



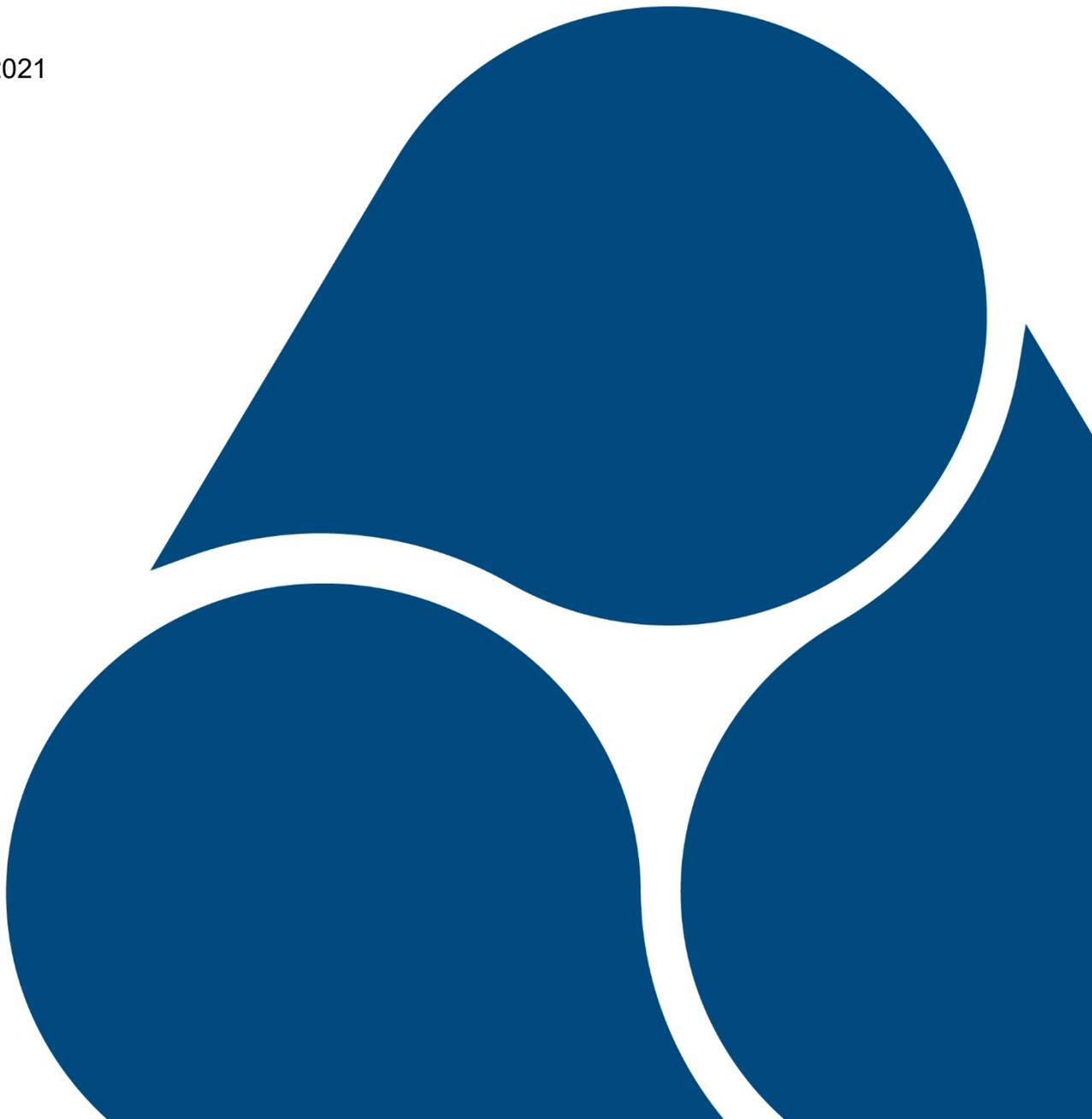
Office for Product
Safety & Standards

Public Perceptions of Smart Products

Attributions of Risk and Blame in Smart Product Failure

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Public Perceptions of Smart products: Attributions of Risk and Blame in Smart Product Failure

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The views expressed in this report are those of the authors, not necessarily those of the Office for Product Safety and Standards or the Department for Business, Energy & Industrial Strategy (nor do they reflect Government policy).

