceutical potentials of a substance; This is in direct conflict with the general principle that there is a positive (though not infinite) relation between dosis and effect.

Scientific substantiation of claims of this latter type is therefore not only unlikely but in fact impossible in the light of what we know about the world. They all involve claimed mechanisms that are at odds with the laws of nature, which makes them fit the definition of paranormality. Some of them are actually presented as paranormal, with emphasis on the "alternativity" and the "spiritual approach" of a treatment. A positive relationship between belief in alternative medicine and paranormal beliefs as found in an earlier study (Grimmer & White, 1990) also suggests that the two are in fact associated, a question addressed in Study III.

1.6. Similitude of belief in alternative medicine and paranormal beliefs

As noted, paranormal claims as well as some of the claims in alternative medicine run afoul of the laws of nature. The telekinetic notion that mental power could lift an object, which is obviously at odds with the well-established notion of gravity, is but one illustration. In addition to violating the gravitational principle, though, the claim makes another violation: That of the boundaries of the fundamental categories of physics and psychology.

Gravity can only be defeated by a physical power that pulls stronger than the earth, for example by practicing enough muscle force. In telekinesis, however, gravity is claimed to be defeated by a mental act. Such border violations, in which properties from one category (physics, psychology, but also biology) are borrowed to describe members of another, seem present both in paranormal claims as well as in claims from alternative medicine. For example, believers in Tarot consider the outcome of a random draw of cards purposeful, and feng shui teaches that erroneous furnishing may absorb vital energy, leading to crimes and divorce. Similarly, reiki teaches that "energy blocks" are a source of illness and that "intelligent" healing energy "knows" where to go to resolve them.

These examples involve attribution of such mental qualities as purpose, intentionality and agency, and biological qualities like the ability to heal, to objects and events that are scientifically considered to be free of them, like a draw of cards, furniture, planets, and energy. Notably, the whole conception of energy in these beliefs appears to be based on categorical confusion, in which energy (physical) is described in terms belonging to biology (e.g., living) and psychology (e.g. intentional, intelligent).

Overattribution of intentionality and purpose are commonly found in children (Kelemen, 1999; Morris, Taplin & Gelman, 2000; Piaget, 1929/1951). They are generally thought to be reflective of children's initial attempts to understand the world and to disappear as children gain more insight in the world and learn to better

distinguish between physical, biological, and psychological processes. However, the forementioned examples suggest that the same type of thinking is present also in paranormal beliefs as well as belief in alternative medicine. Study IV tested the assumption that category violations can be found in superstitious adults as well as believers in alternative medicine. Specifically, it tested how paranormal believers and believers in alternative medicine differ from skeptics in their conceptions of biological, mental, and physical phenomena. It was expected that paranormal believers and believers in alternative medicine, but not skeptics, attribute purpose, intentionality, life, and other category-bound attributes to objects and processes belonging to other categories.

1.7. Dual-processing of information

In the previous text, a variety of food and health-related issues have been discussed in which lay and expert views differ. Psychologists do not assess personality on the basis of diet, plant biologists do not recognize any dangers exclusively related to GM production, nutrition scientists do not underwrite the belief that organic food is notably healthier than non-organic food, nor do physicians treat patients by rearranging furniture. Of course, sometimes lay people disagree with experts because lay judgments are by definition based on more restricted or one-sided information. However, there is reason to believe that differences in knowledge level alone cannot account for differences in lay and expert views.

Evidence against the knowledge deficit to explain these differences are available for all the instances mentioned above. Psychology students may believe in horoscopes (Hamilton, 2001); attitudes towards genetically modified and organic food have been shown to be largely independent of knowledge level (Gaskell et al., 2000; Koivisto Hursti & Magnusson, 2003; Priest, 2000); lay people may not even acknowledge and at least rarely admit that they make personality inferences on the basis of food consumption (Rozin, Bauer & Catanese, 2003); and there are medical doctors who practice alternative medicine, for example homeopathy.

However, lay persons and experts are likely to differ not only in the amount of substance knowledge they have, but also in the style in which they approach and process this information and draw conclusions about it. Dual models of information recognize two modes of processing information that underlie all reasoning; The “quick and dirty” intuitive system and the slow and deliberate rational system processing (Evans, 2003; Haidt, 2001; McClelland, McNaughton & O'Reilly, 1995; Sloman, 1996; Stanovich & West, 2000; Sun, Sluzarz & Terry, 2005; terminology differs across publications).

Intuitive thinking is described as an unconscious, fast and effortless style of thinking, making use of such information sources as personal experiences, feelings, concrete images and narratives. As a rule, intuitive judgments are slow to change. Its orthogonal counterpart, rational thinking, is characterised by conscious reasoning and mental effort, using all available objective information to come to a true answer,

and willingness to adjust conclusions in the light of new facts. Table 1 illustrates the central characteristics of the two systems of information processing.

The two systems operate concurrently and in parallel. Typically, objects elicit an automatic, initial reaction as the product of intuitive processing, which is the default mode of thinking. This reaction can be adjusted through rational, corrective processing (e.g., McClelland et al., 1995). See Figure 1 for a graphic display of the temporal interplay of the two systems. The figure gives only an indication of this interplay: Both situational and individual differences affect the degree of activation of each system (Epstein, Pacini, Denes-Ray & Heier, 1996). The default style of everyday thinking is intuitive thinking (DeCoster & Claypool, 2004; Epstein, Lipson, Holstein & Huh, 1992), while the default mode of thinking in science is rational

Table 1.
Two systems of information processing

	Intuitive thinking	Rational thinking
Process characteristics	Automatic Effortless Associative Rapid, parallel Process opaque Skilled action	Controlled Effortful Deductive Slow, serial Self-aware Rule application
Content on which process acts	Affective Causal propensities Concrete, specific Prototypes	Neutral Statistics Abstract Sets

Note. From “Representativeness revisited: Attribute substitution in intuitive judgment” by Kahneman, D., & Frederick, S. In T. Gilovich, D. Griffin and D. Kahneman (Eds.), *Heuristics and biases. The psychology of intuitive judgment*, p. 51. Copyright 2002 by Cambridge University Press. Reprinted with permission.

thinking. This is not to say, however, that these defaults are absolute: lay people also use rational thinking, and experts intuitive thinking (Slovic, 1987), and both thinking styles can independently and simultaneously be applied to a problem. As a result, people can simultaneously hold conflicting beliefs about the same topic; one intuitive and one rational (Denes-Rej & Epstein, 1994; Subbotsky, 2001, 2004). Thus, it is possible to make an intuition-based, non-optimal gambling choice, rationally know better, and nevertheless prefer this choice over a readily available more optimal one (Denes-Rej & Epstein, 1994). Reasonably, this could hold for paranormal beliefs as well. Paranormal beliefs are argued to be a product of the intuitive system (Epstein, 1993), while the scientific notions that invalidate them are rationality-based. Study

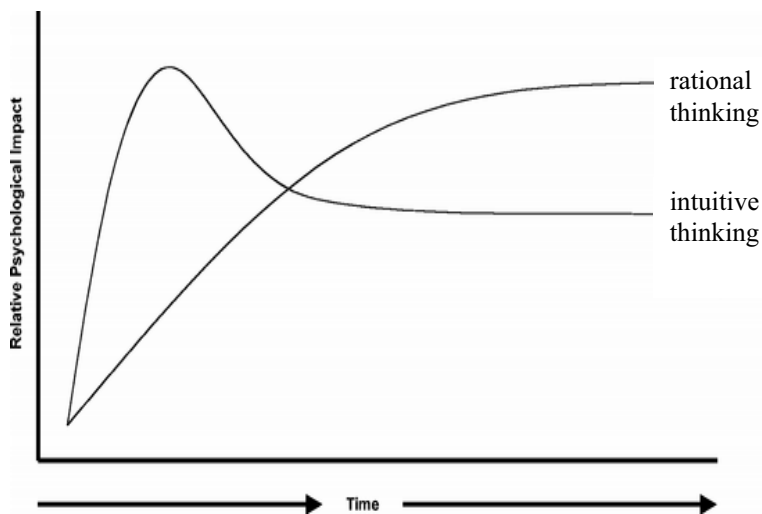


Figure 1. The temporal development of rational and intuitive processes. Note that both situational demands and individual differences affect the relative involvement of the two processes. From: Pryor, J. B., Reeder, G. D., Yeadon, C., & Hesson-McInnis, M. (2004). A dual-process model of reactions to perceived stigma. *Journal of Personality and Social Psychology*, 87, 436-452. Copyright © 2004 by the American Psychological Association. Adapted with permission.

