



ELSEVIER

Contents lists available at ScienceDirect

## Journal of Retailing and Consumer Services

journal homepage: [www.elsevier.com/locate/jretconser](http://www.elsevier.com/locate/jretconser)

# Understanding consumer reactions to product contamination risks after national disasters: The roles of knowledge, experience, and information sources

Björn Frank<sup>a,\*</sup>, Shane J. Schvaneveldt<sup>b</sup><sup>a</sup> Sophia University, Graduate School of Global Environmental Studies, 7-1 Kioi-cho, Chiyoda-ku, Tokyo 102-8554, Japan<sup>b</sup> Weber State University, Goddard School of Business and Economics, 1337 Edvalson St Dept 3802, Ogden, UT 84408-3802, USA

## ARTICLE INFO

## Article history:

Received 14 November 2014

Received in revised form

7 August 2015

Accepted 8 August 2015

Available online 14 November 2015

## Keywords:

Chronic technological disaster

Radioactivity

Product contamination risk

Consumer behavior

Environmental pollution

Fukushima Daiichi nuclear disaster

## ABSTRACT

This study shows that not all consumers intend to decrease purchases of potentially contaminated products after disasters; some rather intend to increase purchases. Purchase intent reductions derive from contamination risk knowledge, which depends on observed behavior of other consumers, objective media information, and past opposition to the technology causing contamination. Technology hazard expertise reinforces the effects of consumers' risk assessments and of past opposition to technology use. By contrast, purchase intent increases derive from empathy and salient social identity shared with disaster victims, which are triggered by affect-laden media exposure, past disaster-related experience, and disaster involvement of consumers' social networks.

© 2015 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

## 1. Introduction

Disasters caused by technological failure frequently lead to large-scale environmental pollution, which in turn creates risks of product contamination affecting consumer decision making. For instance, the 2010 Deepwater Horizon oil spill created uncertainty whether fish from the Gulf of Mexico are safe to eat (Levy and Gopalakrishnan, 2010). Likewise, large-scale chemical accidents create worries about air and groundwater pollution, such as the 2014 West Virginia chemical spill that left 300,000 residents without potable water and temporarily shut down an estimated 16% of the state's economy (Brodwin, 2014). Similarly, Japan's 2011 Tohoku earthquake and tsunami damaged the Fukushima Daiichi Nuclear Power Plant and thus led to widespread radioactive contamination of regions supplying food and other products to eastern Japan and the Tokyo metropolitan area (Carpenter, 2011; Fackler, 2012). These disasters are characterized as chronic technological disasters (Gunter et al., 1999) because their technological origins create long-term contamination hazards and consequent product safety risks for consumers. Also, they are characterized as national disasters because their large-scale nature affects many people and draws attention from media and people across the

nation (Dube and Black, 2010).

The marketing literature on chronic technological disasters with consequential product contamination has illuminated consumer purchase reductions (Grande et al., 1999), but not purchase increases, as a response to product-related health risks. By contrast, the marketing literature on national disasters has focused on situations not involving any product-related health risks. For contexts such as the 9/11 terrorist attacks, it has highlighted purchase increases in economic support of disaster victims or regional reconstruction efforts (Dube and Black, 2010; Levine and Thompson, 2004). A recent study by Frank and Schvaneveldt (2014) merged these two streams of literature by investigating effects of the Fukushima nuclear accident in Japan, which was both a national disaster and a chronic technological disaster causing product contamination. Drawing on the psychological trade-off between self-preservation and economic support of disaster-stricken regions, they highlighted that not all consumers intended to decrease their purchases of potentially contaminated products, but rather some consumers intended to increase such purchases. Moreover, they explored the influences of personal characteristics on the extent of purchase reduction vs. increase. While their research thus explored *who* engages in purchase reductions vs. increases, this study is the first to examine *what factors* cause consumers to reduce or increase purchases of potentially contaminated products after national disasters. Knowledge of these factors would enable marketing managers and public policy

\* Corresponding author.

E-mail address: [frank@genv.sophia.ac.jp](mailto:frank@genv.sophia.ac.jp) (B. Frank).

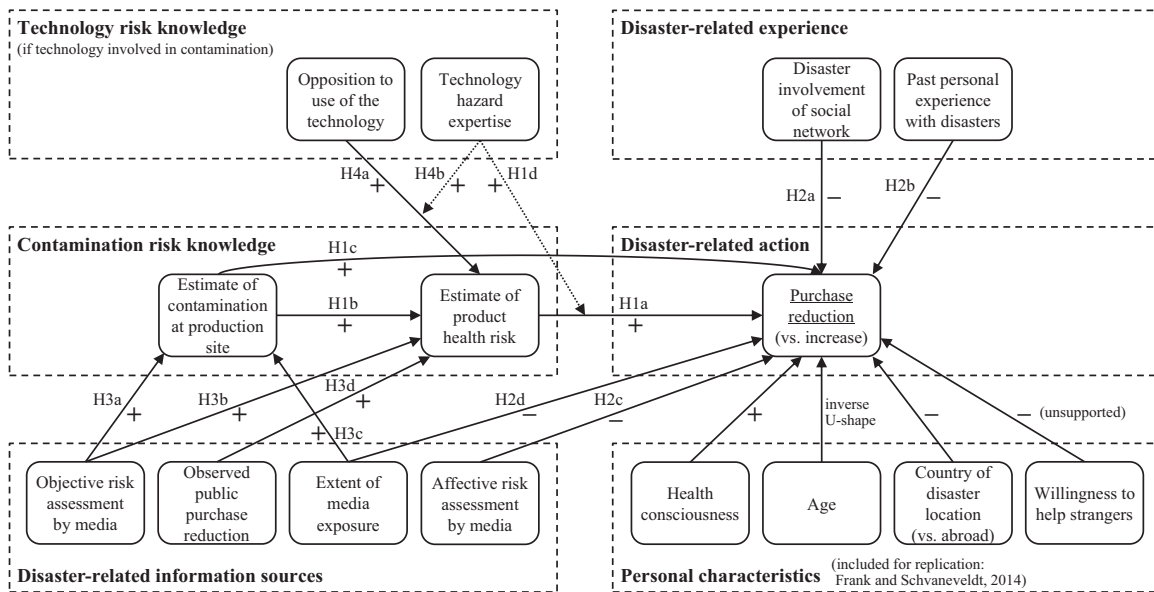


Fig. 1. Conceptual framework and hypotheses.

makers to design strategies that minimize the economic fallout of chronic technological disasters. We develop hypotheses about direct and indirect effects of contamination risk knowledge, technology risk knowledge, disaster-related information sources, and disaster-related experience on changes in consumer purchasing. As a secondary goal, we seek to replicate some of the results of Frank and Schvaneveldt (2014).

Fig. 1 presents the conceptual framework of our study. In line with Frank and Schvaneveldt (2014), we chose the context of the Fukushima nuclear accident to test our hypotheses. We collected more recent questionnaire-based experimental data on mobile phones and apparel from six countries: Japan (focal disaster location), USA, France (developed economies), Ecuador, Bolivia, and Sri Lanka (developing economies).

The remainder of our article is structured as follows. Section 2 presents the conceptual background and develops our research hypotheses. Section 3 explains our research methodology, including descriptions of our survey design, our data, and their validity. Section 4 succinctly presents the results of our hypothesis tests. Finally, Section 5 discusses the theoretical and practical implications of our study, as well as its limitations and directions for future research.