Introduction

When humans attribute blame to other human agents, they take into account the intentions and the causal role agents play in bringing about an outcome¹ as well as the capacity of those agents to achieve the task in question². When we delegate a task, it is common to also shift the blame for an unsuccessful outcome to the delegee³. The general tendency is to blame the last human agent in the causal chain that led to the outcome. When Suzie gives Billy a rock that Billy throws to break the neighbour's window, the neighbour will be mad with Billy, less so with Suzie or Billy's parents, but chances are she won't blame the rock. It seems obvious that the rock, although capable and causally critical, is missing the intentionality and foreseeability people require when attributing blame. However, the rock is also a natural artefact not a designed one. What happens when objects that are created to replace human action lead to undesired outcomes? Smart products, although an ill-defined category, are broadly designed artefacts to which users delegate tasks and are, in theory, as capable as their human masters in autonomously achieving those tasks^{4,5}. How do people distribute responsibility to the various stakeholders when smart products fail in the tasks delegated to them, causing harm in the process?

Unfortunately, people's attitudes towards smart products remain, despite their growing popularity, a poorly understood area. Given the complexity in the design and operation of such products, it is inevitable that there will be instances of failure, posing variable health and safety risks. This project examines how consumers perceive the risks associated with a variety of smart products (e.g. smart oven, smart toddler's highchair, smart pet feeder etc.), how they attribute blame when such products fail causing harm, and what actions they are prepared to take in response to such failures. Understanding the patterns underlying perceptions, attributions and putative actions will provide the regulator with an insight into the conditions under which consumers are more likely to blame themselves, avoid decisive action and reuse smart products despite failure, and the factors that make them more likely to blame third parties (manufacturer, retailer, regulator) and engage in punitive action.

Experiments

We conducted 3 online experiments on a representative sample of 1850 UK residents aged 18-82, drawn from an online panel (Prolific).

In all 3 experiments, each participant read about a single imaginary smart product, was asked to evaluate some of its attributes (propensity to buy, usefulness, complexity, risk/probability of causing harm, required precautions) and was presented with a failure scenario and asked for blame attributions and actions they'd be willing to take in response to the failure. The products were either fictional (smart ladder) or rare (smart diaper), to reduce the probability of participants having relevant prior experiences but were designed to appear as realistic as possible. An important constraint was that each product had to take over a task that is normally done by the user. The smart ladder, for example, alleviates the user from having to ensure its stability, since its sensors will inform the user when it is safe to climb. We tried to vary the products in terms of their complexity and risk, as well as the severity of their ensuing failure (Fig.1).

Product	Smart Ladder	Smart Oven	Smart Pet Feeder	Smart Diaper	Smart Mug	Smart Jacket
Smart Functionality	Estimates angle safety	Recognises food and configures cooking duration	Replenishes food automatically	Inspects diapers, alerts when diapers need changing	Monitors temperature, alerts when safe to drink	Adjusts heating temperature
Scenario	Falling and minor injuries	Burnt food and smoke in kitchen	Pet left hungry for one week	Mild infection from dirty diaper	Burnt tongue from a too hot beverage	Insufficient heating while user is far from home

Figure 1: The smart products used in Experiment 1, their smart features and the type of failure described in the scenarios. Similar products and scenarios were used in the other two experiments.