IV was designed to address simultaneous subscription to scientific knowledge and paranormal statements. It investigated whether unscientific beliefs about biological, mental, and physical phenomena, as we expected to find in paranormal believers and believers in alternative medicine, can exist side to side with scientifically valid views of the same topic.

1.8. Food and health beliefs from a dual-processing perspective

Signs of dual-processing of information, including the occasional coexistence of conflicting beliefs on an issue as a result, can be found in everyday attitudes, beliefs, and impressions. For example, impression formation is believed to unite the two types of processing (Kunda & Thagard, 1996; Pryor, Reeder, Yeadon & Hesson-McInnis, 2004; Smith & DeCoster, 1998). The initial impression is thought to be the result of immediate, intuitive processing of general features. This impression is then fine-tuned by a slower, active reaction taking into account individualizing features. For example, stigmatized persons like HIV-positive patients, cancer patients, or the obese, have been shown to first evoke an automatic, negative reaction based on their category membership (e.g., of HIV patients). This reaction can then be quickly but effortfully corrected into a more positive one, for example if the person was infected with HIV through blood transfusion and therefore cannot be held responsible for their condition (Pryor et al., 2004).

There is preliminary evidence to support the notion of a two-level representation of attitudes towards organic foods, too (Rozin et al., 2004). Often, a preference for organic food is verbally justified with reference to health and taste benefits (O'Donovan & McCarthy, 2002; Schifferstein & Oude Ophuis, 1998; Zanolini & Naspetti, 2002). However, when offered the choice between an organic and a regular product that was just as healthy or tasty, preference for the organic product remains, though in somewhat deflated form (Rozin et al., 2004). Thus, the verbal arguments were relatively resistant to rational rebuttal, suggesting that they were after-the-fact rationalizations of intuition-based notions.

A similar resistance to rational arguments is found in GM attitudes, in relation to which several instances, including consumer and environmental organizations, have expressed their unconditional refusal to adjust their opinion on the basis of possible new evidence (Trewavas & Leaver, 2001). As it seems, there is no lack of evidence contrasting their views; Experts do not endorse many of the objections to GM as exclusive for GM products, or even as valid at all (Conner & Jacobs, 1999; Trewavas, 1999; Trewavas & Leaver, 2001).

However, scientists' approach of and communication about the matter is predominantly rational, with reference to statistics, probabilities, methodology, and other information that appeal little to one's imagination. Interest groups like Greenpeace and EarthFirst!, on the other hand, communicate quite differently and much more emotionally, in a manner appealing especially to the intuitive system. In

Study I, the relation of thinking style preference to GM and organic food attitudes was investigated. It was expected that a preference for intuitive thinking is negatively related to GM attitudes and positively to organic food attitudes. In addition, it was expected that neither type of attitude is related to preferring a rational thinking style.

Also alternative medicine is usually presented not with reference to rational, science-based evidence but with anecdotes, personal accounts, and other types of messages that appeal mostly to the intuitive system. Probably the best illustration of the appeal to intuition is the often-heard claim that alternative treatments are unsuitable for, or "beyond", scientific testing, and that the only way to learn about their effectiveness is through personal experience. In other words, rational knowledge is stated to be "not applicable" to this type of medicine, while intuitive is. It is therefore to be expected that intuitive thinking, but not rational thinking, is related to believing in alternative medicine. This question was addressed in Study III.

In sum, the aim of this series of studies was to demonstrate 'you are what you eat'-beliefs, assess the relationship of several food and health-related beliefs to paranormal beliefs and preferred thinking style, investigate whether unscientific everyday beliefs can exist side to side with scientifically valid beliefs on the same topic, and to address possible common features in paranormal beliefs and belief in alternative medicine. More specifically, we pursued to answer the following questions.

2. Summary of the research questions

What kind of impressions do people form of functional food consumers? (II)

How do impressions of functional food consumers depend on the health image of the other products they consume? (II)

How are attitudes towards genetically modified and organic food (I) and belief in alternative medicine (III) related to paranormal beliefs?

How are preferences for intuitive and rational thinking related to attitudes towards GM and organic food (I) and to belief in alternative medicine (III)?

How do paranormal believers and believers in alternative medicine differ from skeptics in their conceptions of biological, mental, and physical phenomena? (IV)

Can unscientific beliefs about biological, mental, and physical phenomena exist side to side with scientific valid views of the same topic? (IV)

3. Method

3.1. Participants

Studies I and III made use of the same sample of 3261 participants. They were in the age range of 15-60 ($M = 24.0$), and 74 % were females. A majority (85 %) of participants were students, of whom 77 % attended university and 23 % were enrolled in vocational education. Together, they represented a wide variety of disciplines including medical sciences, technology, natural sciences, psychology, law, humanities, education, business, social sciences, and service. Nine percent of the participants worked full-time and 6 % reported to be otherwise occupied. Due to the recruitment method of sending invitations to participate in the study to e-mail lists, the response rate cannot be calculated. Of the original participants, 21 were excluded because of missing data.

Originally, 472 people participated in **Study II**. Out of this population, the 350 participants were selected who recognised at least two out of three functional foods. Participants' age ranged from 14 to 90 ($M = 44$), and 79 % of them were women. The majority (75 %) were in the work force, 11 % were students, and 14 % retired. The original response rate was 58.8 %.

For **Study IV**, two hundred and thirty-nine participants were recruited among the most and least superstitious participants from study III. We selected participants who belonged to the highest or lowest decile in terms of either paranormal beliefs or belief in alternative medicine in the initial study. Inclusion in the category of *believers* required either a) belonging to the highest decile for paranormal beliefs and having at least moderate belief in alternative medicine ($M > 2.5$, scale range 1 – 5) or

b) belonging to the highest decile for belief in alternative medicine and having at least moderate paranormal beliefs ($M > 2.5$, scale range 1 – 5). Inclusion in the category of *skeptics*, in turn, required either a) belonging to the lowest decile for paranormal beliefs and having at most moderate belief in alternative medicine or b) belonging to the lowest decile for belief in alternative medicine and having at most moderate paranormal beliefs. Altogether, 155 believers (81 % females) and 185 skeptics (72 % females) participated. Their age ranged from 16 to 48 ($M = 24.2$). Most of them (94 %) were full-time students, of whom 81 % were enrolled in university education and 19 % attended a vocational school. The response rate was 52 %; 12 participants were excluded because of missing data.

3.2. Procedures

The participants for **Studies I and III** were recruited through student e-mail lists and communication boards at six universities and ten vocational schools in Finland. A minority of the participants was informed about the study by a researcher at the beginning of a lecture at their educational institute. The participants were told that the study concerned beliefs, personality, cognition, and values, and the contact information of the researchers was provided. Students were referred to the questionnaire, which was posted on the Internet in a hidden directory where it was unavailable to casual browsers. As incentives, they were offered feedback on their own responses, and they could take part in a draw for a boat trip to Tallinn.