## 2. Development of hypotheses

### 2.1. Consumer reactions to national disasters: self-preservation vs. collective resilience

Consumer purchase reductions of potentially contaminated products have been reported by many studies in the literature and can be explained intuitively by self-preservation instincts (Grande et al., 1999). By contrast, purchase increases of such products despite health risks are counter-intuitive and more intriguing. To explain purchase increases, Frank and Schvaneveldt (2014) reviewed several theories from the disaster sociology literature explaining risk-defiant supportive behaviors after disasters and examined whether these theories can be extended to account for analogous behaviors by consumers. They concluded that the vulnerability framework (Dynes, 2003), emergent norm theory (Turner and Killian, 1987), and affiliation theory (Mawson, 2005) only account for group phenomena in the focal disaster location

and thus cannot be extended to explain individual consumer purchasing behavior in locations far removed from the disaster. To explain risk-defiant, supportive consumer purchase behaviors, they extended collective resilience theory (Drury et al., 2009b). As this theory is based on shared social identity, it does not require the immediate presence of disaster victims and is compatible with individual consumer actions.

Collective resilience theory (Drury et al., 2009a,b) is based on self-categorization theory, which suggests that feeling and acting with others as part of a group operates through cognitive self-categorizations (Turner, 1982; Turner et al., 1987). These range from self-categorizations at a personal level to broader self-categorizations with groups with which one shares social identity. Behavior is influenced most strongly by the salient level of identity (Turner, 1982; Turner et al., 1987). Collective resilience theory predicts that national disasters may cause social identity shared with disaster victims to become salient and, thus, to trigger behaviors in support of disaster victims (Drury et al., 2009a,b).

While individuals may support disaster victims through a range of behaviors such as volunteering and donating to disaster victims, Frank and Schvaneveldt (2014) extended this conceptual background to focus on changes in consumer purchasing behavior after national disasters. They posited that self-preservation instincts trigger consumer purchase reductions of potentially contaminated products because individual identity tends to be salient in most individual consumer behavior. At the same time, they suggested that some consumers may increase purchases of potentially contaminated products after disasters to support disaster victims and regional economic reconstruction efforts when they empathize sufficiently with disaster victims. Media reports have given account of such purchases in Japan (Ito, 2015). From collective resilience theory (Drury et al., 2009b), Frank and Schvaneveldt (2014) deduced that such empathy is strongly reinforced when social identity shared with disaster victims becomes salient. As a first step towards investigating the nature of changes in consumer purchasing after national disasters involving product contamination, they confirmed with data from Japan and the USA that a substantial share of consumers intend to make purchase increases. Moreover, they found that purchase intent reductions (vs. increases) vary by consumer age with a peak in the 30s when many consumers have young children. Purchase intent reductions (vs. increases) are more pronounced for fast food restaurants than

mobile phones, for non-Japanese consumers in Japan and the USA than for Japanese consumers in Japan, and for more health-conscious consumers. While purchase intent reductions only weakly depend on cultural values, they tend to be positively influenced by uncertainty avoidance and negatively influenced by individualism (positively in the USA), masculinity values, and long-term orientation.

In summary, Frank and Schvaneveldt (2014) explored the effects of personal characteristics, unrelated to the disaster, on changes in consumer purchasing. Drawing on their theoretical framework of self-preservation vs. collective resilience, our study is the first to highlight the roles of factors related to national disasters and to the technology involved in chronic technological disasters. Specifically, we seek to examine direct and indirect effects of contamination risk knowledge, technology risk knowledge, disaster-related information sources, and disaster-related experience on changes in consumer purchase intent after national disasters where technology failures cause product contamination risks. As a secondary goal, we seek to replicate some of the effects of personal characteristics identified by Frank and Schvaneveldt (2014).

## 2.2. Conceptual framework

Fig. 1 presents our conceptual framework, which aims to explain the formation of changes in consumer purchasing (reductions vs. increases) after large-scale chronic technological disasters. Psychological urges to reduce and/or increase purchases are not mutually exclusive but can coexist, although only the net, overall change in consumer purchase intent is observable.

Frank and Schvaneveldt (2014) described psychological urges to reduce purchases as deriving from self-preservation instincts. Since self-preservation instincts are triggered upon the identification of health threats, we posit that contamination risk knowledge is the primary driver of purchase reductions. In general, knowledge comes from external information sources or from inferences based on other internal knowledge (Bettman, 1979). Hence, we posit that contamination risk knowledge derives from disaster-related information sources and from inferences based on consumers' technology risk knowledge regarding the technology causing contamination during the disaster.

Based on collective resilience theory (Drury et al., 2009b), Frank and Schvaneveldt (2014) described psychological urges to increase purchases as motivated by the willingness to economically support disaster victims and regional construction efforts. This willingness derives from empathy with disaster victims, which is reinforced when social identity shared with disaster victims becomes salient, and this shared social identity can only become salient when disaster-related information reaches consumers. We posit that such information derives from consumers' own disaster-related experience or from external, disaster-related information sources.

A very different avenue for explaining the willingness to continue purchasing potentially risky products would be the automated behavior sequence proposed by Langer (1989) in her theory of mindfulness. In order to avoid an overload of information, humans only pay attention to a limited number of signals from the world while ignoring others, and decisions or actions consequently may appear irrational. This theory might explain that some consumers ignore product safety hazards and engage in continued purchases of potentially risky products after a chronic technological disaster, though it would not explain increased purchases (since it involves a change). While collective resilience theory is based on cognitive self-categorizations, the automated behavior sequence thus would stipulate lack of such cognition. Although Frank and Schvaneveldt (2014) found indications of cognitive self-categorizations as drivers of increased purchases of

potentially risky products, it might be possible that automated behavior reinforces this effect by causing some consumers to ignore hazards that surface after a chronic technological disaster.

In summary, we posit that purchase reductions are triggered by contamination risk knowledge, which derives from disaster-related information sources and technology risk knowledge. By contrast, we posit that purchase increases are triggered by disaster-related experience and information sources. As we also seek to replicate Frank and Schvaneveldt's (2014) main findings, our conceptual framework also includes personal characteristics unrelated to the disaster. Frank and Schvaneveldt (2014) explained that purchase increases are more pronounced for consumers in Japan than abroad because social identity shared with disaster victims is more salient in the country of the disaster location. They also hypothesized, but did not find, that willingness to help individual strangers translates into collective resilience and thus into purchase increases. Moreover, they reported that health consciousness, which strengthens inherent self-preservation instincts, positively influences purchase reductions. In addition, they found that the effect of age on purchase reductions follows an inverse U-shape and peaks in the 30s where consumers with young children focus more on health preservation.

## 2.3. Determinants of purchase reductions

Our conceptual framework (see Fig. 1) assumes that psychological urges to reduce purchases of potentially contaminated products derive from contamination risk knowledge.