For many of the rated attributes, we also asked participants to evaluate the respective properties of the non-smart version of each product, to be used as a baseline. When asking for the complexity or associated risk, for example, we were interested in relative not absolute ratings. Since, ladders are inherently riskier than jackets, for example, the question of interest was whether smart versions increase or decrease risk, compared to their simple, non-smart counterparts.

Experiment 1: How price, care and risk perceptions affect blame attributions

As shown in Figure 2 below, for half of the products participants thought that the smart features make the product less safe to use (oven, diaper, jacket) and for the other half, smartness either increases or does not change the associated risks (pet feeder, ladder, mug).

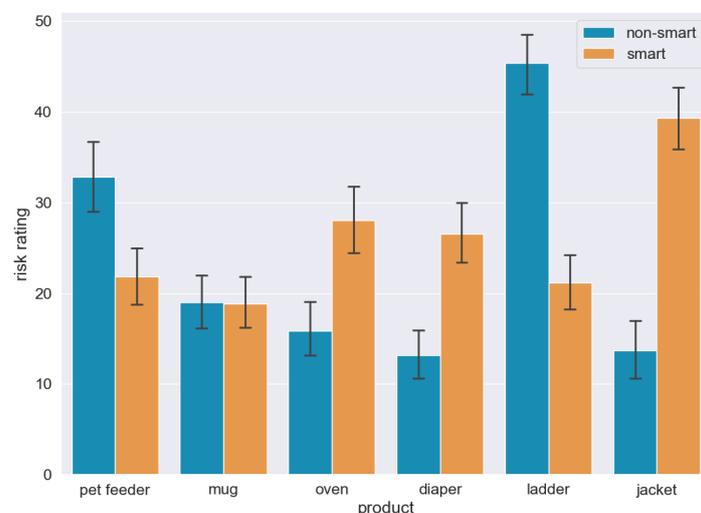


Figure 2: Perceptions of risk for smart and non-smart versions of products in Exp. 1

Irrespective of the product, price and care level, participants blamed the manufacturer more (75%) than the regulator (54%), themselves (50%) or the retailer (41%) - except from for the smart ladder where they blamed themselves as much as the manufacturer. They were generally more likely to reuse the product more carefully (87%) and less likely to take stronger actions including filing consumer (44%) and regulator (33%) complaints or pressing charges (29%).

The product's price strongly affected the likelihood of buying the product (dropping from 45% for the low-price level to 18% for the high-price level) but had no significant effect in blame attributions or the actions participants were willing to take. The care level, on the other hand, did affect both blame and action ratings: The more care was taken by the user, the lower the probability of blaming themselves and the higher the probability of blaming all other parties (see fig.3). Although the relationship between care level and actions wasn't as pronounced, participants were generally more likely to take decisive action when they had shown higher levels of care.

