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What People Tell Other People About New Technologies: The Impact of Attitudes Toward the Technology and Trust Toward the Source on Information Distortion

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People often receive information about scientific developments and new technologies from peers and via social media instead of from the original source. During this process, information may get lost or distorted, resulting in an inaccurate perception of the technologies' risks and benefits. It has been hypothesized that people's trust in the information source and their initial attitude toward the technology are drivers of this distortion. In two experiments, participants received information about a new technology that elicited either a positive or a negative attitude and that was provided by a trusted source or a less trusted source. They were asked to write down what they would tell a friend about it. Both the initial attitude and the source trustworthiness influenced what and how participants communicated about the new technology.

Keywords: emerging technologies, trust in institutions, distortion, interpersonal communication, information transmission

New scientific developments may lead to technologies that could improve people's health or the planet's sustainability. Whether such a technology is implemented depends as much on the public's perception of its associated risks as it does on its perceived benefits. If the public considers these risks unacceptable, the technology is unlikely to be implemented. The relevant information on these issues is provided by scientists and transmitted by media.

However, the general public has increasingly shifted away from traditional media sources and turned to social media and messaging services for news (Shearer, 2021; Vorhaus, 2020). Millions of people now get science-related information via their Facebook feeds or other social media platforms (Hitlin & Olmstead, 2018). In a large-scale study, Mueller-Herbst, Xenos, Scheufele, and Brossard (forthcoming) reported, for instance, that social media had a significant impact on people's awareness of gene-editing. Other studies show that a

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major goal to process science information is to have something to talk about with others (e.g., Ho, Yang, Thanwarani, & Chan, 2017; Li, 2019). As a result, people often receive new information indirectly via friends and family (Mitchell, 2013). Indeed, Brondi, Pellegrini, Guran, Fero, and Rubin (2021) report that Italian and Slovakian respondents identify conversations with family and friends as important sources of information on scientific developments.

When information is transmitted, it may get lost or transformed: Benefits are minimized and risks exaggerated—or the other way around (R. E. Kasperson et al., 1988). Charting what factors drive the selection and distortion of the original information is important to understanding how perceptions of new technologies are formed in a context in which laypeople base their perceptions on what they learn from other laypeople.

What Determines What People Want to Talk About?

There is a long tradition of research on the phenomenon that people do not receive their information directly from the media, but via another person. In the highly influential two-step model of media influence (Katz, 1957), this person is believed to be an opinion leader by his or her peers. However, even if this person is not considered an opinion leader, receiving information from other laypeople has been shown to have an impact in diverging contexts such as politics (e.g., Bond et al., 2012; Carlson, 2018), the news (Bergström & Jervelycke Belfrage, 2018), marketing (Bao & Chang, 2014), and health (e.g., van den Putte, Yzer, Southwell, de Bruijn, & Willemsen, 2011).

It is therefore unsurprising that interpersonal communication also plays a role in the perceptions of risks and benefits associated with new technologies. Binder, Scheufele, Brossard, and Gunther (2011) found that survey respondents' perceptions of the risks and benefits associated with a biological research facility were strongly impacted by interpersonal talk, its impact being second only to the respondents' overall attitude. Brenkert-Smith, Dickinson, Champ, and Flores (2013) pitted the impact of interpersonal communication on people's risk perceptions to that of experts. When considering the probability of a wildfire, talking to one's neighbors was as impactful as being informed by an expert; when considering the consequences of a wildfire, only talking to one's neighbors had an impact, whereas expert sources did not. Information provided through social media also has a strong impact on people's perceptions of new technologies (Wen, 2020) and health dangers (Ng, Yang, & Vishwanath, 2018; Wirz et al., 2018).

This raises the question as to what factors influence what people want to communicate about. Kusumi, Hirayama, and Kashima (2017) conducted a survey among Japanese citizens to assess their perception of radiation risks for food products in the aftermath of the meltdown of the Fukushima Daiichi nuclear power plant as well as their intention to communicate about these risks. The respondents' risk perception was measured before and after reading four opinion pieces of experts on these risks. Their initial risk perception was by far the most important predictor of the post risk perception; they intended to communicate that the risk was substantial. The first impression of the risks and benefits associated with a technology is thus an important factor in predicting what people will tell other people about this technology.

People form such first impressions even if they have little information to go on (Scheufele, 2006)—for instance, the feelings elicited by the technology or development (Slovic, Finucane, Peters, & MacGregor,

2004). Scientific developments and technologies that evoke positive feelings are perceived as less risky than those that evoke negative feelings. Slovic and colleagues (2004) found that even experts (toxicologists) rated health risks associated with a very low exposure to a substance as higher when the substance evoked a more negative feeling. Merk and Pönitzsch (2017) conducted a survey to identify the predictors of the general public's attitude toward stratospheric aerosol injection, a new technology that may counteract global warming. They found that both the positive and negative affect evoked by the technology had strong direct and indirect influences on the perception of the technology's benefits and risks. The affect evoked by a technology is thus important for people's initial impression.