By reducing their purchases of potentially contaminated products, consumers seek to avoid the health risks of consuming hazardous products (Grande et al., 1999). Among different types of contamination risk knowledge, consumers' estimates of product health risks thus should exert the strongest positive influence on purchase reductions (**H1a**). However, information asymmetries make it difficult for consumers to estimate the specific extent of product health risks. One type of information asymmetry concerns lack of knowledge of the production processes involved. Consumers can be expected to presume that contamination at the production site causes contamination of the product and consequent product health risks (**H1b**) because they would not comprehend the hazardous nature of contaminated products otherwise. At the same time, consumers tend to lack specific knowledge of how contamination at the production site actually translates into product health risks because of uncertainty about the deployment of advanced production processes that prevent contamination from affecting products (Benneer et al., 2013; Foster and Just, 1989). Consumers tend to hedge against such uncertainty by partially accounting for the worst case (Singh and Sirdeshmukh, 2000) that contamination fully affects products. Hence, we expect purchase reductions to depend not only on consumers' realistic estimates of product health risks but also on their estimate of contamination at the production site, which represents the worst-case product health risk (**H1c**). Another type of information asymmetry concerns lack of information on the risks of the technology responsible for the contamination in chronic technological disasters. Since consumer beliefs more strongly influence intentions when consumers have confidence in their beliefs (Fishbein and Ajzen, 1975), we presume that consumers' estimates of product health risks more strongly influence purchase reductions when consumers have high self-perceived expertise regarding hazards of the technology (**H1d**).

## 2.4. Determinants of purchase increases

Our conceptual framework (see Fig. 1) suggests that psychological urges to increase purchases of products from contaminated

regions derive from disaster-related experience and information sources.

Based on collective resilience theory (Drury et al., 2009b), Frank and Schvaneveldt (2014) described purchase increases as motivated by an intent to economically support disaster victims and regional construction efforts. This intent derives from empathy with disaster victims, reinforced by salient social identity shared with disaster victims. That is, willingness to increase purchases depends not on the contamination itself but on shared social identity and empathy with disaster victims, and may translate into net, overall purchase increases when it outweighs urges to reduce purchases.

Shared social identity derives from self-categorizations as belonging to particular groups (Turner, 1982; Turner et al., 1987). Such shared social identity can become salient and thus influential (Turner et al., 1987) when disasters adversely affect these groups (Drury et al., 2009a,b). The social network is the primary source of shared social identity (Turner, 1982), and its relevance to supportive behaviors after disasters has been documented in the disaster sociology literature (Aguirre et al., 1998). Thus, we posit that disaster involvement of consumers' social networks causes shared social identity to become salient and contributes to purchase increases of products from disaster-stricken, contaminated regions (H2a).

Even without disaster involvement of the immediate social network, social identity shared with larger anonymous groups may become salient after disasters and trigger supportive behavior (Drury et al., 2009a,b). We predict that past personal experience with disasters causes consumers to identify analogies with current disaster victims' situation and thus leads to self-categorizations of being in the same group as these disaster victims. Hence, past experience with disasters would lead to the formation of shared social identity. Moreover, disaster experience tends to leave long-term emotional impressions (Mawson, 2005) that may cause shared social identity to become salient upon occurrence of analogous events. Thus, we posit that past personal experience with disasters triggers purchase increases (H2b).

While salient shared social identity is an important driver of empathy with disaster victims (Drury et al., 2009a,b), such empathy also may derive from other external, disaster-related information sources. Since empathy is a primarily affective construct (Doherty, 1997), affective information from external sources is most likely to induce empathy. In the context of supportive consumer purchases, which can occur in completely different locations than the focal disaster (Frank and Schvaneveldt, 2014), the media can be assumed to serve as the primary vehicle of disaster-related information. Hence, affective media assessments of disaster risks likely induce empathy with disaster victims either directly through mechanisms of emotional contagion (Doherty, 1997) or indirectly by enhancing the salience of shared social identity (Drury et al., 2009a,b). Therefore, we posit that affective risk assessments by the media induce purchase increases (H2c). As the amount of received media information, especially of visual cues, drives emotional contagion (Jackson et al., 2005) and likely consumers' awareness of disaster-related suffering, the extent of media exposure may affect consumers' empathy and salient shared social identity. Thus, we posit that the extent of media exposure positively affects purchase increases (H2d).

### 2.5. Determinants of contamination risk knowledge

Ultimately, our conceptual framework (see Fig. 1) suggests that contamination risk knowledge derives from disaster-related information sources and from inferences based on consumers' technology risk knowledge regarding the technology causing contamination during the disaster.

Among disaster-related information sources, the media have the capability of bringing disaster-related information to distant locations to which globalized distribution channels transport products from disaster-stricken regions for consumption (Frank and Schvaneveldt, 2014). Hence, risk assessments by the media likely influence contamination risk knowledge. While risk assessments consist of cognitive and affective processes, the affective process is meant to accelerate decision making and is engaged only under time constraints when life depends on immediate reactions to a sudden danger (Slovic et al., 2004; Verplanken et al., 1998). Changes in consumer purchasing after disasters tend to occur in remote locations where consumers have sufficient time to assess risks and decide on purchases. Hence, we expect contamination risk knowledge to depend on objective, data-based, rather than on affective, risk assessments by the media. Specifically, we hypothesize that estimates of contamination at the production site of products (H3a) and estimates of product health risks (H3b) are positively influenced by objective, but not affective, risk assessments by the media.

Moreover, the extent of exposure to disaster-related media coverage has been shown to influence both the public awareness and perceived severity of general disaster-related problems (Arlt et al., 2011; Sampei and Aoyagi-Utsui, 2009). Therefore, the extent of disaster-related media exposure may create awareness of contamination as a general disaster-related problem, independently of risk assessments by the media whose effects are captured separately by our conceptual framework. Consequently, we hypothesize that the extent of media exposure positively influences estimates of contamination at the production site (H3c). By contrast, product health risks are not an inherent consequence of all chronic technological disasters but may occur only as the side effect of a chain of unfortunate events. Hence, we do not presume that the extent of media exposure exerts a direct, non-mediated effect on estimates of product health risk that is independent of risk assessment by the media. Rather, we consider estimates of product health risk to derive from risk assessments by the media (H3b) and from estimates of contamination at the production site (H1b).

As predicted by social learning theory, risk assessments also tend to follow other people's risk assessments, especially when humans lack complete information and are cognizant of information asymmetries (Miller and Byrnes, 1997). Similarly, marketing research has shown that information asymmetries cause consumers' product choices to depend more on the perceived public opinion, which accounts for potential risks not identified by consumers themselves, than on their own opinion (Fischer et al., 2010; Frank, 2012; Frank et al., 2012, 2014a, 2015). As consumers lack complete knowledge of product contamination, we posit that their estimate of product health risks follows observed public purchase reductions (H3d), which may reflect product health risks not identified by consumers themselves. However, observed public purchase reductions serve only as a cue of product safety because they exclusively concern products, and not as a cue of regional contamination. Consequently, observed public purchase reductions are unlikely to affect estimates of contamination at the production site of products.

Knowledge derives not only from external information sources but also from inferences based on other internal knowledge (Bettman, 1979). Thus, contamination risk knowledge also may derive from inferences based on technology risk knowledge regarding the technology causing contamination in the disaster. Long-standing opposition to the use of this technology may positively affect contamination risk knowledge as it reflects prior risk assessments, which should carry over to current disaster-related contamination risk assessments for two reasons. First, analogous reasoning may independently lead to analogous risk assessments. Second, consumers tend to keep current attitudes in line with past

attitudes toward similar issues in order to minimize cognitive dissonance, which refers to mental discomfort due to contradictory beliefs (Akerlof and Dickens, 1982; Frey, 1986). We posit that opposition to use of the technology positively affects product health risk estimates (H4a) because it reflects assumptions about adverse health consequences of using this technology. By contrast, we do not expect that it affects estimates of contamination at the production site as it does not convey any information on the degree of contamination in the current disaster, which depends on situational factors (Grande et al., 1999).

