



# Biased perception about gene technology: How perceived naturalness and affect distort benefit perception



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## ABSTRACT

In two experiments, the participants showed biased responses when asked to evaluate the benefits of gene technology. They evaluated the importance of additional yields in corn fields due to a newly introduced variety, which would increase a farmer's revenues. In one condition, the newly introduced variety was described as a product of traditional breeding; in the other, it was identified as genetically modified (GM). The two experiments' findings showed that the same benefits were perceived as less important for a farmer when these were the result of GM crops compared with traditionally bred crops. Mediation analyses suggest that perceived naturalness and the affect associated with the technology per se influence the interpretation of the new information. The lack of perceived naturalness of gene technology seems to be the reason for the participants' perceived lower benefits of a new corn variety in the gene technology condition compared with the perceptions of the participants assigned to the traditional breeding condition. The strategy to increase the acceptance of gene technology by introducing plant varieties that better address consumer and producer needs may not work because people discount its associated benefits.

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## 1. Introduction

New technologies are important for developing innovations and consequently, for economic growth. However, not all food technologies are equally accepted by consumers and citizens. Public acceptance is obviously a key driver for the successful introduction of a new product, specifically its technology. Therefore, it is essential to unveil the factors that may influence public acceptance. In the agri-food domain, the public had reacted quite differently to various new technologies introduced over the last couple of decades (Frewer et al., 2011). For example, gene technology is publicly discussed but not well accepted in many European countries (Gaskell et al., 2011, 2000). Public perception about gene technology differs considerably from the assessment of experts who perceive notably less risks associated with genetically modified (GM) foods (Savadori et al., 2004). Past research suggests perceived benefits and perceived risks as important factors influencing people's acceptance of gene technology (Costa-Font & Gil, 2009; McComas, Besley, & Steinhardt, 2014; Prati, Pietrantonio, & Zani,

2012; Siegrist, 2000; Tanaka, 2013). Based on such findings, it is tempting to conclude that if GM products deliver more benefits, acceptance of the technology will increase. However, this is the case only if the benefits and risks associated with GM products are evaluated objectively. If a biased perception results in discounting the benefits of gene technology, additional benefits may not necessarily result in a higher acceptance of the technology. Gene technology may provide benefits to the producer (e.g., lower production cost) or benefits to the consumer (e.g., lower food prices). The focus of the present study was on the benefits for producers.

Our research aimed to examine whether laypeople's perception about the benefits associated with gene technology would be biased, specifically, be viewed as less advantageous than identical benefits associated with conventional technology. Furthermore, we investigated possible mechanisms that could explain such biased perceptions about gene technology's benefits. We hypothesized that the affect heuristic and perceived naturalness might cause distorted evaluations.

### 1.1. Affect heuristic

Different heuristics have been proposed that influence people's judgments and may result in biased risk estimates (Kahneman,

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Slovic, & Tversky, 1982; Lichtenstein, Slovic, Fischhoff, Layman, & Combs, 1978). The affect heuristic has been suggested as an important mental shortcut on which people may rely when judging the risks and benefits of specific hazards (Finucane, Alhakami, Slovic, & Johnson, 2000; Slovic, Finucane, Peters, & MacGregor, 2004). According to the affect heuristic, hazards may evoke images and associations tagged with positive or negative feelings, which in turn influence judgments of these hazards. Results of past studies suggest the possible significance of the affect heuristic in laypeople's risk perception (Finucane et al., 2000; Keller, Visschers, & Siegrist, 2012; Peters & Slovic, 1996).

According to the affect heuristic, people use the affect evoked by a hazard for assessing its associated risks. A person who is asked about the risks associated with gene technology may rely on the affective meaning of the images that come to his or her mind. The degree of "goodness" or "badness" elicited by the images shapes people's risk perception (Connor & Siegrist, 2011). The findings related to the affect heuristic suggest that people judge a hazard by how they feel about it, not just based on what they think or know (Slovic & Peters, 2006). A recent study found that affective information influenced people's risk judgments and value-of-a-statistical-life estimates (Pachur, Hertwig, & Steinmann, 2012). Simple heuristics not only help people make quick decisions but may also cause biased ones. A recent study showed that the affect heuristic could lead to biased decisions (Siegrist & Sütterlin, 2014). Its participants evaluated the same outcome as more severe when caused by humans than by nature because the human-caused event resulted in a more negative affect.