The second determinant of the initial impression is people's trust in the organizations responsible for the technology (J. X. Kasperson, Kasperson, Pidgeon, & Slovic, 2003; Merk & Pönitzsch, 2017). These findings corroborate earlier research on the importance of trust in the acceptance of new technologies such as food manufacturing (De Jonge, Van Trijp, Van der Lans, Renes, & Frewer, 2008), gene technology (Siegrist, 1999, 2000), nanotechnology (Siegrist, Cousin, Kastenholz, & Wiek, 2007), CO_2 storage (Midden & Huijts, 2009), and radioactive waste disposal (Flynn, Burns, Mertz, & Slovic, 1992). Trust was observed but not manipulated in these studies, thus providing only correlational evidence for its importance.

Terwel, Harinck, Ellemers, and Daamen (2011) manipulated trust. They presented participants with the same information about benefits and risks of underground CO_2 storage while manipulating the source's trustworthiness. Their results confirm that people used trust as a heuristic for arriving at judgments when they lacked the expertise to assess the risks and benefits themselves. When they did not trust the source's motives, people adopted the position opposite to that of the source (i.e., they accepted the technology more when the source was *against* the technology than when the source was in favor of it). In sum, the affective reactions evoked by a new technology, as well as the trust in the organizations that are responsible for it, influence people's response to this new technology.

Information Distortion

When people relate a message from the media to other people, information gets lost. In several studies, a telephone game design was used in which participants were provided with a media message and asked to relate this message to another participant; the recipient was instructed to transmit this message to yet another participant. These studies show that when a message is transmitted from one person to the next, the message becomes considerably shorter, whether this information is about politics (Carlson, 2018, 2019; Coronel, Ott, Hubnerm Sweitzer, & Lerner, forthcoming), climate change (Connor et al., 2016), other groups of people (Lyons & Kashima, 2001, 2003), or the benefits and risks of a new product (Moussaïd, Brighton, & Gaissmaier, 2015).

Information reduction would not be problematic if the shortened version constituted an accurate summary of the message. However, during the transmission process, the message becomes distorted. Connor and associates (2016) found that topics typically associated with climate change (e.g., impact on nature) were more likely to survive the transmission process than less conventional topics (e.g., societal competence). Aarøe and Petersen (2020) reported that personal stories illustrating political issues were more likely to be transmitted than more abstract descriptions of these issues. Coronel and colleagues

(forthcoming) had participants transmit a media message that contained two opposing perspectives on an issue. During the transmission process, only one of those perspectives survived turning a rather nuanced description into a much cruder one.

Similar effects have been obtained for the transmission of information on new technologies. Moussaïd and associates (2015) provided participants with information on the benefits and risks associated with an antibacterial agent. Next, they were asked to tell another participant about this product. Moussaïd and colleagues (2015) studied 15 such diffusion chains with an average of 10 participants. They also measured the participants' attitude toward this product before and after they had the conversation. Their results show that the transmitted messages became shorter and less accurate. More specifically, the proportion of negative statements increased at the expense of positive statements. This process was partly driven by the participant's initial risk perception: Participants with a higher risk perception were inclined to leave out positive statements and stress the harms, whereas participants with a lower risk perception showed the opposite pattern.

Whereas Moussaïd and cohorts (2015) observed the influence of people's initial perceived risk, Jagiello and Hills (2018) manipulated this factor. They provided participants with four documents on a highly dreaded risk (nuclear energy) and four on a less dreaded risk (food additives), and they studied to what extent information was distorted in a diffusion chain consisting of eight participants. A further manipulation was that in each chain, the sixth participant either received the information as it had been transmitted by the previous participants, or the participant received this information along with the original four documents. Jagiello and Hills (2018) were interested in whether reintroducing the original information could redress the distortions resulting from the first five transmissions. Their findings corroborate those of Moussaïd and colleagues (2015), as they also report that the proportion of negative statements about the technology grew as the number of transmissions increased. This effect was stronger for the dreaded topic. In addition, reintroducing the original information did not redress the distortions resulting from the previous transmissions.

Theoretical Contribution, Research Question, and Hypotheses

Surveys reveal that people's perceptions of scientific and technological developments are influenced by the information they receive from peers (e.g., Binder et al., 2011; Brenkert-Smith et al., 2013). During this communication process, information gets lost and distorted (Jagiello & Hills, 2018; Moussaïd et al., 2015), resulting in people getting an inaccurate view of what the development entails. Two factors appear to be driving the distortion process: the initial attitude toward the development (Kusumi et al., 2017) and the extent to which people trust the source of the original information (Merk & Pönitzsch, 2017).