As consumer beliefs more strongly influence intentions when consumers have confidence in their beliefs (Fishbein and Ajzen, 1975), we also hypothesize that opposition to use of the technology more strongly influences estimates of product health risks when consumers have high self-perceived expertise regarding hazards of the technology (H4b).

### 3. Methodology

As the focal chronic technological disaster of our study, we chose the large-scale accident at the Fukushima Daiichi nuclear power plant in Japan, for which Frank and Schvaneveldt (2014) highlighted the trade-off between consumer purchase reductions and increases at the center of our conceptual framework. Another reason for adopting this context is that a secondary goal of our study is to replicate, with more recent data, their findings on the effects of personal characteristics on changes in consumer purchase intent for this context. To test our hypotheses, we designed a questionnaire-based experiment with the construct scales summarized in the Appendix. Based on the established and widely used guidelines by Bergkvist and Rossiter (2007), we measured all constructs involving concrete attributes and concrete objects with single-item scales, and the other constructs with reflective multi-item scales. These established guidelines recommend designing response scales with at least 7 points in order to achieve sufficient discrimination between response options of single-item scales (Bergkvist and Rossiter, 2007). Therefore, we devised our original scales with 7 points. Moreover, we adopted the 10-point scales used by Frank and Schvaneveldt (2014) for variables whose effects we sought to replicate (see Appendix). The use of different scale formats within the same study is common in marketing research and even recommended as a way to reduce respondent fatigue and resultant common method variance (Lindell and Whitney, 2001; Podsakoff et al., 2003).

Of particular note, we modeled purchase reductions (vs. increases) as the intent to repurchase a product from the primarily used brand in a product category (methodology of the American Customer Satisfaction Index: Fornell et al., 1996; Frank et al., 2014a,b) minus the repurchase intent for the case that the brand manufactures its new products 30 km west of the Fukushima Daiichi Nuclear Power Plant where the accident occurred on March 11, 2011. For comparability with Frank and Schvaneveldt (2014), we adopted the context of mobile phones. In addition, we chose the apparel context of casual upper-wear clothing because clothing is worn on the body for extended durations and thus may evoke greater risk assessments and greater purchase reductions than mobile phones. Also, clothing is far less expensive and purchased more frequently than mobile phones, facilitating small contributions to the reconstruction of disaster-stricken regions through purchase increases. Hence, we expected contextual differences to induce systematic differences in our results between mobile phones and apparel.

We targeted the following six countries for data collection: Japan (focal disaster location), USA, France (developed economies), Ecuador, Bolivia, and Sri Lanka (developing economies). This mix of diverse contexts, including developed and developing economies, Western and Eastern countries, as well as predominantly Christian and Buddhist religious influences, minimizes the problem of context-specific bias that might lead to false and misleading generalizations. Multi-lingual teams translated the questionnaires from English to local languages and back for verification, pre-tested the questionnaires with local consumers, and revised the questionnaires repeatedly. In 2013 we collected data in each country from a geographically diverse mix of universities, firms, and public places. After removing response sets with missing values, this resulted in responses from 1809 consumers (Japan: 109; USA: 335; France: 84; Ecuador: 612; Bolivia: 449; Sri Lanka: 220), which includes 1234 responses on mobile phones and 663 on apparel. In Japan, 88 consumers provided responses on both mobile phones and apparel. While we were targeting a similar sample size across our survey countries, budget limitations and/or social sensitivities about the research topic made it difficult to achieve this target. Compared with the national populations, our samples overstate the number of young consumers and represent only urban consumers. The samples are evenly distributed across male and female consumers. Table 1 presents the descriptive statistics and correlations of our constructs.

In order to confirm the factor structure of our three reflective constructs with multi-item scales through two different methods for

**Table 1**  
Correlations and descriptive statistics.

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 Purchase intent reduction: mobile phones														
2 Purchase intent reduction: apparel	.57*													
3 Health consciousness	.06*	.10*												
4 Willingness to help strangers	.01	.01	.27*											
5 Past personal experience with disasters	-.08*	-.19*	.06*	.06*										
6 Disaster involvement of social network	-.02	-.08*	.03	.08*	.08*									
7 Technology hazard expertise	.02	.02	.09*	.08*	.19*	.01								
8 Opposition to use of the technology	.12*	.13*	.16*	.08*	.21*	.09*	.33*							
9 Estimate of product health risk	.23*	.31*	.13*	.04	.06*	.02	.16*	.38*						
10 Estimate of contamination at production site	.13*	.16*	-.01	.01	-.02	-.05*	.01	.02	.11*					
11 Extent of media exposure	-.06*	.04	.00	.02	.01	-.01	.02	-.01	.04	.16*				
12 Affective risk assessment by media	.05	.03	-.02	.03	.07*	-.06*	.28*	.21*	.27*	.02	.03			
13 Objective risk assessment by media	.09*	.19*	.10*	.05*	.05*	-.03	.22*	.28*	.37*	.05*	.05*	.60*		
14 Observed public purchase reduction	.09*	.16*	.11*	.05*	.07*	.04	.22*	.26*	.49*	.04	.06*	.38*	.47*	
Mean	.99	1.79	6.38	6.64	2.33	.52	3.82	3.12	4.03	.00	15.1	4.67	4.48	3.98
Standard deviation	3.01	3.02	2.01	1.83	1.56	1.33	1.84	1.52	1.54	.82	43.6	1.66	1.61	1.68

Notes: \*p < .05 (two-sided p-values). Variable 10 based on standardized items.

cross-verification as a preliminary step, we separately conducted two exploratory factor analyses with principal axis factoring and (a) Varimax rotation and (b) Promax rotation. Both analyses extracted three factors with Eigenvalues larger than one and a pattern of loadings that clearly matched the three reflective constructs that we had intended to measure. Subsequently, we conducted a confirmatory factor analysis of these constructs. Its results satisfy the standard psychometric acceptance criteria of  $\chi^2/df < 5$ , CFI  $\geq .95$ , RMSEA  $< .07$ , and upper bound of RMSEA confidence interval  $\leq .1$  (Hair et al., 2010). Furthermore, the model fit deteriorates significantly ( $\chi^2$  differences test) when constraining pairs of separate reflective constructs to load on a common factor, that is, when constraining their correlation to one (Bagozzi, 2011). Also, our reflective constructs meet the following criteria of convergent and discriminant validity (Hair et al., 2010): Cronbach's  $\alpha > .6$ , item loadings significant, average variance extracted [AVE]  $> .5$ , and AVE  $>$  maximum variance shared with other constructs (see Appendix). Based on Cheung and Rensvold (2002), we found evidence of full configural and metric measurement invariance of these constructs across countries. To reduce common method variance [CMV], we used different scale lengths, formats, and anchors (see Appendix) (Podsakoff et al., 2003). Lindell and Whitney (2001) stated that negative construct correlations indicate absence of CMV and that the second-lowest positive correlation can be regarded as an upper bound for CMV. Due to the presence of both negative and very small, non-significant positive correlations in Table 1, CMV does not seem to adversely affect our results. Also, Harman's single factor test (Podsakoff et al., 2003) did not reveal any problem of CMV in our study.

