CHAPTER 51

Misinformation about food safety

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OUTLINE

Abstract
False beliefs, the widespread prevalence and persistence of misinformation, are likely to influence people's health negatively. If a majority believe in something that is factually incorrect, and base their decisions on this, the consequences may not be in the best interest for them, their families or the society as a whole. To be able to correct misinformation, we need to understand how consumers assess the truth of statements and what makes them believe in certain things but not others.

We need to know that consumers form they beliefs first by trying to make sense of all the stimuli they are exposed to and then, afterwards, look for evidence in support of those beliefs; they are rarely fully informed rational decision makers. Instead, decisions are made on limited information, gut feelings or misinformation. We are all prone to a biased interpretation of reality.

To correct for misinformation we need to pay attention to the backfire effects. If we are not careful, a retraction may fail or even worse, backfire, since repeating misinformation increases familiarity and thereby strengthen the false belief.

Keywords: Food safety, Misinformation, Information deficit, Belief formation, Cognitive illusions, Correction of misinformation, Backfire effects.

Introduction

Every year bacteria, parasites, toxins and allergens in food cause illness and death. WHO estimates as much as 23 million cases of illness and 5 000 death in Europe every year (WHO, 2015). A large portion of these cases, nearly 40% according to EFSA (2015), is kitchen outbreaks. Poor hygiene and insufficient heating and cooling are among cooking at home food safety violations (Ruppanner, 2010). Consumers seems to be a core problem and therefore also a part of the solution. Improving consumers' food handling practices will clearly reduce the number of food safety outbreaks. The big question is how. Are consumers behaviour based on misinformation? Will their behaviour change if their knowledge is up-dated? How to correct misinformation? What do we know about these questions?

Mark Twain once said, "A lie can get halfway around the world before the truth can even get its boots on" (Heath and Heath, 2007). A catchy food story, a story with all the right ingredients may have a stronger ability to stick, to be remembered and thereby possibly to change behaviour, than a story with more balanced and scientifically correct information (Veflen, et al. 2017). False beliefs, the widespread prevalence and persistence of misinformation, such as the belief that eggs are better stored at room temperature than in the fridge, are likely to influence people's health negatively. If a majority believe in something that is factually incorrect, and base their decisions on this, the consequences may not be in the best interest for them, their families or the society as a whole (Lewandowsky et al., 2012). To be able to correct misinformation, we need to understand how consumers assess the truth of statements and what makes them believe in certain things but not others.

Paranormal beliefs, beliefs that if true would violate the laws of nature (Broad, 1953) exists also in relation to food and health (Saher and Lindeman, 2005). Two examples of magical thinking for food is the law of contagion and the law of similarity. The law of contagion holds that things that have been in contact continue to have an effect when separated. A magic enigmatic essence (e.g. spirit, vibes, and energy) from a source, such as a crystal, a hand or a colour can cure, and purification rituals can help to wash out toxic waste of additives or preservatives from the body. As an example, today some people believe that a warm bath, exposure to snow or eating garlic can help against Covid-19. WHO has even developed a myth buster to try to correct these and other misinformed beliefs about the virus (WHO, 2020). The second law of magical thinking, the law of similarity, holds that superficial resemblance indicate deep resemblance, which implies that similarities can cure. For instant, eating a diet that has approximate 70% water content is good for us since our bodies are 70% water. Another example is the belief within homeopathy, that a small amount of a substance thought to cause a disease will cure the disease (Saher and Lindeman, 2005).
Many strange beliefs exist both for food safety and for all other aspects of life. Through all times people have tried to make sense of what they cannot understand. Thunder and lightning was in Norse mythology explained by Thor (the god of thunder) riding his sledge over the sky while crashing his hammer down on his foes. All religions explain how to understand the world and how to behave (e.g. do not eat pork; eat only fish on Fridays etc.). Also today, when people are more informed and better educated than ever do people hold strange unscientific believes. Especially, non-observable phenomena, such as viruses and bacteria can easily lead to magic beliefs.

In this chapter, we will try to explain why scientific information is not always enough to correct misinformation. We will do so by describing the general mechanisms behind belief formation, belief change and our cognitive illusions of truth, before offering examples of misinformation in relation to food. Lastly, we will discuss how to correct food safety misinformation.