Participants in **Study II** were recruited through four adult education institutions in the Helsinki capital area, several choirs, and a cafeteria located in a fire station of the Helsinki municipality. The experimenter randomly distributed the questionnaires to the participants prior to their lesson/rehearsal and came to collect them again one week later, which was usually the next occasion that the group gathered. If necessary, the experimenter returned once more the week after, and/or postage-paid envelopes were handed out to those who had forgotten to bring their questionnaire or had not had time yet to fill it out. Upon turning in the completed questionnaire, participants received a bag of sweets. There were large font versions of the questionnaire available for those requiring it.

Participants in **Study IV** were contacted at the e-mail address that they had provided in the initial study and invited to participate in a follow-up study “concerning beliefs, personality, cognition, and values”. The recruitment message contained a personal password and a hyperlink to the questionnaire on the Internet, as well as the names and contact information of the researchers. Confidentiality and voluntariness of participation were stressed, and the respondents were given between one and three weeks time to participate in the study. They could return to their questionnaires within that time to complete or change their answers.

3.3. Measures

Attitudes toward genetically modified and organic food (Study I). Attitudes towards GM and organic foods were measured by a semantic differential approach as used by

Sparks and Shepherd (1992). Both scales included the same five 7-point items of bipolar attributes: good–bad, pleasant–unpleasant, enjoyable–unenjoyable, foolish–wise, and safe–unsafe. For both scales, the scores were averaged to compute the total score. Their reliabilities (Cronbach’s α) in this study were .91 (GM) and .80 (organic foods).

Belief in alternative medicine (Studies III and IV) was measured by asking respondents’ belief in the efficacy of 22 alternative treatments: chiropractic, relaxation techniques, acupuncture, homeopathy, natural remedies, hypnosis, megadoses of vitamins, magnetic field treatments or Kirlian photography, stone therapy, spiritual healing, meridian massage, biorhythm forms, iridology, Kuhne healing, macrobiotics, raw food, reiki, shiatsu, colour therapy, aroma therapy, reflexology, and meditation. There were also three filler items: a balanced diet, physical exercise, and traditional massage. The participants indicated their belief in the treatments on a 6-point scale (0 = *I do not know the therapy*, 1 = *I do not believe in the therapy at all*, 5 = *I strongly believe in the efficacy of this treatment*). Because of the close relation between beliefs and experience (Southerland, Sinatra & Matthews, 2001) we recoded 0-responses into 1. The scores were averaged to compute the total score. The reliability (Cronbach’s α) of the scale was .90.

Rational and intuitive thinking styles (Studies I and III) were assessed with the Rational-Experiential Inventory (Pacini & Epstein, 1999). The scale consists of the

20-item Rationality Scale ($\alpha = .89$), containing items like “I have a logical mind” and “I enjoy intellectual challenges”, and the 20-item Experientiality Scale ($\alpha = .88$), including items as “I like to rely on my intuitive impressions” and “I believe in trusting my hunches”. The scores, measured on a 5-point scale, were averaged to compute the total score.

Magical beliefs about food and health (Studies I and III) were assessed with the Magical Beliefs about Food and Health Scale (Lindeman et al., 2000). The scale ($\alpha = .84$) consists of 22 items (including five fillers) like “If we don’t somehow clean our bodies, unhealthy toxins remain in them” and “The consumption of meat makes people behave aggressively”. Ratings were made on a 5-point scale ranging from *strongly disagree* (1) to *strongly agree* (5).

Paranormal beliefs (Study III) were assessed with the 26-item Revised Paranormal Belief Scale (Tobacyk, 1988). All items, of which an example is ‘Some individuals are able to levitate objects through mental forces’, were measured on a 5-point scale varying from strongly disagree (1) to strongly agree (5). The reliability (α) of the scale was .92. For **Study IV**, these paranormal belief scores were supplemented with a number of items to cover a wider spectrum of superstitions. These included belief in paranormal agents, paranormal abilities of human beings, God, luck, astrology, lunar effects, and feng shui. The 55 items were each measured on a five-point scale, and a mean score of the items was used.

Food choice stimuli (Study II). The foods forming the basis of impression formation were either three functional foods (probiotic yoghurt, omega 3-eggs and fruit juice with added fibre and calcium) or three conventional counterparts of these foods (strawberry yoghurt, brown eggs and orange juice). These products were embedded in a shopping list containing either foods with a healthy image (e.g., wholegrain bread) or a neutral health image (e.g., corn flakes). All products had a specification, either related to functionality (e.g., probiotic yoghurt) or to flavour or contents (orange juice, cream cheese). As the two shopping lists could be combined with either the functional foods or the conventional foods, there were four different shopping lists that were randomly presented to the participants.

Impressions (Study II). Respondents rated their impressions of the buyer, and not of the food, in order to avoid the pitfall of rationally inquiring about intuitive knowledge (see e.g. Haire, 1950; Loewenstein, Weber, Hsee & Welch, 2001; Nisbett & Wilson, 1977). Participants indicated their impressions of the buyer, who was said to be an approximately 40-year-old man (or woman) on 66 adjective pairs on a seven-point scale (e.g., 1 = *boring*, 7 = *interesting*). The adjective lists were adapted from studies on food-based impressions (Barker et al., 1999; Chaiken and Pliner, 1987; Fries and Croyle, 1993 and Stein and Nemeroff, 1995), as well as from the personality profile scales 16 Personality Factor Questionnaire (Cattell, 1981) and the Jackson Personality Inventory (Jackson, 1975). Attributes from two personality inventories were included because we did not want to limit the content of the impressions in advance and because the inventories include scientifically derived

summaries of the numerous attributes that can be used to describe human personalities. Adjectives appearing in more than one, either literally or as near-to-synonyms, were included only once.

Perceived purpose of entities (Study IV). Participants indicated on a 5-point scale (1 = *has no purpose*, 5 = *clearly has a purpose*) whether they thought 18 items from 6 different categories exist for a reason or ‘just exist’. The categories were biological wholes (e.g., a cat), biological parts (e.g., a tree trunk), natural wholes (e.g., a mountain), natural parts (e.g., the trail of a cloud), artefact wholes (e.g., a clock), and artefact parts (e.g., a jeans pocket). For any of these categories, a mean score of the relevant items was calculated.

Explanations for biological processes (Study IV). Participants were presented with seven biological processes like breathing and wound healing. They had to indicate on a 5-point scale (1 = *strongly disagree*, 5 = *strongly agree*) to what extent they agreed with any of five different explanations for each process: a vitalistic explanation involving energy transmission, a vitalistic explanation involving organ intentionality, a scientifically valid explanation, and two filler items involving body cells and bodily waste products. We calculated mean scores on the energy items (Cronbach's $\alpha = .71$), organ intentionality items ($\alpha = .93$) and scientifically valid items ($\alpha = .77$) across the different biological functions.

Conceptions of energy (Study IV). Participants indicated on a five-point scale how well they thought that each of 36 statements fit their conceptions of energy (1 = *does not apply at all*, 5 = *applies very well*). In the statements, energy was described as a material substance, as a living entity, as a mental phenomenon, in scientifically valid terms, and as a vital power.