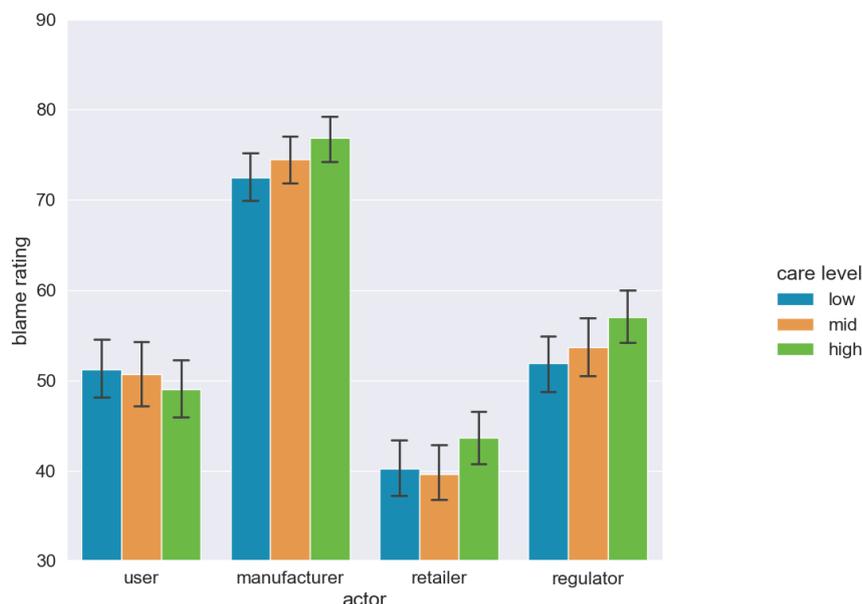


Figure 3: Attributions of blame after smart product failure for each involved party by level of precautions taken during usage in Exp.1

What was most interesting, however, was the way judgements of risk affected the blame and action ratings. As discussed, to acquire a relative rating of perceived risk, we subtracted the risk ratings for the smart version of each product from the risk ratings for its non-smart counterpart. Regressing this risk-increase variable against the blame ratings, showed a negative correlation when blaming the user and a positive correlation when blaming all other parties.

In other words, when the smart product was perceived to be increasing the risk relative to its non-smart counterpart, participants were more likely to blame third parties when things went wrong. Conversely, when the product appeared to be aimed towards safety (thus decreasing the risk compared to the non-smart counterpart), participants were more likely to blame themselves and less likely to blame the other parties. This role of increasing risk was also reflected in the actions participants were prepared to take in response to the failure described in the scenario: When the smart features were thought to make the product safer, participants were more likely to use it again (with more caution) and less likely to stop using it, return it or file complaints.

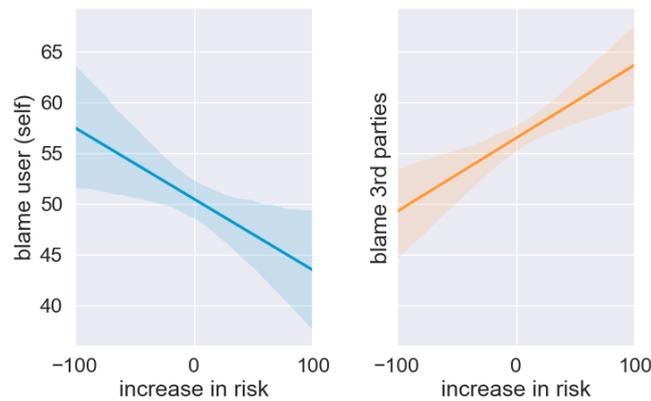


Figure 4: Attributions of blame to the user or third parties as the relative risk (perceived risk in smart version - perceived risk in simple version) increases.

Experiment 2: Do safety commitments decrease blame for third parties?

Given the importance of understanding the basis on which consumers would be motivated to follow up on product faults resulting from smart products, experiment 1 suggests that, against intuition, the presence of safety-oriented features makes consumers less likely to blame the manufacturer and other parties when things go wrong. To examine how robust this finding is, we created two versions for each product; one stressing how the smart features increase the product’s safety and another version that made no references to risk and where the smart features were instead geared towards simplifying a task. The aim here is to explicitly disentangle two different ways in which smart products could be marketed – as increasing safety (reducing risk) or increasing convenience.

For example, the convenient version of the smart iron automatically adjusts the temperature depending on the detected fabric, while the safe version switches off when it is left on the fabric for too long. The 3 products (iron, oven, highchair) that we included in this study aren’t immediately associated with risk but can evoke risk scenarios without great effort.

Unlike our expectations, participants were equally likely to blame third parties when the product was advertised as reducing risk (59.1%) or increasing convenience (58.2%) and statistically there was no difference in blame ratings between safety-oriented and convenience-oriented versions of products (fig.5).