Information deficit

The information deficit model attributes unscientific beliefs and scepticism to science in general to a lack of understanding, resulting from a lack of information. The model implies that experts should focus on informing the non-experts. By filling the knowledge gap, public hostility to science and mythical, unscientific beliefs will disappear. Although, there still are experts around believing in the deficit model, the model coined in the 1980's, has been discredited by a wealth of literature. Simply giving more information does not necessarily change views or behaviour (Dickson, 2005). In addition to scientific facts, people consider ethical, political and religious beliefs and culture, history and personal experiences when making their decisions. Together this forms a holistic gut feel that might be difficult to change with facts alone. As an example, despite numerous campaigns by national food safety authorities and widespread news coverage of past outbreaks, many consumers still prefer to eat rare, not well done hamburgers (Olsen et al., 2014). Studies show that consumers, especially those with high levels of education, eat risky food, and that food safety information not always results in proper food handling behaviour (Brennan et al., 2007).

Although, information is not always enough to change beliefs or correct behaviour, a recent meta-analysis based on 65 studies, shows a moderate but positive effect on communication ability to correct information (Walter and Murphy, 2018). Health beliefs seem to be easier to change than political beliefs and communication form matters (rebuttals are more important than forewarnings and appeals to coherence outperform fact checking and appeals to credibility). While the critics of the information deficit model argues correctly that providing information is not always enough to change beliefs, this meta-analysis shows at least a moderate positive effect on correcting misinformation.

Belief formation and transformation

To be able to understand why people believe in misinformation, we need to understand formation and change of beliefs. It all starts with our brain trying to make sense of all the sensory stimuli we are exposed to. The brain looks for and find patters in what we see, read, hear, taste, smell, and touch, and then infuses those patterns with meaning. We cannot help it. We have evolved to connect the dots of our world into meaningful patterns that explain why things happen. This happens for both meaningful and meaningless data (Grayling, 2011; Shermer, 2011). We form our beliefs first and then, afterwards, we look for evidence in support of those beliefs. We try to reinforce our beliefs, and what we believe becomes our reality. Most people arrive at their beliefs by filtering the facts of the world through their lenses of worldviews, theories, hunches and prejudices they have accumulated over time. We sort the facts and select those that confirm what we already believe and ignore or rationalize away the rest (Shermer, 2011).

The associative-propositional model of evaluation (APE) (Gawronski and Bodenhausen 2006, 2007), explains belief formation well (Scholderer, 2010). APE is based on the two systems view of the human mind (Sloman, 1996), and consists of the *associative system* that process information fast, in parallel, automatic and effortless, and the *reasoning system* that processes information in a slow, serial, controlled and effortful manner. These two systems are what Kahneman (2011) calls the fast and slow way of thinking, the system 1 and the system 2. The *associative system* responds directly to the input stimuli in the surroundings. It activates automatically a pattern of evaluative associations that might create an impulse behaviour. The *reasoning system* might stop this impulse by making people reflect. It can evoke memories or facts that may, again, trigger the associated system that can generate emotions as pleasure, fear, disgust, shame or guilt. While the *associative system* generates immediate affective reactions that do not separate right from wrong, our *reasoning system* can monitor these gut feelings by checking the validity and appropriateness of these reactions. It translates the affective outcome of the associative system into propositional formats such as "I like…", or "I want…" and checks if these propositions fit with everything else that we find valid at this time (Scholderer, 2010). While the associative system is unconscious, the reasoning system is clearly conscious.

As an example, observing that eggs are stored at room temperature in the retailer store and/or that peers do the same, might make people unconsciously believe that this is the way eggs are supposed to be stored. If they later read that eggs are better stored in the fridge to avoid the growth of salmonella and other microbes, this information might make them reconsider their existing belief and result in changed behaviour. The reasoning system might overrule the associative system to secure consistency in the belief structure. Such inconsistencies can also result in an attempt to come up with an explanation, an excuse for why the original belief is best. However, the APE model assumes that the reasoning system will only attempt to overrule the associative system if inconsistent information is considered. Without actively thinking about the salmonella information when putting away the eggs, the eggs will end up on the bench (if that is the habitual, pre-established belief for egg storing).

According to the APE model, beliefs are constantly in flux. Both new associations formed via associative learning, reasoning around these associations and/ or considering new facts can change beliefs. A slightly different context might also activate a slightly different pattern of existing associations and thereby result in different beliefs. While different cognitive processes are at play in the associative system and the reasoning system, they can both mutually provide input to each other. It is important, however, to remember that we first formulate associated beliefs, and then later we may validate them by the reasoning system. It is also so that our perception of reality depends on our beliefs. Although reality exist independent of the human mind, peoples understanding of it depends upon the beliefs they hold at any given time (Shermer, 2011).