4. Results

The results of **Study I** showed that attitudes towards GM and organic foods were related to thinking styles and magical food and health beliefs in a mostly opposite manner. GM attitudes were inversely related to magical thinking about food and health, such that positivity in GM attitudes was associated with less MFH beliefs ($r = -.34, p < .001$). GM attitudes were inversely related also to intuitive thinking style ($r = -.17, p < .001$), but positively correlated with a preference for rational thinking ($r = .13, p < .001$). Attitudes towards organic food showed a predominantly opposite pattern: they were positively related to MFH ($r = .23, p < .001$) and intuitive thinking ($r = .16, p < .001$), but virtually unrelated to rational thinking ($r = .04, p < .05$).

Structural equation modelling demonstrated that GM attitudes were mostly affected indirectly by the examined variables. Magical food and health beliefs were among the best predictors of GM attitudes, while neither rational nor intuitive thinking affected GM attitudes directly. Both, however, affected MFH: rational thinking was

negatively and intuitive thinking positively related to magical food and health beliefs. Attitudes towards organic foods were mostly influenced directly. Overall, GM attitudes were more strongly related to the variables at study than attitudes towards organic food. The minimal variance among attitudes towards organic foods is likely to have contributed to this.

The study showed that attitudes towards both these food groups are related to magical food and health beliefs, but only moderately. Magical thinking about food and health was related to negativity in GM attitudes, as well as (extreme) positivity in organic food attitudes. Intuitive and rational thinking styles affected the attitudes in question mainly through their relation with magical food and health beliefs: Intuitive thinking predisposed to MFH, while rational thinking was negatively related to it.

The results of **Study II** showed that impressions of people were related to the products they were said to buy, in this case either functional foods or regular food products. By means of factor analysis, three dimensions were identified on which buyers of these two food categories differed: discipline, innovativeness, and gentleness. Consumers of functional food were thought of as more disciplined, $F(1, 322) = 12.1, p < .001$, more innovative, $F(1, 322) = 17.9, p < .001$, but less pleasant people, $F(1, 322) = 22.3, p < .001$ than buyers of conventional foods. However, when functional food buyers were described as buying overall healthy products, functional food did not add to their perceived degree of discipline.

In **Study III**, it was found that belief in alternative medicine coincided with belief in the paranormal and with intuitive thinking, but that it was unrelated to rational thinking style. Belief in alternative medicine correlated most strongly with paranormal beliefs ($r = .44, p < .001$), followed by magical beliefs about food and health ($r = .38, p < .001$), and intuitive thinking style ($r = .33, p < .001$). Rational thinking style did not correlate with belief in alternative medicine, $r = .00, ns$.

In order to unravel unique contributions of the different independent variables, a hierarchical regression analysis was performed with belief in alternative medicine as the dependent variable, and intuitive and rational thinking styles (step 1) and paranormal beliefs and magical thinking about food and health (step 2) among the independent variables. Together with values and gender (discussed in publication III) these variables accounted for 29 % of the variance.

When all independent variables entered into the equation, paranormal beliefs ($\beta = .31, t = 18.30, p < .001$) and magical food and health beliefs ($\beta = .24, t = 15.02, p < .001$) were most strongly predictive of belief in alternative medicine, followed by intuitive thinking style ($\beta = .17, t = 10.29, p < .001$). Also rational thinking, which did not correlate with belief in alternative medicine, significantly predicted the latter in the regression analysis, $\beta = .10, t = 6.28, p < .001$. This suggests that rational thinking served as a suppressor variable, that is, it increased the multiplier R^2 only by virtue of its correlations with the other independent variables (Tabachnick & Fidell, 2001).

The results of **Study IV** (see Table 2) showed that, in comparison to skeptics, superstitious individuals assigned more purpose to biological wholes, natural parts and natural wholes, they explained biological processes more often with organ intention and energy, and they regarded energy more as matter, a living entity, a mental phenomenon, and vital power. In addition, superstitious individuals assigned less purpose to artefact parts and artefact wholes than skeptics did.

No differences were found in scientific conceptions of energy or purpose of biological parts between the groups. Furthermore, scientific explanations for

Table 2
Conceptions of purpose, biological processes and energy among paranormal believers and skeptics

Variable	Believers	Skeptics	F (1, 338)	η^2
Purpose of entities				
Artefact part	3.80	4.02	5.90*	.02
Artefact whole	4.05	4.24	5.23*	.02
Biological part	4.82	4.75	1.63	.01
Biological whole	4.44	4.05	13.90***	.04
Natural part	2.69	2.25	11.04**	.03
Natural whole	3.67	3.10	14.00***	.04
Explanations of biological processes				
Organ intention	2.56	1.77	56.55***	.14
Energy	4.04	3.65	30.71***	.08
Scientific	4.67	4.73	2.16	.01
Energy conceptions				
Material entity	3.46	2.64	102.36***	.23
Living entity	3.19	2.04	205.55***	.38
Mental phenomena	3.36	2.13	175.27***	.34
Vital power	4.46	3.03	120.73***	.26
Scientific	4.47	4.52	0.50	.00

Note. All items rated on a five-point scale.

* $p < .05$. *** $p < .001$.

biological processes were regarded as more valid than other explanations, both among superstitious, $F(1, 115) = 218.83, p < .001, \eta^2 = .66$, and skeptics, $F(1, 122) = 775.03, p < .001, \eta^2 = .86$. Similarly, scientific descriptions for energy were regarded as more valid than other descriptions, both among superstitious, $F(1, 115) = 322.19, p < .001, \eta^2 = .76$, and skeptics, $F(1, 122) = 1642.32, p < .001, \eta^2 = .93$.

Rational thinking was more pronounced in skeptics ($M = 4.05$) than in superstitious individuals, $M = 3.78; F(1, 237) = 14.50, p < .001$. However, adjustment for rational thinking left the original finding that skeptics and superstitious did not differ in scientific conceptions of energy descriptions unchanged, $F(1, 225) = 0.01, ns$. Both belief in alternative medicine and a range of superstitions were positively correlated to conceptual confusions, with correlations ranging from $.15, p < .001$ (between belief in astrology and observing purpose in natural parts) to $.75, p < .001$ (between belief in alternative medicine and viewing energy as a living thing). In addition, the energy conceptions were intertwined: The more participants described energy as a vital power, the more they agreed that energy is a mental phenomenon ($r = .75, p < .001$), a living thing ($r = .65, p < .001$) and a material entity ($r = .55, p < .001$). In contrast, thinking of energy in physical terms was unrelated to the notion of energy as vital power ($r = .09, ns$).

5. Discussion

In the present series of studies, a number of attitudes and beliefs from the realm of food and health were presented: Food-based impression formation, attitudes towards genetically modified and organic food, and belief in alternative medicine. At first sight, they may seem like any other everyday belief, but this series of studies revealed that several of them may be best understood through magical thinking and belief in the paranormal. In addition, the results shed light on the role of thinking style preference and on dual representation of knowledge in the mind.

Study II confirmed the common finding that food intake, in this case the consumption of functional foods, is used as a cue for impression formation. In line with other studies (Barker et al., 1999; Basow & Kobrynowicz, 1993; Chaiken & Pliner, 1987; Fries & Croyle, 1993; Stein & Nemeroff, 1995), it showed that these impressions go much further than what food intake could reasonably cause to the body, like affect body weight and size. On the basis of consumed food alone, impressions were made that stretched as far as personality, including whether or not the eater leads a disciplined life and whether s/he is pleasant company. Functional food eaters were believed to be more disciplined, more innovative, but socially less favourable than others. The image evoked by the functional food eater, however, was related to the other foods s/he reportedly ate. If the overall diet consisted of healthy foods, consumption of functional foods did not add to the image of leading a

disciplined life. This is in line with earlier findings suggesting a similar effect for implied laziness (Haire, 1950).