Although these studies are suggestive of what drives distortion, they also leave some important gaps. First, in most studies revealing the importance and impact of interpersonal communication, participants were not asked what they had said or what they had heard. Second, in those studies in which the actual content of the transmission process was studied, neither trust in the source nor the initial attitude was manipulated (Moussaïd et al., 2015), or the manipulation of the initial attitude resulted in changes of what information was provided on the different issues (Jagiello & Hills, 2018).

In this study, we aim to address these gaps by conducting two experiments in which we provide the exact same risks and benefits associated with two technologies to increase the shelf life of food, with one technology eliciting a negative initial attitude (irradiation with gamma rays) and the other eliciting a positive one (high-pressure pasteurization). The information is ascribed to either a trustworthy source or a less trustworthy one. Subsequently, participants were asked what they would tell a friend about this development. The messages are analyzed for the information they contain and their valence. This design enables us to test the following hypotheses:

H1a: If the initial attitude toward the technology is negative, the transmitted message will include more risks and fewer benefits than if it is positive.

H1b: If the initial attitude toward the technology is negative, the transmitted message's valence will be more negative than if it is positive.

H2a: If the information source is considered less trustworthy, the transmitted message will include more risks and fewer benefits than if it is considered more trustworthy.

H2b: If the information source is considered less trustworthy, the transmitted message's valence will be more negative than if it is considered more trustworthy.

In addition, this design enables an assessment as to whether these factors independently influence what will be communicated or whether they interact.

Pretest

We conducted a pretest to select technologies that evoked different initial attitudes and organizations that differed with respect to trustworthiness.

Participants

The pretest was programmed in Qualtrics software, and data were collected online. We recruited 29 volunteers via student Facebook groups. The participants were young (M = 24.6 years, SD = 5.08, range: 18–39) and highly educated (75.9% was currently enrolled in or had finished university, another 13.8% were currently enrolled in preuniversity education). The gender distribution was quite even (55.2% female).

Procedure

Participants were presented with four for-profit and two not-for-profit organizations in random order. Studies have shown that for-profit sources were considered less trustworthy than not-for-profit sources because the former are perceived as having a vested interest (Hoeken, Šorm, & Schellens, 2014; Hoeken, Timmers, & Schellens, 2012; Terwel et al., 2011). For each organization, participants answered the following questions: "Do you know [organization]?" (*Yes*/*No*); "To what extent do you think [organization] is credible?"; and "To what extent do you trust this organization?" (on a scale from −3 to 3,

with −3 being labeled as *not at all*, 0 as *neutral,* and 3 as *very much*). The scores on the latter two questions were averaged (Cronbach's alpha = .85).

Furthermore, participants were presented with nine new sustainability-related technologies. Each technology was introduced using a one-sentence explanation. Participants were then asked to indicate to what extent the characteristics "desirable," "societally acceptable," and "possible health risks" (reverse-coded) applied to it on a scale ranging from −3 to 3, with −3 labeled *not at all*, 0 as *neutral,* and 3 as *very much.* The three characteristics formed a reliable scale (Cronbach's alpha = .86).

Results

We chose The Netherlands Food and Consumer Product Safety Authority (NFCPSA) as the high trust organization because the pretest indicated that it was both well known (86.2% familiarity) and perceived as highly trustworthy (M = 1.36, SD = 1.30). We chose Nestlé as the less trustworthy organization because the pretest indicated it was well known (100% familiarity), but not perceived as trustworthy (M = −0.02, SD = 1.44). The two organizations differed significantly from each other, $t(28) = 5.54$, $p < .001$.

High-pressure pasteurization, which had been introduced as "the very high-pressure pasteurization of food with air pressure to increase the shelf-life of food," was chosen as the positive attitude technology because it elicited a positive attitude: M = 0.95, SD = 1.14, significantly above the neutral midpoint, $t(28) = 4.49$, $p < .001$. Irradiation, which had been introduced as "the irradiation of food with gamma rays to increase the shelf-life of food," was chosen as the technology for which the participants had a negative attitude because it elicited a negative attitude: M = −0.71, SD = 1.62, significantly below the neutral midpoint, $t(28) = -2.37$, $p = .025$. The initial attitudes toward the technologies differed significantly, $t(28) = 5.55$, $p < .001$.