Cognitive illusions

Consumers are rarely fully informed rational decision makers. Instead, decisions are made on limited information, gut feelings or false beliefs (misinformation). Once encoded in memory, misinformation often continue to influence reasoning also after a correction (Nyhan and Reifler, 2010; Ecker et al., 2011). Consumers are prone to a biased interpretation of reality. That people tend to falsely believe that they and their kids are smarter than others are, that they due to their skills will be more successful than others and that they are optimistic about

the future is probably good for their mental health and well-being (Yarritu et al., 2015). It might even be so that the cognitive system has evolved to interpret the world unrealistically, in a manner that assures the protection of the self (Taylor, 1989). From a food safety point of view, these cognitive illusions might not be so good. Optimism bias might make people think that eating an undercooked hamburger will be OK. They might think that someone is likely to get sick from eating risky food, but that nothing will happen to them. Own experiences might also be biased. Since food safety outbreaks are relatively rare events, consumers can in spite of risky and far from optimal food handling not experience negative consequences. If so, they might perceive their food handling to be safe behaviour. Such a biased mental model based on "own" experiences can be hard to correct with information.

The illusion of truth effect, the effect that the experience of processing a repeated statement increases its perceived truth-value, has been found in many studies after Hasher and colleagues first demonstrated it (Hasher et al., 1977; Garcia-Merques et al., 2016). Fluency and familiarity seem to be the mechanisms that explains why. Repeating a statement many times makes the processing of the statement more fluent, and as long as the thoughts flow smoothly people may see little reason to question their veracity (Schwarz et al., 2007). Repeating information makes it also more familiar and familiarity strengthens that information in memory and thus strengthens people's belief in it (Allport and Lepkin, 1945; Ecker et al., 2011; Lewandowsky .et al., 2012). More exposure of false information will accordingly increase its perceived truth-value. While repeating a false message many times will not make it truer, it will be perceived so because of the ease of processing and the familiarity. However, familiarity and fluency will also increase fact-based information's perceived truth-value. Frequent exposure of correct information, starting at an early age, e.g. 3 years young with basics like hand washing, will therefore have a positive effect on the populations' food safety behaviour.

Examples of misinformation

Irradiation

When atomic bombs were dropped on Hiroshima and Nakasaki, apart from the direct destructive results, there was radioactivity that continued to kill exposed people for a long time and the radiation also caused birth defects and many radiation related diseases. This gave radiation a bad name, worsened by the disasters in Tsjernobyl and Fukushima. Radiation, however, is also used to the benefit of man, such as to cure cancer, to look inside the body to find damages and even to repair them without major surgery. Many essential medicines are produced using nuclear reactors and 30,000 patients are treated daily with the radio-isotopes produced (NRG.EU, 2020). Radiation is used to sterilise the tools and other utensils used by surgeons to prevent infecting the patient. Nevertheless, most people believe that radioactivity is bad and application of it should be abandoned. Similar to the belief that chemicals are bad and their use must be forbidden. Not realising that everything is chemical and not knowing that many, if not most, medicines are manmade chemicals.

Radiation can be used to make food safe without destroying it; it can be used to slow down the ripening of and spoilage of fruit and prevent the sprouting of potatoes, thereby reducing the amount of produce otherwise wasted and contributing to food security.

Activists maintain that irradiated food is dangerous and will make you sick because irradiation makes the food radioactive. The radura symbol (Fig. 51.1), intended to show that food has been made safe by irradiation is suggested to be a warning that the food is radioactive.

***** Insert Fig. 51.1 about here*****

People expose themselves to radiation from the sun that may cause cancer to obtain a healthy colour, but this does not make the exposed people radioactive. Fruit exposed to the sun for months does not make the fruit radioactive. Without radiation no healthy colour and no fruit.

Genetic modification

Mankind is the result of evolution that took millions of years. That evolution was, and still is, genetic modification, and it will continue in the future. Genes are modified all the time and the modifications that result in benefits for the organisms become dominant. Nature does it all the time, at random, and so does mankind since it turned to agriculture, by selection and cross-breeding and then selecting crops with improved traits. Today scientist do the same, no longer at random, but precisely, under controlled conditions. This is why entire populations no longer starve because crops have been made resistant to diseases, insects and bad weather conditions. That is also why some populations no longer or no longer need to suffer from nutrient insecurity, because crops now produce nutrients that they did not produce originally.