The study adds to a tradition of studies addressing how associations with certain foods are reflected in images of the eater. Similar studies comparing impression formation on the basis of healthy vs. unhealthy diets have yielded largely similar results: Healthy eaters are predominantly thought of in positive terms and unhealthy eaters in negative ones (Basow & Kobrynowicz, 1993; Chaiken & Pliner, 1987), though ambivalence has been met before, too (Barker et al., 1999; Fries & Croyle, 1993; Stein & Nemeroff, 1995). The latter was also found in this study, in which functional food eaters were attributed both desirable and undesirable characteristics to. This is in line with the representation of health and pleasure as opposites (Tuorila & Cardello, 1994) and even with the popular notion “no pain no gain”.

Some have argued that ‘you are what you eat’-beliefs are an example of magical thinking, in which a foodstuff is thought to have the power to pollute the eater (Nemeroff & Rozin, 1989; Rozin & Nemeroff, 1990; Stein & Nemeroff, 1995). Certainly, the belief that you are what you eat has a biochemical reality to it; all the building blocks of the human body were once ingested in the form of food. However, conclusions in the ‘you are what you eat’ –fashion go much further than the physical build-up of the body; they stretch as far as character, personality, and even morality.

Explanation of the latter beliefs as magical thinking may be compelling: The thought of a food morally staining the consumer is unquestionably beyond what foods are biologically known to do. However, an alternative explanation is possible. From an associative point of view, food-based impressions can be understood as activation spread among related concepts. For example healthy eating and practicing sports are both part of a healthy lifestyle, and thus, it is plausible that a healthy diet evokes the notions of sportiness, physical health, and other related concepts. These do not all have to be restricted to notions of the person's physique: One could, for example, believe that healthy eaters, who apparently can resist nutritional temptations, will also be able to resist other temptations, for example to put morality ahead of personal gain.

The demand for parsimony in science holds that only when existing explanations evidently fall short is introduction of a new concept to explain the phenomenon justified. Thus, before it is justified to state that psychologically, the idea that a healthy eater is sporty is essentially different from the idea that a healthy eater is moral, solid evidence is required. The present study, aimed at addressing images evoked by functional foods, does not answer the question which of the mechanisms was involved. However, it is pointed out that labelling this effect magical thinking may be premature. For example, an earlier attempt to tell magical thinking apart from associative thinking (Stein & Nemeroff, 1995) was mostly based on interpretations of the authors, but did not offer empirical evidence supporting them. Importantly, attempts to draw a sharp line between the two may turn out artificial as

magical thinking can be argued to be based on associative thinking. More research is evidently needed to illuminate not only the true nature of food-based impressions, but also that of magical thinking.

An indicator that can be of assistance in assessing the paranormal nature of an attitude or belief is its association with other paranormal beliefs, as they tend to coincide (Grimmer & White, 1990; Peltzer, 2003; Tobacyk, 1988). Thus, any paranormal belief would be expected to be positively related to other paranormal beliefs, for example, in telekinesis, telepathy, astrology, ghosts, haunted houses, witchcraft, pyramid power, precognition, and lunar effects. This fact was taken advantage of in Studies I and III, which addressed possible integration in paranormal beliefs of attitudes towards organic food, attitudes towards genetically modified food, and belief in alternative medicine.

Although magical food and health beliefs were among the strongest correlates of both GM and organic food attitudes in our model, the relationship was not very strong. Therefore, the results lend but little support to the notion of either GM attitudes or attitudes towards organic food reflecting magical beliefs of contagion and pollution (Frazer, 1922/1963; Rozin et al., 1986; Rozin et al., 2004). A construction of lay notions of GM and organic food as associative beliefs may be closer to the truth. For example, lay persons with no particular knowledge of agriculture may relate to organic foods through such commonly appreciated categories as naturalness, environmental friendliness and purity. The conclusion that

a product representing these constructs must be healthy, tasty, and in general commendable is much in line with dichotomic good-bad representation of foods (Oakes & Slotterback, 2001; Oakes, 2005) and would be based on generalization rather than on magical thinking.

Notably, the results do not exclude the possibility that attitudes towards genetically manipulated and organic food nevertheless reflect ‘you are what you eat’-thinking, in which the properties of a food are believed to be somehow transferred to the eater. If they do, however, then the results do not lend much support to the notion that this is an example of magical thinking. Unfortunately, we did not test the alternative explanation of associative thinking. The data remain inconclusive in this matter, and further research is needed to settle the question.

Study III showed that belief in alternative medicine was stronger related to paranormal beliefs than GM and organic food attitudes were. Both paranormal and magical food and health beliefs predicted belief in alternative medicine moderately well. The results are in line with earlier demonstrations that belief in alternative medicine coincides with paranormal beliefs (Grimmer & White, 1990) and magical beliefs about food and health (Lindeman et al., 2000). However, they do not give reason to consider belief in alternative medicine altogether a dimension of paranormal beliefs; for that, the relationship was much too weak.

Important to note is that the only factor uniting all alternative treatments is an extrinsic one, namely not having withstood the test of science. There is no intrinsic factor uniting all alternative treatments, and this limits the meaningfulness of any generalizing statements about them. However, among the different treatments there are subgroups to be distinguished. As argued, some alternative treatments are based on claims that could hypothetically be true (e.g., there is no reason to believe that blueberries could not possibly contain any pharmaceutically active substances), while others involve claims that are immediate violations of the laws of nature (e.g., there is reason to believe that extreme dilution does not fortify a drug). Alternative treatments may involve any of these types of claims, as well as scientifically valid advice, for example in the form of healthy dietary advice or stress management guidance. The apparent differences in degree of alternativity of these treatments (see also Eisenberg et al., 1998) may imply that some types of alternative therapies are much deeper rooted in a system of paranormal beliefs than others. Here we found no indications for a division in alternative therapies, but it would be premature to say there is none.

Although Study III demonstrated that belief in alternative medicine coincides to a degree with paranormal beliefs, this still does not demonstrate intrinsic commonalities between the two. Only when this is done is it justified to claim that an attitude or a belief truly is of a paranormal nature. This was addressed in Study IV, in which a common denominator of category violation was demonstrated for belief in alternative medicine and paranormal beliefs. The study demonstrated that mental

readiness to cross the ontological borders is related to paranormal beliefs. It shows that both those who believe in a host of paranormal phenomena, including telekinesis, astrology, and witchcraft, and believers in alternative medicine, including reiki healing, homeopathy, and stone therapy, were much more liberal than skeptics to transcend categorical boundaries and to attribute, for example, intentionality (mental) to body growth (biological) and life (biological) to energy (physical).

Importantly, subscribing to paranormal beliefs did not imply ignorance. Skeptics and superstitious believers alike had adequate scientific knowledge of, for example, the physical properties of energy and the biological processes that occur in the body. The difference between the two groups thus lay not in their scientific understanding of these entities and processes, but in their willingness or reluctance to transcend properties from one category to another.

Such dual representation of knowledge is in line with dual-process theories (Evans, 2003; Haidt, 2001; McClelland et al., 1995; Sloman, 1996; Stanovich & West, 2000; Sun et al., 2005) and with earlier studies (Denes-Rej & Epstein, 1994; Subbotsky, 2001) showing that subscribing to a claim does not necessarily rule out subscribing to a conflicting claim at the same time. Although paranormal believers as well as believers in alternative medicine distinguished between the fundamental categories of biology, physics, and psychology, they were at the same time willing to transcend these categorical borders and attribute mental properties to physical objects and biological processes, as well as physical properties to mental events. The results

suggest that this willingness to transcend the borders between these categories is a, if not the, common denominator in paranormal beliefs and belief in alternative medicine.