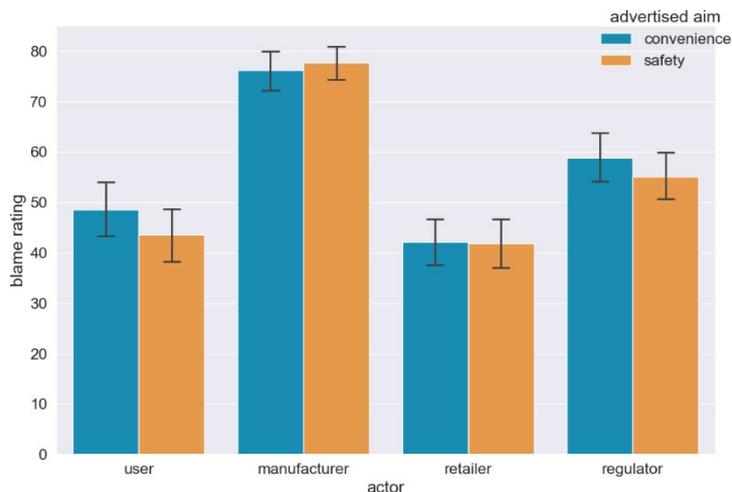


Figure 5: Blame ratings for the various parties depending on the advertised aim of the product in Exp.2.

However, a number of participants (24%) still thought that the safe versions of smart products were riskier than their non-smart counterparts, while a larger proportion (41%) thought that the convenient versions were less risky than their non-smart counterparts, indicating that our manipulation did not always work as intended. Repeating the main analysis of experiment 1 here, showed that the perceived increase in risk (the difference between the risk associated with the smart version and the risk associated with the simple version) was still predictive of blame attributions and in the same direction (though statistically significant only in the case of manufacturer). In other words, participants were again slightly more likely to blame third parties and take more aggressive actions when they thought that the smart features of the product made it riskier compared to the standard product.

Therefore, while, as far as the perceived risk increase is concerned, the main effect of experiment 1 was replicated, we did not observe a significant difference in blame attributions or action types, depending on the 'advertised' aim of the product. While it is possible that our aim manipulation did not work for all participants, another possibility is that the overt promise to increase safety has a counteracting effect: if consumers think that the manufacturer and/or the regulator are taking safety into account, they are more forgiving when something goes wrong, but this ceases to be the case when the product is explicitly advertised as less risky, thus overtly promising to increase safety.

Experiment 3: Do perceived product intentions affect blame attributions?

Given that in both studies we measured the perceived product aim either indirectly by comparing risk perceptions in smart vs non-smart products or by explicitly advertising safety features, in this final study we employed a more direct measure of perceived aim. Participants were asked to explicitly tell us whether they saw each product as aimed towards increasing convenience or safety, while product descriptions were kept relatively vague, omitting references to risk or safety. Moreover, for most questions we replaced the continuous scale format with a dichotomous forced-choice format, i.e. we asked participants to select whether, compared to the simple version, the smart features are more likely to cause harm or less, are more complicated or less and whether one should take more precautions when using the smart product or less. We used a wider variety of 9 products (ladder, oven, pet feeder, diaper, jacket, iron, highchair, fridge, lock) to ensure generalizability, thus ensuring that any observed effects will not be attributable to specific products.

As shown in figure 6 below, the main findings of the previous experiments were replicated. Participants were less likely to blame third parties for the failure when they judged that the product aimed to increase safety (more pronounced in the case of the manufacturer), when they thought that the smart product was less likely to cause harm compared to its non-smart counterpart, or when they thought it required the user to take less precautions. Similarly, participants were more likely to take aggressive actions in response to the failure, when they thought that the smart product was intended to increase safety or was in theory less likely to cause harm.