Nature modified genes since life started, does so now and will do so in the future. There is no control and no evidence that nature does it for the benefit of mankind. Why would "natural" be better than “modified by man”? Everything living in nature tries to kill competing living things, including man. Mankind has evolved and survived using gathered knowledge. Some people think that eating genetically modified (GM) based food will cause mutations in the genes of man and offspring may have many kinds of defects, despite the fact that all peer reviewed research results have shown that GM crops are not more or less safe than non-GM crops (European Commission, 2010; Nicolia et al., 2014; National Academies of Sciences, Engineering, and Medicine, 2016). Thanks to understanding genetic modification and its application, vaccines could be developed in 2020 against the pandemic SARS-CoV-2 virus causing Covid-19.

Chemicals

Everything is chemical, also water and air. Water is hydrogen oxide and air consists of nitrogen, oxygen and carbon dioxide. Chemical names are used to tell what is in the food that is offered. This is nicely shown by posters (Fig. 51.2) prepared by James Kennedy, a chemistry teacher in Melbourne, Australia, for fruits (Kennedy, 2021). Chemicals that may become toxic are found in all food. Examples are lectins (or hemaglutinins) in pulses; enzyme inhibitors in soy, peas, beet and cereals; piperidines in black pepper, caffeine, theobromine and theophyline in coffee, chocolate and tea; solanine in potatoes, tomatoes and aubergines, tomatine in tomatoes, oxalates in rhubarb, spinach, parsley, chives, purslane, cassava, amaranth, chard, taro leaves, radish, kale and monstera fruit; coumarin in cinnamon, peppermint, green tea, chicory and blueberries; glucosinolates such as sinigrin, progoitrin in cabbage, broccoli, brussels sprouts, cauliflower, turnip, radish, horseradish, mustard and rapeseed; cyanogenic glycosides, such as amygdalin in almond and laurel and linamarin in

cassave; saponins in peanut, soy, spinach, broccoli, potato and apple. The point is that there are no exceptions.

*****Insert Fig. 51.2 about here*****

Many chemicals are essential for our health. Without humans will suffer from deficiency diseases and premature death. All these chemicals have names and all are potentially toxic. In general, toxic chemicals do not exist. The quantities make toxins[*]. Paracelsus (Bombastus ab Hohenheim, 1658) described this hundreds of years ago. Still, most people do not know and are scared of chemicals. Fig. 51.3 shows what applies to by far most chemicals.

*****Insert Fig. 51.3 about here*****

If the concentration of a chemical in the body is too low, it causes harm. If the concentration is too high, it causes harm. In both cases, this will lead to diseases and eventually death. There is, however, a concentration range that is right for the body and the good news is that people through the ages have learned what is good to eat and when people eat properly, they get enough of what they need, unless they live in an area where food with the essential nutritions are not available. Not too much and not too little. Within that range, the body takes care of the right concentration by excreting or breaking down what is too much. Only with exceptional high concentrations, the body (kidneys, liver) cannot cope and people suffer. With too little people need extra nutrients or get ill, like lack of vitamine A causes blindness and lack of selenium may cause Keshan disease, a fatal heart condition and other disorders (Smith and Garg, 2017).

Many people know that vitamins and selenium are essential to the extent that many buy and consume vitamins in quantities that are unhealthy. The results of accidental excess consumption of selenium is described by MacFarquhar and his colleges (MacFarquhar et al., 2010).

How to correct misinformation?

"It ain't what you don't know that gets you into trouble. It's what you know for sure that just ain't so."

-Mark Twain

Misinformation is widespread, prevalent and persistent. Humans form beliefs both unconsciously and consciously. They try to make sense of the world around them by connecting the dots from what they observe, read and hear into patterns that are filtered through their worldview, experiences, knowledge, prejudice etc. These beliefs, when first encoded in memory can be hard to correct. Beliefs, both valid and false, that has become familiar and easy to process, are automatic, without awareness or any effort judged for its truth-value. How can we then correct them? One of the factors we need to consider is the backfire effect. If we do not pay attention to how we correct misinformation, we may,

[*] Exceptions are chemicals that have been designed to kill and even then, a certain amount is needed to do the job. An example is Novichok (Nepovimova and Kuca, 2018), used in an attempt to kill the Russian opposition leader Alexei Navalny and several others in the past decades.

ironically increase misbeliefs. However, there are some recommendations for how misinformation corrections should be designed, structured, and applied in order to maximize their impact (Lewandowsky et al. 2012; Cook and Lewandowsky, 2012).