Paranormal beliefs have been argued to spring from the intuitive system (Epstein, 1993). In line, we found that belief in alternative medicine, which we found to resemble paranormal beliefs, was unrelated to rational thinking but positively related to intuitive thinking. Our results corroborated also earlier findings (Grimmer & White, 1990; Lindeman et al., 2000; Tobacyk, Nagot & Mitchell, 1989) and are in line with the observation that both paranormal beliefs and belief in alternative medicine appear to involve features of intuitive reasoning, for example, the use of prototypes as evidence, propensity to causal inferences, and associativism (Beyerstein, 2001; Gilovich, 1993; Kahneman & Frederick, 2002).

Associative thinking in paranormal believers has been noted before, and has been argued to tell of creativity (Gianotti, Mohr, Pizzagalli, Lehmann & Brugger, 2001). Others, however, have claimed that paranormal believers are merely more gullible than skeptics (Brugger & Graves, 1997; Granqvist et al., 2005; Wiseman, Greening & Smith, 2003, but see Wiseman & Greening, 2005). Paranormal believers' willingness to violate categorical borders can in principle be explained as the result of either one. One could argue that a central feature of creativity is to make new associations, as one does when combining notions from biology and physics. To this, critics could reply that suggestibility or gullibility could lead to the very same

concept representations. It may prove difficult to tell these two apart, but a useful factor in attempts to do so may be the degree of believing. Combining such notions as energy and life in the creative sense does not imply believing that there is a relation between them also beyond the surface. Gullibly adopting the notion that energy is a living thing, however, does imply a degree of belief. A challenge for further research would be to experimentally separate the two. This challenge is still hindered by the dual representation of knowledge, which enables simultaneous believing and disbelieving the same notion.

The relation of thinking styles with attitudes towards GM and organic foods was studied as well, reasoning that persistent differences in lay and expert opinions on these topics may be retraceable to differences in relating to knowledge. It was found that food attitudes both were related to a preference for intuitive thinking, such that intuitive thinkers thought relatively higher of organic foods and lower of GM foods than others. Rational thinkers showed an opposite pattern: relative positivity about GM foods, and more moderate attitudes towards organic produce. However, the relations between thinking style and food attitudes were mainly moderated by magical beliefs about food and health. Intuitive thinking only slightly predisposed directly to positive organic food attitudes, but did not affect GM attitudes; rational thinking did not directly affect either of them. This is in line with earlier findings that (rational) knowledge is largely unrelated to GM attitudes (Gaskell et al., 2000; Koivisto Hursti & Magnusson, 2003; Priest, 2000), and to the finding that (rationally) refuting verbalized (rationalized) pro-organic attitudes does nothing to

change them (Rozin et al., 2004), as these attitudes appear based more in intuitive thinking.

In spite of the possibility of coexistence of contradicting knowledge in the mind, it is worth addressing the acquaintance believers have with the substance they believe in. For example, in the area of alternative medicine it may be hard for a lay person to tell on the basis of the name of a treatment alone whether s/he is dealing with a regular or an alternative method, let alone what the philosophy or the actual claims of the method are. Erroneously believing that a method one trusts belongs to the scope of regular medical practice is essentially different from acknowledging that a method has paranormal features and nevertheless believing in its effectiveness. The same goes for attitudes towards GM or organic foods: It can be argued to be essentially different to know better but choose to ignore this rational knowledge in favour of intuitive notions, than not to know at all and be unsuspecting of the fact that there is anything irrational at all about a claim.

There are a number of limitations to the studies. All four studies made use of questionnaires, which are mainly suitable to tap information that is easily verbalized. However, paranormal beliefs are conceptually intuition-based notions, and these operate mainly outside of conscious awareness. Methods focusing on unconscious knowledge, like priming tasks, may be more suitable.

Importantly, the divergent validity of the measures of belief in alternative medicine and magical thinking about food and health leaves to be desired. Both measures contain items on belief in reflexology, colour therapy, and homeopathy. Therewith, a correlation between the two constructs as found in Study III is actually built into the measures. However, as was demonstrated in Study IV, the constructs also conceptually overlap, which suggests that it is not sensible to try to separate paranormal beliefs from belief in alternative medicine by force.

Studies I-III used convenience samples, in which women, students, and young people were overrepresented. This poses restrictions on the generalizability of the study. The use of extreme ends, as done in Study IV, also limits generalizability.

In spite of these limitations the study contributes to the understanding of everyday beliefs about food and health, providing a basis for the idea that some phenomena in relation to food and health may be best understood as having paranormal features. Involving conceptual enmeshment they go beyond mere associations, and can coincide with scientifically valid views on the same topic.

References

- Barker, M. E., Tandy, M., & Stookey, J. D. (1999). How are consumers of low-fat and high-fat fiets perceived by those with lower and higher fat intake? *Appetite*, 33, 309-317.
- Barker, P. (2000). *Handbook of family therapy*. New York: Oxford University Press.
- Basow, S. A., & Kobryniewicz, D. (1993). What is she eating? The effects of meal size on impressions of a female eater. *Sex Roles*, 28, 335-344.
- Beyerstein, B. (2001). Alternative medicine and common errors of reasoning. *Academic Medicine*, 76, 230-237.
- Bock, B. C., & Kanarek, R. B. (1995). Women and men are what they eat: The effects of gender and reported meal size on perceived characteristics. *Sex Roles*, 33, 109-119.
- Bredahl, L. (2001). Determinants of consumer attitudes and purchase intentions with regard to genetically modified foods - Results of a cross-national survey. *Journal of Consumer Policy*, 24, 23-61.
- Brugger, P., & Graves, R. E. (1997). Testing vs. believing hypotheses: Magical ideation in the judgement of contingencies. *Cognitive Neuropsychiatry*, 2, 251-272.
- Cardello, A. V. (2003). Consumer concerns and expectations about novel food processing technologies: effects on product liking. *Appetite*, 40, 217-233.
- Chaiken, S., & Pliner, P. (1987). Women, but not men, are what they eat: The effect of meal size and gender on perceived femininity and masculinity. *Personality and Social Psychology Bulletin*, 13, 166-176.
- Collins, A. M., & Quillian, M. R. (1969). Retrieval time from semantic memory. *Journal of Verbal Learning and Verbal Behavior*, 8, 240-247.
- Collins, A. M., & Loftus, G. R. (1975). A spreading-activation theory of semantic processing. *Psychological Review*, 82, 407-428.
- Conner, A. J., & Jacobs, J. M. E. (1999). Genetic engineering of crops as potential source of genetic hazard in the human diet. *Mutation Research*, 443, 223-234.
- D'Adamo, P. J., with Whitney, C. (1996). *Eat right 4 your type*. New York: G. P. Putnam's sons.