## 4. Results

### 4.1. Determinants of purchase intent reduction (vs. increase)

Fig. 2 presents the distribution of purchase intent reductions vs. increases in the sample pooled across all countries. The distributions for mobile phones and apparel have a highly similar shape, even though only a very few respondents filled out both surveys. For mobile phones/apparel, 52/62% would decrease their purchases, 27/20% would increase their purchases, and 21/18% would not change their purchases in the scenario where products come from contaminated regions. Using data from the 88 respondents who filled out surveys on both product categories, a  $t$ -test confirms that purchase intent reductions (vs. increases) are higher for apparel than mobile phones ( $p < .05$ ), potentially because apparel is worn on the body for extended durations and thus is perceived to pose greater health risks.

To test our hypotheses (H1a–H4b), we used hierarchical linear modeling (HLM) because individual consumer responses (level 1) are nested within the primarily used brand (level 2, product-

specific HLM models only) and within countries (level 2, all HLM models). We calculated interaction terms (H1d, H4b) by multiplying mean-centered variables. All variance inflation factors are well below five and thus do not indicate any problems of multicollinearity (Hair et al., 2010). Table 2 summarizes the results. The error variance terms indicate that the predictive ability of our models does not vary significantly ( $p < .05$ ) across countries and apparel brands, whereas the variation is marginally significant (two-sided  $p < .1$ , one-sided  $p < .05$ ) across mobile phone brands. The pseudo  $R^2$  values range between .044 and .354, which indicates that our models are incomplete, although these values are not abnormal for research on a new topic. These values might also indicate that risk assessments and changes in purchase intent after disasters cannot be fully explained by rational, logical deduction from other pre-processed attitudes and thus may have an irrational component, which is difficult to capture empirically.

Our results garner support for our hypotheses about the determinants of purchase intent reductions (vs. increases), though partially so for one of the two product categories. For both mobile phones and apparel, estimates of product health risk (H1a) and of contamination at the product site (H1c) positively influence purchase intent reductions. In terms of standardized  $\beta$  coefficients, estimates of product health risk exert the strongest effect on purchase intent reductions. Past personal experience with disasters negatively influences purchase intent reductions (vs. increases) (H2b). In the case of apparel only, purchase intent reductions (vs. increases) are influenced positively by objective risk assessments by the media and negatively by both disaster involvement of the social network (H2a) and affective risk assessments by the media (H2c). Moreover, technological hazard expertise positively moderates the effect of estimates of product health risk on purchase intent reductions (H1d, marginally significant). In the case of mobile phones only, the extent of media exposure negatively influences purchase intent reductions (vs. increases) (H2d).

Also, our results partially replicate findings by Frank and Schvaneveldt (2014). Our results confirm that purchase intent reductions (vs. increases) are less pronounced in Japan than in other countries, but only for mobile phones. Moreover, they confirm that the effect of age on purchase intent reductions follows an inverted U-shape, but only for apparel. They extend Frank and Schvaneveldt (2014) by showing that the effect of health consciousness on purchase intent reductions is not direct but mediated by product health risk estimates. As in their analyses, our results do not confirm their hypothesis that willingness to help individual strangers translates into collective support through purchase increases.

### 4.2. Determinants of contamination risk knowledge

Our HLM results in Table 2 confirm that estimates of product health risk are positively influenced by estimates of contamination at the production site (H1b), objective risk assessments by the

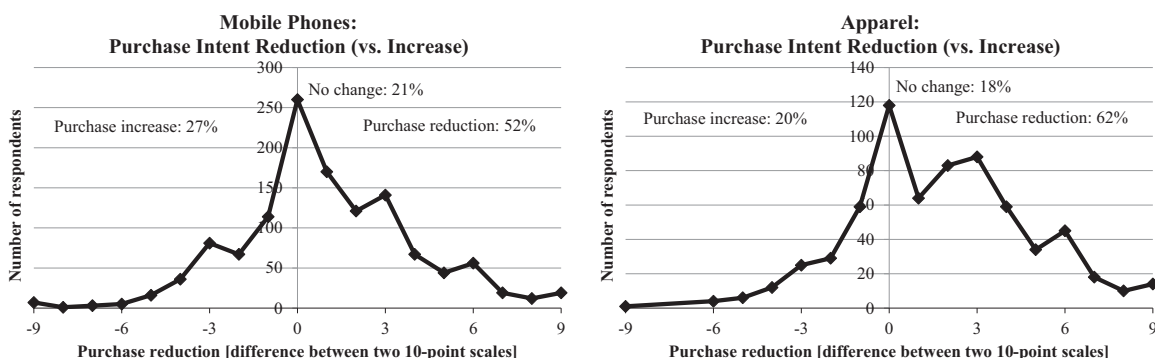


Fig. 2. Purchase intent reduction (vs. increase) for mobile phones and apparel.

**Table 2**  
Determinants of contamination risk knowledge and purchase intent reductions (vs. increases).

Independent variable	Purchase intent reduction			Contamination risk knowledge		
	Mobile phones $\beta$	Apparel $\beta$	Hypotheses	Estimate of product health risk $\beta$	Estimate of contamination at production site $\beta$	Hypotheses
<i>Personal characteristics:</i>						
Country of disaster location (Japan: 1; abroad: 0)	-.125*	-.048	F&S: –	.001	.005	
Sex (female: 1; male: 0)	-.027	.032		.024	.018	
Age	.028	.249***		-.030	.041	
Age <sup>2</sup>	-.055	-.246***	F&S: –	.001	-.080†	
Health consciousness	.032	.032	F&S: +	.055**	-.006	
Willingness to help strangers	-.029	-.024		-.017	.012	
<i>Disaster-related experience:</i>						
Past personal experience with disasters	-.083**	-.184***	H2b: –	-.006	-.008	
Disaster involvement of social network	-.011	-.085*	H2a: –	-.009	-.050*	
<i>Technology risk knowledge:</i>						
Technology hazard expertise (THE)	-.035	.015		-.027	.003	
Opposition to use of the technology	.046	.002		.235***	.020	H4a: +
<i>Contamination risk knowledge:</i>						
Estimate of product health risk	.203***	.300***	H1a: +			
Estimate of contamination at production site	.110***	.097**	H1c: +	.078***		H1b: +
<i>Disaster-related information sources:</i>						
Extent of media exposure	-.059*	.027	H2d: –	.003	.155***	H3c: +
Affective risk assessment by media	.032	-.122**	H2c: –	.007	-.033	
Objective risk assessment by media	-.011	.135**		.144***	.058†	H3b/a: +
Observed public purchase reduction	-.014	.005		.350***	.008	H3d: +
<i>Hypothesized interaction effects:</i>						
THE × Estimate of product health risk	-.006	.065†	H1d: +			
THE × Opposition to use of the technology				.046*		H4b: +
<i>Error variance:</i>						
Respondent-specific residual	7.708***	6.984***		1.527***	.649***	
Country-specific residual	.140	.063		.050	.017	
Brand-specific residual	.504†	.077				
<i>Fit statistics:</i>						
HLM Pseudo R <sup>2</sup>	.146	.231		.354	.044	
Sample size	1234	664		1809	1809	

Notes: Hierarchical linear modeling (HLM). † $p < .1$ ; \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$  (two-sided  $p$ -values).  
F&S=results by Frank and Schvaneveldt (2014) on effects of personal characteristics on purchase intent reduction.

media (H3b), the observed public purchase reaction (H3d), opposition to use of the technology (H4a), and health consciousness. In terms of standardized  $\beta$  coefficients, the observed public purchase reaction exerts the strongest influence. Moreover, technology hazard expertise positively moderates the effect of opposition to use of the technology on estimates of product health risk (H4b).