Study 1

Participants and Design

The main experiment used a 2 (initial attitude: positive vs. negative) x 2 (trust in organization: higher vs. lower) between-participants design. The dependent variable was the inclusion of benefits and risks as well as the valence of the message. We did not conduct an a priori power analysis because we investigated a novel effect with an unknown effect size. Following recommendations from Simmons, Nelson, and Simonsohn (2013), we decided on a sample size of at least n = 50 per experimental condition. The experiment was programmed in Qualtrics software, and data were collected online. Participants were recruited via university mailing lists, informal promotion among students, and student Facebook groups. The sample consisted of 223 participants, who were randomly assigned to the four experimental conditions: negative/high trust: n = 57; negative/low trust: n = 50; positive/high trust: n = 63; positive/low trust: n = 53. The participants were young (M = 21.3 years, SD = 4.22, range: 15–52), mostly female (85.7%), and highly educated (70.4% were currently enrolled in or had finished university, and another 22.9% were currently enrolled in preuniversity education). They received 2.50 euros or partial course credit for their participation.

Materials

Four versions of a text were created that differed on whether the irradiation or pasteurization as a technology to improve the shelf life of food products was discussed and whether the information was provided by the NFCPSA or by Nestlé. Care was taken to only manipulate the organization and the technology, while keeping the benefits and risks associated with the technology the same. The number of words used to describe the benefits and risks was also the same. Following is a translation of the text, with italicized words indicating the differences between the versions:

> Yearly, more than two billion kilos of food are thrown away in the Netherlands. An important step toward a more sustainable society would consist of increasing the shelf life of perishable food. According to *the Netherlands Food and Consumer Product Safety Authority/Nestlé* the *high-pressure pasteurization/the irradiation* of food would be an interesting new technology in this respect. The food products to be treated would be *pasteurized under very high pressure/irradiated with radiation*.
>
> The amount of *pressure/radiation* needs to be adapted to the product. For instance, chicken will be *pasteurized under higher pressure/radiated to a stronger extent* than shrimp. Eggs will take an intermediate position.
>
> Proponents list the following benefits:
>
> - The eggs of insects that are in the food will be killed in this way.
> - Illness-causing bacteria such as Salmonella also stand no chance to survive *pasteurization/irradiation.*
> - This technology will strongly delay the process of the food going bad.
>
> Opponents point to the following risks:
>
> - Errors in the application can easily lead to exceeding the maximum *pressure/radiation.*
> - The technology's safety for humans has not yet been studied.
> - It is completely unclear what the long-term consequences of eating this food will be.

Procedure

Manipulation Checks

Before reading the text, participants indicated how trustworthy they perceived six organizations to be. The task was identical to the trustworthiness task of the pretest, except that the familiarity question was omitted. The Cronbach's alphas for the different scales ranged between .78 and .91.

Participants then evaluated technologies aimed at improving a sustainable society. The task was similar to the attitude pretest, except that only four technologies were presented, and the labels of the

sliders were changed to −3 = *very undesirable*, 0 = *neutral*, and 3 = *very desirable*; −3 = *very societally unacceptable*, 0 = *neutral*, and 3 = *very societally acceptable*; −3 = *very dangerous for health*, 0 = *neutral*, and 3 = *definitely not dangerous for health.* The three items formed a reliable scale (Cronbach's alphas ranging between .76 and .84).

Information Completeness

Next, participants were informed that they would receive information about one of the sustainability initiatives. They were randomly assigned to read one of the four text versions. Participants were instructed to read the text carefully and to form an impression of the technology. Subsequently, participants were informed that they would be asked what they would tell about the technology to someone else. Then, in line with Lyons and Kashima's (2001, 2003) procedure, participants were asked to complete a short filler task to reduce the chance of easy reproduction. The filler task asked participants to judge 12 short texts regarding how moving and funny they were. The results of this filler task are irrelevant for the present research and will not be discussed here.

Participants were asked to enter the name or initials of a colleague or classmate with whom they occasionally had informal chats, and then to write down in a text box what they would tell this person about the technology in an informal conversation. To guide their response, participants were given three questions: "What is the technology about?", "Which benefits does the technology have?" and "Are there any disadvantages related to the technology?" After submitting their response, participants were asked to count the number of pros and cons they had provided.

An independent coder scored, for each benefit and each risk, whether it was mentioned in the participants' text. A second coder independently scored the texts of 100 participants. The interrater agreement (intraclass correlation coefficient [ICC]) ranged from substantial to almost perfect (Landis & Koch, 1977) across the three benefits and three risks (.76 < ICC < .95). The scores of the first coder were used in the analyses. This resulted, for each participant, in a score for the number of included risks and a score for the number of included benefits (both scores ranging from 0 to 3).

Message Valence

The valence of the message was coded as positive, neutral, or negative. One rater coded all responses, and a second coder independently scored the texts of 100 participants. The coding was based on the use of explicit overall evaluations (e.g., "great technique," coded as positive); use of subjective language (e.g., "This technique has many risks, namely . . ." coded as negative); stressing benefits more than risks, or vice versa (e.g., "Important benefits are . . ., risks are . . ." coded as positive); and mentioning benefits or risks that were not in the original text (e.g., "A toxic way to increase the shelf-life of food," coded as negative). The interrater agreement was substantial (ICC = .79). The scores of the first coder were used in the analyses.