- DeCoster, J., & Claypool, H. M. (2004). A meta-analysis of priming effects on impression formation supporting a general model of informational biases. *Personality and Social Psychology Review*, 8, 2-27.
- Denes-Rej, V., & Epstein, S. (1994). Conflict between intuitive and rational processing: when people behave against their better judgment. *Journal of Personality and Social Psychology*, 66, 819-829.
- Eisenberg, D. M., Davis, R. B., Ettner, S. L., Appel, S., Wilkey, S., Van Rompay, M., & Kessler, R. C. (1998). Trends in alternative medicine use in the United States, 1990-1997: Results of a follow-up national survey. *JAMA*, 280, 1569-1575.
- Epstein, S., Lipson, A., Holstein, C., & Huh, E. (1992). Irrational reactions to negative outcomes: Evidence for two conceptual systems. *Journal of Personality and Social Psychology*, 62, 328-339.
- Epstein, S. (1993). Implications of cognitive-experiential self-theory for personality and developmental psychology. In D. C. Funder, R. D. Parke, C. Tomlinson-Keasy and K. Widaman (Eds.), *Studying lives through time: Personality and developmental psychology* (pp. 399-438). Washington, DC: American Psychological Association.
- Epstein, S., Pacini, R., Denes-Ray, V., & Heier, H. (1996). Individual differences in intuitive-experiential and analytical-rational thinking styles. *Journal of Personality and Social Psychology*, 71, 390-405.
- Evans, J. S. B. T. (1989). *Bias in human reasoning*. Hove: Lawrence Erlbaum Associates.
- Evans, J. S. B. T. (2003). In two minds: dual-process accounts of reasoning. *Trends in Cognitive Sciences*, 7, 454-459.
- Frazer, J. G. (1922/1963). *The golden bough. A study in magic and religion*. New York: MacMillan.
- Fries, E., & Croyle, R. T. (1993). Stereotypes associated with a low-fat diet and their relevance to nutrition education. *Journal of the American Dietetic Association*, 93, 551-555.
- Gaskell, G., Allum, N., Bauer, M., Durant, J., Allansdottir, A., Bonfadelli, H., Boy, D., de Cheveigné, S., Fjaestad, B., Gutteling, J. M., Hampel, J., Jelsoe, E., Jesuino, J. C., Kohring, M., Kronberger, N., Midden, C., Nielsen, T. H., Przystalski, A., Rusanen, T., Sakellaris, G., Torgerson, H., Twardowski, T., & Wagner, W. (2000). Biotechnology and the European public. *Nature Biotechnology*, 18, 935-938.

- Gianotti, L., Mohr, C., Pizzagalli, D., Lehmann, D., & Brugger, P. (2001). Associative processing and paranormal belief. *Psychiatry and Clinical Neurosciences*, *55*, 595-603.
- Gibson, E. J., & Spelke, E. S. (1983). The development of perception. In J. H. Flavell and E. M. Markman (Eds.), *Cognitive Development* (pp. 1-76). New York: Wiley.
- Gilovich, T. (1993). *How we know what isn't so*. New York: The Free Press.
- Gilovich, T., Griffin, D., & Kahneman, D. (Eds.). (2002). *Heuristics and biases. The psychology of intuitive judgment*. Cambridge University Press.
- Granqvist, P., Fredrikson, M., Unge, P., Hagenfeldt, A., Valind, S., Larhammar, D., & Larsson, M. (2005). Sensed presence and mystical experiences are predicted by suggestibility, not by the application of transcranial weak complex magnetic fields. *Neuroscience Letters*, *379*, 1-6.
- Grimmer, M. R., & White, K. D. (1990). The structure of paranormal beliefs among Australian psychology students. *Journal of Psychology*, *124*, 357-370.
- Haidt, J. (2001). The emotional dog and its rational tail: A social intuitionist approach to moral judgment. *Psychological Review*, *108*, 814-834.
- Haire, M. (1950). Projective techniques in marketing research. *The Journal of Marketing*, *XIV*, 649-656.
- Hamilton, M. (2001). Who believes in astrology? Effect of favorableness of astrologically derived personality descriptions on acceptance of astrology. *Personality and Individual Differences*, *31*, 895-902.
- Harper, G. M., & Makatouni, A. (2002). Consumer perception of organic food production and farm animal welfare. *British Food Journal*, *104*, 287-299.
- Hebl, M., & Heatherton, T. F. (1997). The stigma of obesity: The differences are black and white. *Personality and Social Psychology Bulletin*, *24*, 417-426.
- Hobden, K., & Pliner, P. (1995). Effects of a model on food neophobia in humans. *Appetite*, *25*, 101-113.
- Hunter, N. D. (1989). *Epidemic of fear*. New York: American Civil Liberties Union.

- Inagaki, K., & Hatano, G. (1999). Children's understanding of mind-body relationships. In M. Siegal and C. C. Peterson (Eds.), *Children's understanding of biology and health* (pp. 23-44): Cambridge University Press.
- Kahneman, D., & Frederick, S. (2002). Representativeness revisited: Attribute substitution in intuitive judgment. In T. Gilovich, D. Griffin and D. Kahneman (Eds.), *Heuristics and biases. The psychology of intuitive judgment* (pp. 49-81). Cambridge University Press.
- Kelemen, D. (1999). The scope of teleological thinking in preschool children. *Cognition, 70*, 241-272.
- Kimchi, R., Berhmann, M., & Olson, C. R. (Eds.). (2003). *Perceptual organization in vision: Behavioral and neural perspectives*. Mahwah: Lawrence Erlbaum Associates.
- Knight, L. J., & Boland, F. J. (1989). Restrained eating: An experimental disentanglement of the disinhibiting variables of perceived calories and food type. *Journal of Abnormal Psychology, 98*, 412-420.
- Koivisto Hursti, U.-K., & Magnusson, M. K. (2003). Consumer perceptions of genetically modified and organic foods. What kind of knowledge matters? *Appetite, 41*, 207-209.
- Kuhl, P. K. (2004). Early language acquisition: Cracking the speech code. *Nature Reviews Neuroscience, 5*, 831-843.
- Kunda, Z., & Thagard, P. (1996). Forming impressions from stereotypes, traits, and behaviors: A parallel-constraint-satisfaction theory. *Psychological Review, 103*, 284-308.
- Lane, W., & Comac, L. (1992). *Sharks don't get cancer*. New York: Avery Penguin Putnam.
- Lindeman, M., Keskivaara, P., & Roschier, M. (2000). Assessment of magical beliefs about food and health. *Journal of Health Psychology, 5*, 195-209.
- Loewenstein, G. F., Weber, E. U., Hsee, C. K., & Welch, N. (2001). Risk as feelings. *Psychological Bulletin, 127*, 267-286.
- Magnusson, M. K., Arvola, A., Koivisto Hursti, U.-K., Åberg, L., & Sjöden, P.-O. (2003). Choice of organic foods is related to perceived consequences for human health and to environmentally friendly behaviour. *Appetite, 40*, 109-117.

- Makatouni, A. (2002). What motivates consumers to buy organic food in the UK? *British Food Journal*, *104*, 345-352.
- Malinowski, B. (1972/1948). *Magic, science and religion*. New York: Doubleday.
- Martins, Y., Pliner, P., & Lee, C. (2004). The effects of meal size and body size on individuals' impressions of males and females. *Eating Behaviors*, *5*, 117-132.
- McClelland, J., McNaughton, B., & O'Reilly, R. (1995). Why there are complementary learning systems in the hippocampus and neocortex: Insights from the successes and failures of connectionist models of learning and memory. *Psychological Review*, *102*, 419-457.
- Miller, J. L. (1997). The development of biological explanation: Are children vitalists? *Developmental Psychology*, *33*, 156-164.
- Mooney, K. M., DeTore, J., & Malloy, K. A. (1994). Perceptions of women related to food choice. *Sex Roles*, *31*, 433-442.
- Mori, D., Chaiken, S., & Pliner, P. (1987). "Eating lightly" and the self-presentation of femininity. *Journal of Experimental Social Psychology*, *26*, 240-254.
- Morris, S. C., Taplin, J. E., & Gelman, S. A. (2000). Vitalism in naive biological thinking. *Developmental Psychology*, *36*, 582-595.
- Nemeroff, C., & Rozin, P. (1989). "You are what you eat": Applying the demand-free "impressions" technique to an unacknowledged belief. *Ethos*, *17*, 50-69.
- Nisbett, R., & Wilson, T. (1977). Telling more than we can know: verbal reports on mental processes. *Psychological Review*, *84*, 231-259.
- Nisbett, R., & Ross, L. (1980). *Human inference: strategies and shortcomings of social judgment*. Englewood Cliffs: Prentice-Hall.
- O'Donovan, P., & McCarthy, M. (2002). Irish consumer preference for organic meat. *British Food Journal*, *104*, 353-370.
- Oakes, M. E., & Slotterback, C. S. (2001). What's in a name? A comparison of men's and women's judgements about food names and their nutrient contents. *Appetite*, *36*, 29-40.
- Oakes, M. E. (2004). Good foods gone bad: 'infamous' nutrients diminish perceived vitamin and mineral content of foods. *Appetite*, *42*, 273-278.