Estimates of contamination at the production site are influenced positively by objective risk assessments by the media (H3a, marginally significant) and by the extent of media exposure (H3c) and negatively by disaster involvement of the social network. The influence of age on estimates of contamination at the production site tends to follow an inverted U-shape (marginally significant).

## 5. Discussion

As an original contribution to the marketing literature, our study sought to understand the behavioral origins of changes in consumer purchasing after large-scale, chronic technological disasters causing risks of product contamination. Based on HLM of data from six countries and two product categories for the context of the 2011 nuclear accident in Japan, we used more recent data to confirm Frank and Schvaneveldt's (2014) non-intuitive finding that not all consumers

intend to decrease, but some consumers rather intend to increase, their purchases of products from contaminated regions after disasters. While Frank and Schvaneveldt (2014) only explored *who* engages in purchase intent reductions (vs. increases), we sought to identify *what factors* influence purchase intent reductions (vs. increases). We illuminated the roles of contamination risk knowledge, technology risk knowledge, disaster-related information sources, and disaster-related experience in driving purchase intent reductions (vs. increases). Our results at least marginally (two-sided  $p < .1$ ; one-sided  $p < .05$ ) confirm all of our (one-sided) hypotheses, although some of them for only one out of two product categories.

Purchase intent reductions derive from contamination risk knowledge. While consumers primarily rely on product health risk assessments for such decisions, they hedge against uncertainty from limited knowledge by secondarily accounting for estimates of contamination at the production site, independently of whether they are convinced that this contamination indeed affects products. Low technology hazard expertise attenuates the effect of product health risk assessments, relative to the effect of hedging against uncertainty. These results suggest that consumers' suspicions of having only limited knowledge, which may result from lack of trust in information policies of firms and governments (Healy and Palepu, 2001), lead to exaggerated purchase reductions (to hedge against uncertainty) and thus may worsen

the adverse economic effects of disasters. Hence, attempts by managers and policy makers to dampen adverse economic effects by downplaying or obscuring information, which in fact occurred after the nuclear accident in Japan (Fackler, 2012) and after the Deepwater Horizon oil spill (Kunzelman, 2013), are short-sighted because they may cause consumers to doubt their knowledge of the situation and to reduce their purchases. As a secondary contribution, our results also replicate Frank and Schvaneveldt's (2014) findings that purchase intent reductions are more pronounced for health-conscious consumers, for consumers in countries other than the focal disaster location, and for consumers in age ranges where many have young children.

Contamination risk knowledge derives from objective risk assessments by the media, from observed public purchase reductions, and from past opposition to the use of the technology causing contamination during the disaster. Opposition to use of the technology is more influential for consumers with high than low technology hazard expertise, which means that technology risk knowledge is only relevant for consumers possessing such knowledge. Other consumers' risk assessments of chronic technological disasters appear to be driven only by those factors pertinent to general national disasters involving product contamination. Notably, contamination risk knowledge depends more strongly on observed behavior of other consumers than on objective information. This result concurs with past findings that information is not sufficient for influencing disaster-related risk assessments (Benneer et al., 2013) and that humans rely more on social instincts than on rational evaluations during disasters (Mawson, 2005). On a broader level, this result might reflect that humans in danger rely on their ability to build and organize groups as the primary strength compensating for their relative physical weakness in nature (Potts, 2012). Another intriguing result is that affective media reports do not influence risk assessments, potentially because the nature of consumers' risk assessments made in safe locations far removed from the disaster may be more cognitive, rather than affective.

By contrast, purchase intent increases derive from consumers' personal disaster-related experience, from disaster involvement of their social networks, and from media exposure conveying affective, rather than objective, risk assessments. These results give credence to the notion that empathy and salient social identity shared with disaster victims, whose roles for supportive behaviors in the locale of a disaster are predicted by collective resilience theory (Drury et al., 2009a,b), also drive risk-defiant, supportive consumer purchasing behaviors in locations far removed from a disaster (Frank and Schvaneveldt, 2014). However, while collective resilience theory regards supportive behaviors after disasters as emotional consequences of cognitive self-categorizations (Drury et al., 2009a,b), our finding of affective media reports as a driver of supportive behavior does not necessarily presuppose cognitive self-categorizations. This finding may equally be explained by processes of emotional contagion (Doherty, 1997) because the effect of affective media reports operates independently of variables likely related to the level of self-categorization (e.g., disaster-related experience or country of residence). Therefore, our study extends Frank and Schvaneveldt's (2014) theoretical explanation of purchase increases by suggesting that not only cognitive self-categorization processes, but also emotional contagion processes, may underlie risk-defiant supportive consumer behaviors after disasters. Of further note, our results mirror Frank and Schvaneveldt's (2014) finding that willingness to help individual strangers, as a personal characteristic, does not translate into behavior aimed at supporting the large, anonymous group of disaster victims.

A cross-contextual comparison of our results indicates a more intense psychological trade-off among drivers of purchase intent reductions and drivers of purchase intent increases for apparel than mobile phones. On one hand, clothing is worn on the body for extended durations and thus evokes greater and more influential product health

risk assessments. On the other hand, clothing is far less expensive than mobile phones, thereby facilitating small contributions to the economic reconstruction of disaster-stricken regions through purchase increases. Thus, the drivers of purchase intent increases have greater leverage for apparel than mobile phones. Hence, empathy and salient shared social identity with disaster victims, which collective resilience theory (Drury et al., 2009a,b) considers drivers of supportive behaviors, might translate into stronger risk-defiant supportive consumer purchasing actions in product categories with lower average prices.

Our discussion suggests that managers and policy makers benefit from establishing a reputation for honest disclosure of information, even when negative. Just as a reputation for honest disclosure improves stock market performance (Healy and Palepu, 2001), our study implies that such a reputation is also beneficial in consumer markets in order to limit exaggerated consumer purchase reductions meant to offset suspected hazard knowledge deficits after disasters. When faced with contamination after disasters, managers and public policy makers should communicate credible, objective data on both product health risks and contamination at production sites. When offering non-hazardous products in situations where consumers have difficulties assessing product safety, managers and public policy makers are advised to show video footage, pictures, or other evidence demonstrating that other consumers continue to purchase the products in question and are not worried by potential health risks. Moreover, affective disaster-related reports and messages may induce empathy with disaster victims and consequently trigger consumer purchase increases to economically support disaster-stricken regions. We also recommend the use of advertising messages that induce identification with disaster victims by stressing shared issues such as national identity and past common disaster experiences.