The familiarity backfire effect is one of the effects we should try to avoid. If we start the correction by repeating the misinformation, a common way to get attention and make people aware of what we try to correct, we trigger familiarity with the myth or the false belief. As we have mentioned before, the more familiar the more we believe something to be true. As a result, the retraction may fail or even worse, backfire since repetition increases familiarity and thereby strengthen the false belief. For example, if we tell people that storing eggs in room temperature is wrong, that high temperatures leads to growth of salmonella, and eggs, therefore, must be stored in the fridge, people will remember the facts immediately after reading the news. As time passes, however, the memory of the details fades and people may forget what was correct and what was wrong (Lewandowsky et al., 2012). To hinder the familiarity backfire effect, we should avoid presenting the misinformation together with the correction. The best approach is to focus on the fact: *Store eggs in the fridge*. If you for some reason need to mention the myth, present the fact in the heading, and start by emphasizing the fact before you say anything about the myth. The aim is to increase peoples' familiarity with the fact, not the myth.

We also need to consider *the overkill backfire effect.* Since fluency in processing also influence the perception of truth, we need to formulate the correction in such a way that it is easy to read and easy to understand. It is not so that the more counter-arguments you provide, the more successful the correction will be. Less is sometimes more. Three arguments is often better than 12, since too many arguments may end up reinforcing the initial misperception. This effect occurs because processing many arguments takes more effort than just a few. An over-complicated correction may have a hard time towards a simple and appealing fake belief. The solution to avoid the overkill backfire effect is to KISS (Keep It Simple Stupid!); use simple language, short sentences, subheadings and paragraphs (Cook and Lewandowsky, 2012).

Lastly, we need to avoid *the worldview backfire effect.* When exposed to information, people filter this more or less consciously through their worldview lenses. Since we often try to confirm what we already believe, we may be selective in what information we pay attention to (*confirmation bias*). Confronting people with strong opinions with counter-arguments can even backfire and strengthen their worldviews. When presenting someone with arguments that run counter to what they believe, they will try to disconfirm these by actively arguing against opposing arguments (*disconfirmation bias*). By doing so they strengthen their initial belief. Since this worldview backfire effect is strongest among those fixed in their view, the solution is to direct the communication towards the group without strong opinions, the undecided majority. We should also be aware of the fact that mentioning a topic may evoke people's initial beliefs to that topic. As an example, studies of consumers' attitudes towards genetically modified (GM) products found that information proclaiming GM benefits had a negative effect on consumers' probability to choose a GM product (Scholderer and Frewer, 2003). What happened here is that the beneficial information material made consumers' pre-existing attitudes more accessible. By giving people with negative attitudes towards GM, information about the health or sustainability benefits from GM, their negative attitudes become even stronger. A good advice to try to avoid this worldview backfire effect is to frame the correction message in such a way that it is less threatening to a person's view.

When people form beliefs, they construct mental models. When some information is removed from these mental models, due to misinformation correction, it creates a hole. This is a problem, since people prefer an incorrect model to an incomplete model. They prefer a wrong explanation to no explanation (Cook and Lewandowsky, 2012). The solution is to fill the gap with an alternative explanation. After presenting the fact, we should explain why this is correct (or why the myth is wrong).

Conclusion

Misinformation about food safety may cause people to make choices that has negative effects for them, their families or for the society as a whole. The results might be some days off from work due to diarrhea, chronic diseases as kidney failures or in worst case, death. False, non-scientific beliefs, has also made the public demand regulations that forbid the use of technologies and chemicals that would be beneficial for the society. Consequently, food that could have been saved is lost, often to microorganisms and insects. This affects the global availability of healthy food to many children and adults in the world with chronically insufficient food and nutrients.

To be able to correct misinformation, we need to understand how consumers assess the truth of statements and what makes them believe in certain things but not others. We need to know that consumers form they beliefs first by trying to make sense of all the stimuli they are exposed to and then, afterwards, look for evidence in support of those beliefs; they are rarely fully informed rational decision makers. Instead, decisions are made on limited information, gut feelings or misinformation. We are all prone to a biased interpretation of reality.

To correct for misinformation we need to pay attention to the backfire effects. If we are not careful, a retraction may fail or even worse, backfire, since repeating misinformation increases familiarity and thereby strengthen the false belief. We need to know that less is sometimes more. Three arguments is often better than 12. Since fluency in processing also influence the perception of truth, we need to formulate the correction in such a way that it is easy to read and easy to understand. Lastly, presenting someone with arguments that run counter to what they strongly believe, results often in counter arguments and strengthening of their initial belief. The solution is to direct the communication towards the group without strong opinions, the undecided majority.

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