- Oakes, M. E. (2005). Stereotypical thinking about foods and perceived capacity to promote weight gain. *Appetite, 44*, 317-324.
- Pacini, R., & Epstein, S. (1999). The relation of rational and experiential information processing styles to personality, basic beliefs, and the ratio-bias phenomenon. *Journal of Personality and Social Psychology, 76*, 972-987.
- Peltzer, K. (2003). Magical thinking and paranormal beliefs among secondary and university students in South Africa. *Personality and Individual Differences, 35*, 1419-1426.
- Piaget, J. (1929/1951). *The child's conception of the world*. Lanham, MD: Littlefield Adams.
- Pliner, P., & Chaiken, S. (1990). Eating, social motives, and self-presentation in women and men. *Journal of Experimental Social Psychology, 26*, 240-254.
- Pliner, P., & Hobden, K. (1992). Development of a scale to measure the trait of food neophobia in humans. *Appetite, 19*, 105-120.
- Priest, S. H. (2000). US public opinion divided over biotechnology? *Nature Biotechnology, 18*, 939-942.
- Pryor, J. B., Reeder, G. D., Yeadon, C., & Hesson-McInnis, M. (2004). A dual-process model of reactions to perceived stigma. *Journal of Personality and Social Psychology, 87*, 436-452.
- Rosch, E. H. (1973). On the internal structure of perceptual and semantic categories. In T. E. Moore (Eds.), *Cognitive development and the acquisition of language* (pp. 111-144). New York: Academic Press.
- Rosch, E. H., & Mervis, C. B. (1975). Family resemblances: Studies in the internal structures of categories. *Cognitive Psychology, 7*, 573-605.
- Rozin, P., Millman, L., & Nemeroff, C. (1986). Operation of the laws of sympathetic magic in disgust and other domains. *Journal of Personality and Social Psychology, 50*, 703-712.
- Rozin, P., & Nemeroff, C. (1990). The laws of sympathetic magic. In J. Stigler, R. Shweder and G. Herdt (Eds.), *Cultural psychology: Essays on comparative human development* (pp. 205-232): Cambridge University Press.
- Rozin, P., Markwith, M., & McCauley, C. (1994). Sensitivity to indirect contacts with other persons: AIDS aversion as a composite of aversion to strangers, infection, moral taint, and misfortune. *Journal of Abnormal Psychology, 103*, 495-505.

- Rozin, P. (1996). The socio-cultural context of eating and food choice. In H. L. Meiselman and H. J. H. McFie (Eds.), *Food choice, acceptance and consumption* (pp. 83-104). London: Blackie Academic & Professional.
- Rozin, P., Ashmore, M., & Markwith, M. (1996). Lay American conceptions of nutrition: Dose insensitivity, categorical thinking, contagion, and the monotonic mind. *Health Psychology, 16*, 438-447.
- Rozin, P., Bauer, R., & Catanese, D. (2003). Food and life, pleasure and worry, among American college students: Gender differences and regional similarities. *Journal of Personality and Social Psychology, 85*, 132-141.
- Rozin, P., Spranca, M., Krieger, Z., Neuhaus, R., Surillo, D., Swerdlin, A., & Wood, K. (2004). Preference for natural: instrumental and ideational/moral motivations, and the contrast between foods and medicines. *Appetite, 43*, 147-154.
- Rozin, P. (2005). The meaning of 'natural': Process more important than content. *Psychological Science, 16*, 652-658.
- Schifferstein, H. N. J., & Oude Ophuis, P. A. M. (1998). Health-related determinants of organic food consumption in the Netherlands. *Food Quality and Preference, 9*, 119-133.
- Slooman, S. A. (1996). The empirical case for two systems of reasoning. *Psychological Bulletin, 119*, 3-22.
- Slovic, P. (1987). Perception of risk. *Science, 236*, 280-285.
- Smith, E., & DeCoster, J. (1998). Knowledge acquisition, accessibility, and use in person perception and stereotyping: Simulation with a recurrent connectionist network. *Journal of Personality and Social Psychology, 74*, 21-35.
- Southerland, S. A., Sinatra, G. M., & Matthews, M. R. (2001). Belief, knowledge, and science education. *Educational Psychology Review, 13*, 325-351.
- Sparks, P., & Shepherd, R. (1992). Self-identity and the theory of planned behavior: Assessing the role of identification with "green consumerism". *Social Psychology Quarterly, 55*, 388-399.
- Stanovich, K. E., & West, R. F. (2000). Individual differences in reasoning: Implications for the rationality debate? *Behavioral and Brain Sciences, 23*, 645-726.

- Stein, R. I., & Nemeroff, C. J. (1995). Moral overtones of food: Judgments of others based on what they eat. *Personality and Social Psychology Bulletin*, *21*, 480-490.
- Subbotsky, E. (2001). Causal explanations of events by children and adults: Can alternative causal modes coexist in one mind? *British Journal of Developmental Psychology*, *19*, 23-46.
- Subbotsky, E. (2004). Magical thinking in judgments of causation: Can anomalous phenomena affect ontological causal beliefs in children and adults? *British Journal of Developmental Psychology*, *22*, 123-152.
- Sun, R., Sluzarz, P., & Terry, C. (2005). The interaction of the explicit and the implicit in skill learning: A dual-process approach. *Psychological Review*, *112*, 159-192.
- Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics*. Needham Heights, MA: Allyn & Bacon.
- Tobacyk, J. (1988). A revised paranormal belief scale. Unpublished manuscript. Ruston, LA: Louisiana Tech University.
- Tobacyk, J., Nagot, E., & Mitchell, T. (1989). Prediction of future events scale: Assessment of beliefs about predicting the future. *The Journal of Social Psychology*, *129*, 819-823.
- Toyama, N. (2000). Young children's awareness if socially mediated rejection of food. Why is food dropped at the table 'dirty'? *Cognitive Development*, *15*, 523-541.
- Trewavas, A. (1999). Much food, many problems. *Nature*, *402*, 231-232.
- Trewavas, A. (2001). Urban myths of organic farming. *Nature*, *410*, 409-410.
- Trewavas, A. J., & Leaver, C. J. (2001). Is opposition to GM crops science or politics? *EMBO reports*, *2*, 455-459.
- Tuorila, H., & Cardello, A. V. (1994). Antecedents and consequents of expectations related to fat-free and regular-fat foods. *Appetite*, *23*, 247-263.
- Tversky, A., & Kahneman, D. (1973). Availability: A heuristic for judging frequency and probability. *Cognitive Psychology*, *5*, 207-232.
- Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science*, *185*, 1124-1131.

- Wiseman, R., Greening, E., & Smith, M. (2003). Belief in the paranormal and suggestion in the seance room. *British Journal of Psychology*, *94*, 285-297.
- Wiseman, R., & Greening, E. (2005). 'It's still bending': Verbal suggestion and alleged psychokinetic ability. *British Journal of Psychology*, *96*, 115-127.
- Vyse, S. A. (1997). *Believing in magic: The psychology of superstition*. New York: Oxford University Press.
- Zanoli, R., & Naspetti, S. (2002). Consumer motivations in the purchase of organic food. *British Food Journal*, *104*, 643-653.