A limitation of our study is that it focuses on a single, large-scale chronic technological disaster. In order to confirm the general validity of our conceptual model and to identify the moderating influence of contextual conditions, we encourage future empirical research to apply our conceptual model to contexts other than the 2011 nuclear accident in Japan and to additional product categories. Another limitation is our partial use of single-item scales. While we only used such single-item scales for constructs that fulfill the requirements of concrete object and concrete attributes and for which the use of such scales thus is explicitly allowed or even preferred (Bergkvist, 2015; Bergkvist and Rossiter, 2007), we are cognizant of the ongoing debate and different scholarly opinions in the literature about the validity of single-item vs. multi-item scales. A further limitation of our study is the varying sample size across our survey countries, which was caused by budget limitations. For this reason, we refrained from over-emphasizing the specific nature of cross-country differences. We invite future research to explore such differences with a more balanced set of cross-country samples.

In addition, future research may explore more deeply the psychological nature of processes behind purchase increases of products from contaminated regions in order to ascertain whether emotional contagion (Doherty, 1997), emotional consequences of cognitive self-categorizations (Drury et al., 2009a,b), or automated behavior (Langer, 1989) plays a predominant role. Moreover, future research may ascertain whether average product category price moderates the processes underlying risk-defiant purchase increases after disasters involving contamination. Scholars also may consider analyzing the invariance of our focal effects over time in order to obtain knowledge of the long-term nature of risk-defiant collective resilience in consumer purchasing behavior.



## Acknowledgments

The authors extend their gratitude to Editor Harry Timmermans and three anonymous reviewers for their valuable and constructive comments on previous versions of this article and to JSPS KAKENHI (grants 24651176 and 15H05395) for financial support. They also thank Samuel Choukroun, Kohei Fujimoto, Boris Herbas Torrico, Alfredo Wakao Salvador, Dinush Wimalachandra, and all survey participants for their contribution to the data collection.

## Appendix A. Construct Scales

### Purchase intent reduction (10-point Likert type: absolutely yes/no; Frank and Schvaneveldt, 2014)

Formative scale calculated as (item 1 – item 2). Analogous item text for apparel.

Please name the brand of your primarily used cell phone.

1. Are you planning to buy your next cell phone from the same brand?
2. If you assume that your cell phone brand produces all cell phones 30 km west of the Fukushima nuclear power plant, are you planning to buy your next cell phone from the same brand?

### Health consciousness (10-point Likert type: absolutely yes/no; Frank and Schvaneveldt, 2014)

- Do you actively consider the health consequences of every purchase decision?

### Willingness to help strangers (10-point Likert type: absolutely yes/no; Frank and Schvaneveldt, 2014)

- Do you always help immediately when you see a stranger in need?

### Past personal experience with disasters (7-point Likert type: completely agree/disagree)

- I am used to experiencing disasters (e.g., natural disasters, etc.).

### Technology hazard expertise (7-point Likert type: completely agree/disagree)

- I know a lot about the dangers of radioactivity.

### Opposition to use of the technology (7-point Likert type: completely agree/disagree; AVE = .72; $\alpha$ = .61)

- For many years, I have been strongly opposed to the use of nuclear energy.
- To protect my health, I have always tried to avoid taking X-rays at the hospital.

### Disaster involvement of social network (open question: number of persons)

- How many of your current and past acquaintances have been somehow involved in nuclear disasters?

### Estimate of product health risk (7-point Likert type: completely agree/disagree; AVE = .88; $\alpha$ = .93)

- In my opinion, products from 30 km west of the Fukushima power plant are very dangerous.
- Products from 30 km west of the Fukushima power plant may severely damage my health.
- Products from 30 km west of the Fukushima power plant may cause major health problems.

### Estimate of contamination at production site (open question: times; AVE = .68; $\alpha$ = .76)

- How many times is the current radioactivity level 30 km west of the Fukushima nuclear power plant higher than in Paris?
- Spending a full year 30 km west of the Fukushima nuclear power plant exposes a person to how many times the radioactivity of a flight from Paris to Tokyo?
- Spending a full year 30 km west of the Fukushima nuclear power plant exposes a person to how many times the radioactivity of a chest X-ray examination?

### Extent of media exposure (open question: minutes)

- How much media coverage on the Fukushima nuclear power plant have you watched on TV last month?

### Affective risk assessment by media (7-point Likert type: completely agree/disagree)

- The media portray the radioactive contamination caused by the accident as deeply frightening.

### Objective risk assessment by media (7-point Likert type: completely agree/disagree)

- The media show with objective data that health consequences of the accident are very severe.

### Observed public purchase reduction (7-point Likert type: completely agree/disagree)

- As far as I have seen, most people avoid products from near the Fukushima power plant.