The affect heuristic postulates that not only perceived risks but also perceived benefits are influenced by the affect evoked by a technology. Most research has focused on risk perception, however (Keller et al., 2012; Peters & Slovic, 1996; Siegrist & Sütterlin, 2014). There is a lack of studies indicating that the affect heuristic distorts not only risk perception but also benefit perception. To our best knowledge, this effect has not yet been shown.

### 1.2. Perceived naturalness

"Natural" seems to be a positive quality for most people in Western countries (Rozin, Fischler, & Shields-Argeles, 2012). For example, a survey conducted in the US showed that consumers perceived pesticide-related risks as greater than either natural toxin or microbial pathogen risks (Williams & Hammitt, 2001). This preference for natural entities is stronger for foods than for medicine (Rozin et al., 2004). Perceived naturalness is therefore an especially important variable for the acceptance of foods and food technologies. Research suggests that acceptance of GM food is strongly influenced by how natural the GM product is perceived. Consumers more likely tend to accept a GM product if it is regarded as more natural compared with less natural (Tenbült, de Vries, Dreezens, & Martijn, 2005). Similar results were found in a study that examined the acceptance of gene technology for various food products (Siegrist, 2003). Its results suggest that consumers consider it more important for unprocessed food to be free of gene technology compared with processed or convenience food.

In several studies, Rozin and colleagues examined the meaning of the highly desirable food attribute of naturalness (Rozin, 2005, 2006; Rozin et al., 2004). Their research results suggest that judgments about naturalness are more strongly influenced by the process than by the content. How a food is produced may therefore be more important than its content. The biggest drop in naturalness was observed when an entity was the product of genetic modification (Rozin, 2005). Domestication seemed much less damaging to perceived naturalness compared with gene technology. As Rozin (2005) pointed out, this was a surprising finding, given the huge

impact of domestication on the genotype and phenotype of wild species. Compared with domestication, gene technology is associated with minimal changes in genotype and phenotype. Furthermore, it has been shown that genetic modification evokes a negative affect even if this technology is used to create organisms that could also be produced by traditional breeding techniques (Kronberger, Wagner, & Nagata, 2014). One possible explanation for the preference for natural entities could be that these products are perceived as healthier. However, even if natural and artificial foods are specified as equally healthy, a strong preference for naturalness could be observed (Rozin et al., 2004).

### 1.3. Aims of this research

Perceived benefits are strongly correlated with the acceptance of gene technology (Costa-Font & Gil, 2009; McComas et al., 2014; Prati et al., 2012; Ronteltap, van Trijp, Renes, & Frewer, 2007; Siegrist, 2000; Tanaka, 2013). Therefore, it has been suggested that GM products need to provide additional benefits to increase their acceptance (Contrary to popular belief, 2013). However, this reasoning is based on the assumption that consumers assess the benefits of GM crops in an unbiased manner. If people discount the advantages of GM foods because these are considered unnatural and thus elicit a negative affect, additional benefits may not result in higher acceptance.

The first aim of our research was to demonstrate that the same advantages associated with a new plant breed would be perceived as less beneficial when these resulted from gene technology compared with traditional breeding technology. We expected to observe this result even when the outcome was held constant and even in cases where the participants' prior beliefs about gene technology should not influence their responses. Such a result could be viewed as a biased perception about gene technology. The second aim was to test a mediation model that would explain the biased perception. We hypothesized that genetic modification would be perceived as unnatural and would evoke a more negative affect than traditional breeding techniques. Furthermore, we postulated that both perceived naturalness and affect would influence the evaluation of GM and traditionally bred plants; therefore, the same outcome of agricultural production would be less positively evaluated in the case of gene technology. Gene technology can provide benefits to consumers or to producers. The focus of the present study was the benefit for producers, and participants were asked to evaluate the benefits of gene technology from the standpoint of a farmer.

## 2. Experiment 1

Laypeople and experts differ in the risks they associate with gene technology (Savadori et al., 2004). Based on these findings alone, it is not possible to conclude that laypeople's perceptions are biased. Therefore, in our study, we did not measure the perceptions about the risks or benefits directly related to gene technology. The participants were asked to evaluate the importance of additional yields in corn fields in terms of increasing a farmer's revenues. In one condition, the technology was described as traditional breeding; in the other, it was identified as gene technology. If the participants in the gene technology group evaluated the additional revenues as less important for the farmer compared with the perceptions of the participants assigned to the traditional breeding condition, we would observe a biased response. There would be no reason why the importance of a given increase in a farmer's revenues should depend on the breeding technology. We further hypothesized that the description about the corn, whether produced using conventional breeding technology or gene technology, would

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