Exit Questions

Finally, participants answered demographic questions and exit questions, and were thanked for their participation.

Results

Nineteen participants (8.5%) had misinterpreted the task, with 14 communicating information about technology in general (e.g., "Technology is the system where knowledge and science are used for technical innovation") and another five describing how they would approach the task (e.g., "I would discuss all aspects with him in an informal conversation"). These participants' data were not included in the analysis. The dropout rates were similar in each condition, $X^2(3, N = 223) = 1.37$, $p = .71$.

The manipulation check confirmed that the NFCPSA was considered more trustworthy ($M = 1.54$, $SD = 1.19$) than Nestlé ($M = 0.80$, $SD = 1.35$), $t(203) = 6.33$, $p < .001$. As expected, pasteurization elicited a positive attitude ($M = 1.22$, $SD = 1.15$), while irradiation elicited a negative attitude ($M = -1.24$, $SD = 1.35$), $t(203) = -22.77$, $p < .001$.

Information Completeness

To test the hypotheses, a 2 (type of consequences reproduced: number of included benefits vs. number of included risks) x 2 (technology: initial positive attitude vs. initial negative attitude) x 2 (trust in organization: high vs. low) mixed analysis of variance (ANOVA) was conducted with number of included benefits and risks as within-participant repeated measures (see Table 1). The average reproduction rate of benefits ($M = 1.71$, $SD = 0.83$) was higher than that of risks ($M = 1.32$, $SD = 0.87$), $F(1, 200) = 33.30$, $p < .001$, $\eta_p^2 = .143$. The average number of consequences reproduced was higher for irradiation ($M = 1.64$, $SD = 0.72$) than for pasteurization ($M = 1.41$, $SD = 0.69$), $F(1, 200) = 5.48$, $p = .020$, $\eta_p^2 = .027$. These two main effects were qualified by a significant interaction between type of consequences reproduced and technology, $F(1, 200) = 22.30$, $p < .001$, $\eta_p^2 = .100$. Risks were less likely to be reported for pasteurization ($M = 1.07$, $SD = 0.81$) compared with irradiation ($M = 1.60$, $SD = 0.86$); no such difference was found for the benefits (pasteurization: $M = 1.73$, $SD = 0.85$; irradiation: $M = 1.68$, $SD = 0.81$).

Table 1. The Mean Scores (and Standard Deviations) of Study 1 for the Number of Reported Benefits and Risks and the Message Valence (1 = Negative, 3 = Positive) as a Function of Technology and Organization.

	Pasteurization		Radiation	
	NFCPSA	Nestlé	NFCPSA	Nestlé
	M (SD), n = 58	*M (SD), n* = 50	*M (SD), n* = 52	*M (SD), n* = 44
Reported Benefits	1.64 (0.87)	1.84 (0.82)	1.69 (0.85)	1.66 (0.78)
Reported Risks	0.97 (0.77)	1.20 (0.83)	1.54 (0.83)	1.68 (0.91)
Message Valence	2.05 (0.39)	2.08 (0.40)	1.94 (0.31)	1.93 (0.33)

There was no such interaction between the trustworthiness of the organization and the type of consequences reproduced, $F(1, 200) < 1$. None of the other main effects and interactions were significant ($ps > .16$).[2]

Message Valence

A two-way ANOVA revealed that the valence of the messages about pasteurization was more positive ($M = 2.06$, $SD = 0.39$) than the valence of the messages about irradiation ($M = 1.94$, $SD = 0.32$), $F(1, 200) = 6.41$, $p = .012$, $\eta_p^2 = .031$ (see Table 1). Neither the main effect of organization nor the interaction was significant, $F(1, 200) < 1$.

Discussion Study 1

Of the six risks and benefits, on average, three were reported by participants. This loss of information is in line with previous studies on information diffusion. The results corroborate Hypothesis 1a partly: The exact same risks were more likely to be communicated if they were linked to a technology that people had a negative attitude toward (irradiation) as compared with a technology they had a positive attitude toward (pasteurization). No difference, however, was found for the benefits reported. The results confirmed Hypothesis 1b: When participants communicated about the technology they held a positive attitude toward, the valence of the message was more positive than when they communicated about the one they held a negative attitude toward, even though the risks and benefits of both technologies were the same. Hypotheses 2a and 2b were not confirmed: Trust in the organization influenced neither the completeness nor the valence of the reproduced information. In addition, where other studies reported a greater likelihood for risks to be transmitted compared with benefits, in our study, benefits were more likely to be transmitted.