## References

- Aguirre, B.E., Wenger, D., Vigo, G., 1998. A test for the emergent norm theory of collective behavior. *Sociol. Forum* 13 (2), 301–320.
- Akerlof, G.A., Dickens, W.T., 1982. The economic consequences of cognitive dissonance. *Am. Econ. Rev.* 72 (3), 307–319.
- Arlt, D., Hoppe, I., Wolling, J., 2011. Climate change and media usage: effects on problem awareness and behavioural intentions. *Int. Commun. Gaz.* 73 (1–2), 45–63.
- Bagozzi, R.P., 2011. Measurement and meaning in information systems and organizational research: methodological and philosophical foundations. *MIS Q.* 35 (2), 261–292.
- Benbear, L., Tarozzi, A., Pfaff, A., Balasubramanya, S., Ahmed, K.M., van Geen, A., 2013. Impact of a randomized controlled trial in arsenic risk communication on household water-source choices in Bangladesh. *J. Environ. Econ. Manag.* 65 (2), 225–240.
- Bergkvist, L., 2015. Appropriate use of single-item measures is here to stay. *Mark. Lett.* 26 (3), 245–255.
- Bergkvist, L., Rossiter, J.R., 2007. The predictive validity of multi-item versus single-item measures of the same constructs. *J. Mark. Res.* 44 (2), 175–184.
- Bettman, J., 1979. *An Information Processing Theory of Consumer Choice*. Addison-Wesley, Reading, MA.
- Brodwin, D., 2014, February 21. How the Elk River spill makes the case for better regulation. *U.S. News & World Report*. (<http://www.usnews.com/opinion/economic-intelligence/2014/02/21/elk-river-chemical-spill-makes-the-case-for-better-regulation>).
- Carpenter, J., 2011, November 15. Fukushima fallout fears over Japan farms. *BBC News* (<http://www.bbc.co.uk/news/science-environment-15691571>).
- Cheung, G.W., Rensvold, R.B., 2002. Evaluating goodness-of-fit indexes for testing measurement invariance. *Struct. Equ. Model.* 9 (2), 233–255.
- Doherty, R.W., 1997. The emotional contagion scale: a measure of individual differences. *J. Nonverbal Behav.* 21 (2), 131–154.
- Dube, L.F., Black, G.S., 2010. Impact of national traumatic events on consumer purchasing. *Int. J. Consum. Stud.* 34 (3), 333–338.
- Drury, J., Cocking, C., Reicher, S., 2009a. Everyone for themselves? A comparative study of crowd solidarity among emergency survivors. *Br. J. Soc. Psychol.* 48 (3), 487–506.
- Drury, J., Cocking, C., Reicher, S., 2009b. The nature of collective resilience: survivor reactions to the 2005 London bombings. *Int. J. Mass Emerg. Disasters* 27 (1), 66–95.
- Dynes, R.R., 2003. Finding order in disorder: continuities in the 9–11 response. *Int. J. Mass Emerg. Disasters* 21 (3), 9–23.
- Fackler, M., 2012, January 21. Japanese struggle to protect their food supply. *New York Times*. (<http://www.nytimes.com/2012/01/22/world/asia/wary-japanese-take-food-safety-into-their-own-hands.html>).
- Fischer, M., Völckner, F., Sattler, H., 2010. How important are brands? A cross-category, cross-country study. *J. Mark. Res.* 47 (5), 823–829.
- Fishbein, M., Ajzen, I., 1975. *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*. Addison-Wesley, Reading, MA.
- Fornell, C., Johnson, M.D., Anderson, E.W., Cha, J., Bryant, B.E., 1996. The American customer satisfaction index: nature, purpose, and findings. *J. Mark.* 60 (4), 7–18.
- Foster, W.E., Just, R.E., 1989. Measuring welfare effects of product contamination with consumer uncertainty. *J. Environ. Econ. Manag.* 17 (3), 266–283.
- Frank, B., 2012. Consumer attitudes and intentions towards fast food restaurants: how do teenagers differ from adults? *Manag. Serv. Qual.* 22 (3), 260–282.
- Frank, B., Abulaiti, G., Enkawa, T., 2012. What characterizes Chinese consumer behavior? A cross-industry analysis of the Chinese diaspora in Japan. *Mark. Lett.* 23 (3), 683–700.
- Frank, B., Enkawa, T., Schvaneveldt, S.J., 2014a. How do the success factors driving repurchase intent differ between male and female customers? *J. Acad. Mark. Sci.* 42 (2), 171–185.
- Frank, B., Enkawa, T., Schvaneveldt, S.J., Herbas Torrico, B., 2015. Antecedents and consequences of innate willingness to pay for innovations: understanding motivations and consumer preferences of prospective early adopters. *Technol. Forecast. Soc. Chang.* 99, 252–266.
- Frank, B., Herbas Torrico, B., Enkawa, T., Schvaneveldt, S.J., 2014b. Affect vs. cognition in the chain from perceived quality to customer loyalty: the roles of product beliefs and experience. *J. Retail.* 90 (4), 567–586.
- Frank, B., Schvaneveldt, S.J., 2014. Self-preservation vs. collective resilience as consumer responses to national disasters: a study on radioactive product contamination. *J. Conting. Crisis Manag.* 22 (4), 197–208.
- Frey, D., 1986. Recent research on selective exposure to information. In: Berkowitz, L. (Ed.), *Advances in Experimental Social Psychology* vol. 19. Academic Press, New York, pp. 41–80.
- Grande, J., Bjørnstad, E., Wilson, M., Hanley, N., 1999. Assessment of consumer risk attitudes and behaviour related to countermeasures and radioactive contamination of food, CESER Project Report. University of Stirling, Stirling, UK. ([http://www.sbes.stir.ac.uk/research/projects/ceser/Consumer\\_report.pdf](http://www.sbes.stir.ac.uk/research/projects/ceser/Consumer_report.pdf)).
- Gunter, V.J., Aronoff, M., Joel, S., 1999. Toxic contamination and communities: using an ecological-symbolic perspective to theorize response contingencies. *Sociol. Q.* 40 (4), 623–640.
- Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E., 2010. *Multivariate Data Analysis*, 7th ed. Pearson, Englewood Cliffs, NJ.
- Healy, P.M., Palepu, K.G., 2001. Information asymmetry, corporate disclosure, and the capital markets: a review of the empirical disclosure literature. *J. Account. Econ.* 31 (1–3), 405–440.

- Ito, Y., 2015, April 5. Fukushima cotton's appeal. Tokyo Shimbun (translated to English by Japan for Sustainability). ([http://www.japanfs.org/en/news/archives/news\\_id035223.html](http://www.japanfs.org/en/news/archives/news_id035223.html)).
- Jackson, P.L., Meltzoff, A.N., Decety, J., 2005. How do we perceive the pain of others? A window into the neural processes involved in empathy. *NeuroImage* 24 (3), 771–779.
- Kunzelman, M., 2013, September 30. BP trial looks at how much oil spilled from well. *Boston Globe*. (<http://www.bostonglobe.com/business/2013/09/30/acused-lying-government-during-gulf-oil-spill/BsYRA06CrfrGvGtzR93EBP/story.html>).
- Langer, E.J., 1989. *Mindfulness*. Addison-Wesley, Reading, MA.
- Levine, M., Thompson, K., 2004. Identity, place, and bystander intervention: social categories and helping after natural disasters. *J. Soc. Psychol.* 144 (3), 229–245.
- Levy, J.K., Gopalakrishnan, C., 2010. Promoting ecological sustainability and community resilience in the US Gulf Coast after the 2010 Deepwater Horizon oil spill. *J. Nat. Resour. Policy Res.* 2 (3), 297–315.
- Lindell, M.K., Whitney, D.J., 2001. Accounting for common method variance in cross-sectional research designs. *J. Appl. Psychol.* 86 (1), 114–121.
- Mawson, A.R., 2005. Understanding mass panic and other collective responses to threat and disaster. *Psychiatry: Interpers. Biol. Process.* 68 (2), 95–113.
- Miller, D.C., Byrnes, J.P., 1997. The role of contextual and personal factors in children's risk taking. *Dev. Psychol.* 33 (5), 814–823.
- Podsakoff, P.M., MacKenzie, S.B., Lee, J.-Y., Podsakoff, N.P., 2003. Common method biases in behavioral research: a critical review of the literature and recommended remedies. *J. Appl. Psychol.* 88 (5), 879–903.
- Potts, R., 2012. Evolution and environmental change in early human prehistory. *Ann. Rev. Anthropol.* 41, 151–167.
- Sampei, Y., Aoyagi-Usui, M., 2009. Mass-media coverage, its influence on climate-change issues, and implications for Japan's national campaign to reduce greenhouse gas emissions. *Glob. Environ. Chang.* 19 (2), 203–212.
- Singh, J., Sirdeshmukh, D., 2000. Agency and trust mechanisms in consumer satisfaction and loyalty judgments. *J. Acad. Mark. Sci.* 28 (1), 150–167.
- Slovic, P., Finucane, M., Peters, E., MacGregor, D.G., 2004. Risk as analysis vs. risk as feelings: some thoughts about affect, reason, risk, and rationality. *Risk Anal.* 24 (2), 1–12.
- Turner, J.C., 1982. Toward a cognitive redefinition of the social group. In: Tajfel, H. (Ed.), *Social Identity and Intergroup Relations*. Cambridge University Press, Cambridge, UK, pp. 15–40.
- Turner, J.C., Hogg, M.A., Oakes, P.J., Reicher, S.D., Wetherell, M.S., 1987. *Rediscovering the Social Group: A Self-Categorization Theory*. Blackwell, Oxford, UK.
- Turner, R.H., Killian, L.M., 1987. *Collective Behavior*, 3rd ed. Prentice-Hall, Englewood Cliffs, NJ.
- Verplanken, B., Hofstee, G., Janssen, H.J.W., 1998. Accessibility of affective versus cognitive components of attitudes. *Eur. J. Soc. Psychol.* 28 (1), 23–35.