This study had several limitations. The sample consisted mainly of students, leading to an overrepresentation of young and highly educated participants whose attitude toward science and technology may differ from that of the general population. They were instructed to talk about the goal, benefits, and risks of the technology. This instruction is different from a real-life situation. Finally, even the less trustworthy source was considered trustworthy by the participants, but to a lesser degree than the more trustworthy source. This may explain why no effect of source was found. To address these limitations, a

[2] The correlations between the participants' self-reported number of consequences and the number identified by the coders were moderate for both the benefits ($r = .33$, $p < .001$) and risks ($r = .32$, $p < .001$), which suggests that the participants were not highly accurate in their self-reports. The self-reported numbers were analyzed using a three-way ANOVA similar to that used for the reported consequences. The results were highly similar. Overall, participants estimated that they reproduced more benefits ($M = 1.94$, $SD = 1.30$) than risks ($M = 1.71$, $SD = 1.32$), $F(1, 199) = 11.05$, $p = .001$, $\eta_p^2 = .053$. A significant interaction between type of consequences and attitude toward technology emerged, $F(1, 199) = 7.36$, $p = .007$, $\eta_p^2 = .036$. For pasteurization, participants estimated that they reproduced more benefits ($M = 2.00$, $SD = 1.59$) than risks ($M = 1.61$, $SD = 1.46$), whereas they estimated to report a similar number of benefits ($M = 1.88$, $SD = 0.89$) and risks ($M = 1.83$, $SD = 1.14$) for irradiation. All remaining main effects and interactions were not significant ($ps > .40$).

second study was conducted that addressed the same hypotheses, but with a more heterogenous sample and no specific instructions on what to talk about, and it was stated that the source was in favor of implementing the technology. When people believe the organization wants to persuade them, they become more critical toward it (Wood & Quin, 2003).

Study 2

Participants and Design

Again, a 2 x 2 between-participants design was used with completeness and valence of the message as the main dependent variables. The experiment was programmed in Qualtrics software, and data were collected online. Participants were recruited by a professional opinion polling organization. In return for their participation, participants took part in a lottery in which they could win several prizes, including an iPod, gift vouchers, or the possibility to donate the prize money to a charity. The sample consisted of 210 participants, who were randomly assigned to the four experimental conditions. The participants were relatively old (M = 56.9 years, SD = 13.85, range: 19–84), mostly male (57.1%), and relatively highly educated (64.1% held a university or an applied university degree).

Materials

The four versions of Study 1 were used with three changes. First, the sentence that the organization regarded the technology as interesting was replaced by: The *Netherlands Food and Consumer Product Safety Authority/Nestlé* is a strong proponent of this technology. Second, benefits were presented by the organization (*Netherlands Food and Consumer Product Safety Authority* or *Nestlé*), whereas the risks were ascribed to (unnamed) opponents of the technology. Finally, the text ended with the statement that various parties in parliament had asked the minister to conduct studies on this technology.

An independent coder scored, for each benefit and each risk, whether it was mentioned in the participants' text. In addition, it was scored whether the participant included the organization and, if so, whether the organization was evaluated positively, negatively, or neutrally. Finally, valence was scored. A second coder independently scored the texts of a subset of 100 participants. The interrater agreement was almost perfect (Landis & Koch, 1977), .91 < ICC = 1.00 (for organization valence). The scores of the first coder were used in the analyses.

Procedure

The perceived trustworthiness of the organization and the attitude toward the technology were assessed with the same items as in Study 1. Again, the reliabilities of the scales were good: Cronbach's alphas ranged between .87 and .93. The instruction for the participants was the same as in Study 1 except that they were asked to write down what they would tell the friend or colleague they had in mind as a

response to this person asking, "I've heard about *pasteurization/irradiation* lately. Do you know more about it?" Otherwise, the procedure was the same as in Study 1.[3]

Results

Eleven participants had misinterpreted the task and described how they would approach the task in general (e.g., "I would tell what pasteurization is and its importance for public welfare"). The data of these participants were not included in the analysis. Removing these participants did not change the pattern or significance.

The manipulation checks confirmed that the NFCPSA (M = 0.92, SD = 1.41) was considered more trustworthy than Nestlé (M = 0.05, SD = 1.31), $t(195) = 8.41$, $p < .001$. The manipulation check further confirmed that pasteurization elicited a positive attitude (M = 1.03, SD = 1.18), whereas irradiation elicited a negative attitude (M = −1.07, SD = 1.25), $t(195) = -20.72$, $p < .001$. The experimental manipulations of attitude and trust in the organization were thus both successful.

Twenty participants included information about the organization, with Nestlé being mentioned more often (7 pasteurization, 7 irradiation) than NFCPSA (4 pasteurization, 2 irradiation). Only when Nestlé acted as a defender of the irradiation technology did some (3) participants qualify the organization negatively; in the other cases, the organization was presented neutrally.

Information Completeness

The number of consequences reported by the participants was low: M = 0.97, SD = 1.07. A large proportion of participants (74: 37.8%) communicated neither a single benefit nor a single risk, whereas 70 (35.7%) reported one consequence only. The number of participants reporting two (33: 16.8%), three (12; 6.1%), or four (6: 3.1%) consequences declined rapidly, whereas the single remaining participant reported five consequences. More than half of the participants (58.2%) mentioned at least one benefit, whereas this number dropped considerably for those mentioning at least one risk (20.9%).

The data were analyzed in the same way as in Study 1 (see Table 2). The average reproduction rate of benefits (M = 0.78, SD = 0.81) was higher than that of risks (M = 0.24, SD = 0.52), $F(1, 192) = 83.25$, $p < .001$, $\eta_p^2 = .302$. None of the other main effects were significant (ps < .31). With respect to the two-way interactions, no differences were found for reporting risks (or benefits) between the two technologies, $F(1, 192) < 1$. There was, however, a two-way interaction for the type of consequences and organization, $F(1, 192) = 4.12$, $p = .043$, $\eta_p^2 = .021$. In line with Hypothesis 2a, participants were more likely to communicate benefits if they were presented by the NFCPSA than by Nestlé (M = 0.85, SD = 0.84 vs. M = 0.71, SD = 0.77), whereas the opposite pattern emerged in communicating risks (M = 0.19, SD = 0.45 vs. M = 0.30, SD = 0.58). There was a trend toward reporting more consequences (benefits and risks combined) if the NFCPSA proposed pasteurization as compared with Nestlé, whereas the opposite pattern

[3] Given the inaccuracy of the self-reported number of consequences, this question was dropped in Study 2.

was found for irradiation, but this trend did not reach conventional levels of significance, $F(1, 192) = 3.75$, $p = .054$. Finally, the three-way interaction was also significant, $F(1, 192) = 4.14$, $p = .043$, $\eta_p^2 = .021$.

Table 2. The Mean Scores (and Standard Deviations) of Study 2 for the Number of Reported Benefits and Risks and the Message Valence (1 = Negative, 3 = Positive) as a Function of Technology and Organization.

	Pasteurization		Radiation	
	NFCPSA	Nestlé	NFCPSA	Nestlé
	M (SD),n = 49	*M (SD), n* = 47	*M (SD), n* = 49	*M (SD), n* = 51
Reported Benefits	1.04 (0.96)	0.64 (0.76)	0.65 (0.66)	0.78 (0.78)
Reported Risks	0.22 (0.47)	0.30 (0.66)	0.16 (0.43)	0.29 (0.50)
Message Valence	2.51 (0.62)	2.28 (0.54)	2.20 (0.71)	2.06 (0.76)

To further explore this interaction, separate two-way analyses for benefits and risks were conducted. For benefits, only the two-way interaction between technology and organization was significant, $F(1, 192) = 5.47$, $p = .020$, $\eta_p^2 = .028$; this revealed that participants reported more benefits of pasteurization when proposed by NFCPSA than when proposed by Nestlé, whereas the number of benefits reported of irradiation was the same across the two organizations, $F < 1$. None of the other effects were significant (ps > .23). For risks, none of the effects were significant (ps > .18).

Message Valence

A two-way ANOVA revealed that, as predicted by Hypothesis 1b, the valence of the messages about pasteurization was more positive ($M = 2.40$, $SD = 0.59$) than the valence of the messages about irradiation ($M = 2.13$, $SD = 0.73$), $F(1, 192) = 7.64$, $p = .006$, $\eta_p^2 = .038$. In line with Hypothesis 2b, message valence was also more positive when the message was ascribed to NFCPSA ($M = 2.36$, $SD = 0.68$) than to Nestlé ($M = 2.16$, SD = 0.67), $F(1, 192) = 4.00$, $p = .047$, $\eta_p^2 = .020$. The interaction was not significant, $F(1, 192) < 1$.

Discussion Study 2

Few consequences were mentioned by the participants, with benefits mentioned more often than risks. Again, this shows that during transmission, lots of information gets lost. Unexpectedly, the number of risks mentioned was the same regardless of the participants' attitude toward the technology being positive or negative. The absence of this effect may be the result of a floor effect, given that the vast majority of participants failed to mention a single risk. As expected, however, the message's valence was more negative for the negative attitude technology compared with the positive attitude technology. The source of information did influence the relative mentioning of benefits. If participants trusted the source, they were more likely to include benefits in their communication than if they doubted the source's trustworthiness. No such effect was found for the risks, but again, that may have been the result of a floor effect. There was also an effect for the source to influence the message's valence. In the next section, we will provide a general discussion of the results of the two studies.

General Discussion

Research has shown that interpersonal communication strongly influences people's perceptions of the risks and benefits associated with new technologies. In addition, during these communications, information gets lost and distorted, which leads to an inaccurate perception of the technology's merits. Therefore, it is important to gain insight into what factors drive the distortion process. In this article, the exact same information was provided, but referred to either a technology that elicited an initially negative attitude or one that elicited a positive attitude and was provided by either a more or a less trusted source.

With respect to the impact of the initial attitude, the results of both studies confirm that the message valence was more negative if the technology evoked a more negative attitude. This is important because these messages will have been the first introduction to this technology for many other people, thereby already skewing the technology's perception. The prediction that a negative attitude would also lead to a differential transfer of risks over benefits received support only in Study 1. In Study 2, this effect was not obtained, which may have been the result of a floor effect; very few participants communicated risks in their messages in that study.

With respect to the impact of the source's trustworthiness, no source effects were obtained in the first study, which may have been the result of the less trusted source still being considered trustworthy. In Study 2, however, we did find the predicted source effects. If the technology was championed by an organization that the participants trusted, they were more likely to include the technology's benefits and produce a more positively valenced message than in case of a less trustworthy source. No such effect was obtained for risks, but, as already mentioned, that may be the result of a floor effect.

Whereas previous studies found that information on risks stood a better chance of being transmitted than information on benefits, our studies found the opposite pattern. There may be various explanations for this effect. Benefits were always mentioned first in the message which may have resulted in them receiving more attention than the risks. There is also a strong indication that this finding may be the result of the inclusion of the technology's goal (i.e., improving the shelf-life of food products) as one of the three benefits (i.e., "This technology will strongly delay the process of the food going bad"). Given that this benefit more or less rephrases the technology's goal, it was easier to remember. Indeed, in both studies, this benefit was the most frequently included consequence of all benefits and risks (Study 1: 86% of the messages; Study 2: 52% of the messages). When leaving this benefit out of the analysis, we found in Study 2 a lower number of benefits included for the irradiation technology (M = 0.16, SD = 0.42) compared with the pasteurization technology (M = 0.30, SD = 0.53), $F(1, 192) = 4.41$, $p = .037$, $\eta_p^2 = .022$.

In this study, the first step in the transmission process was studied. Jagiello and Hills (2018) showed that further down the diffusion chain, the message became more and more distorted. Reintroducing the original information could not redress this distortion process. The question is to what extent this distortion process is fueled by participants sharing the same initial attitude. An initial negative attitude toward radiation may lead to a more negatively valenced message. If this message is subsequently transmitted by a person who also holds a negative attitude toward radiation, his or her message may be even more negatively valenced. But what would happen if this message was transmitted by a person with

a more positive initial attitude toward the described technology? Would this lead to redressing the distortion, a feat that reintroducing the original information is incapable of? We could present participants with a (more negatively valenced) message produced in describing the radiation technology and tell half of them that this is a description of the radiation technology, whereas the other half are led to believe that the message is about the pasteurization technology. This would enable an assessment of how a shared initial attitude may amplify the distortion process and to what extent a different initial attitude may cancel this effect.

Our studies have certain limitations. First, the effect sizes are small, which raises questions about their practical relevance. However, we only studied the first step in the diffusion process; the distortion effect is likely to become stronger at later stages in this process. Second, we had participants write down what they would tell an acquaintance about this technology. This may differ from what would happen if participants actually had this conversation. The conversational partner may ask for clarification or additional information (e.g., "Are there any drawbacks?"), leading to a more balanced picture. Moreover, when people share information with real others, they may tune the evaluative tone of their message to the other person's expected attitude (Echterhoff, Kopietz, & Higgins, 2017; Echterhoff & Schmalbach, 2018). However, interpersonal communication is also conducted through media such as e-mail, Facebook, or WhatsApp. Using such media, people will write about the technology in a manner similar to the one studied in this article. Still, it would be interesting to study face-to-face conversations and compare them with conversations conducted through media. Finally, we only used two technologies and two organizations in our study. It is important to see whether these results replicate for other technologies that people hold positive or negative attitude toward and other organizations that people consider more or less trustworthy.

Our study extends previous research in this area in important ways. First, we observed actual communication behavior by having participants write down what they would tell other people. Second, we manipulated the source's trustworthiness and the initial attitude toward the technology while keeping the information provided constant. This design enables a more thorough study of how people's actual communication is influenced by these factors. These findings are applied to sustainability-related scientific developments and technologies. Given that more and more people learn about new technologies via social media, it is essential to understand whether and in what way information is distorted when such information is transmitted. The formation of accurate perceptions of the associated risks and benefits is essential for the technology's acceptance and, consequently, for the planet's sustainability and people's health.

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