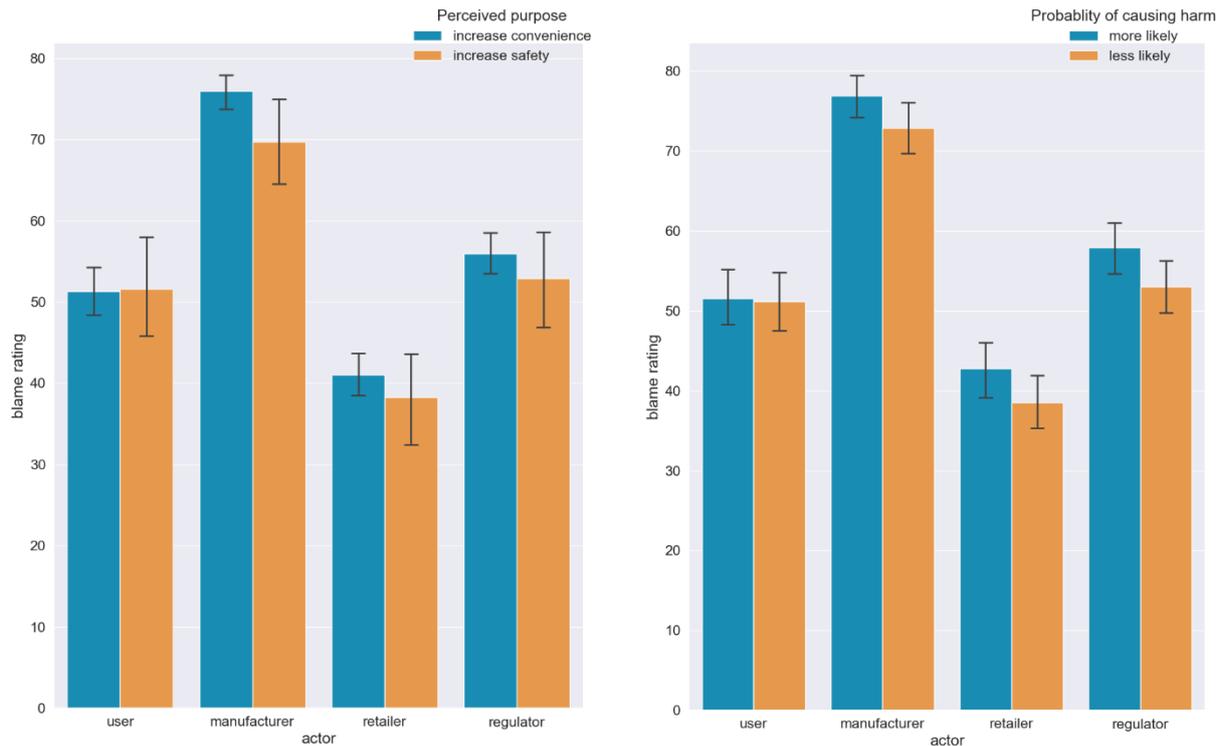


Figure 6: Blame attributions by perceived purpose (left) and perceived likelihood of causing harm compared to the simple version (right) in Exp.3.

Conclusions and suggestions

1. Following product failure, consumers blame third parties less when they perceive the smart product as being oriented towards increasing their safety than when it is oriented towards increasing efficiency (exp1 and exp3).
2. When the manufacturer explicitly advertises the safety of a smart product feature, the above trend is reversed, indicating that consumers adjust their blame attributions depending not only on their perceptions but also on what promises are made (exp2).
3. The less precautions consumers take when using a product, the more likely they are to blame themselves for a failure, even when it is unclear who caused the failure. Product price does not affect blame attributions (exp1).

The unintuitive findings (1) and (2) can be explained by the causal inferences people make when explaining the product's failure. People tend to assume that a smart product that appears to be safer than its non-smart counterpart is less likely to cause harm, thus its failure would most likely be due to themselves mishandling it. This is problematic for a regulator, as consumers may not report incidents if they misattribute blame to themselves rather than the manufacturer, leaving the regulator unaware of any safety issues. A possible solution is suggested by finding (3), that shows that manufacturers cannot reduce the blame assigned to them by advertising the safety of their products, since doing so is taken as a promise which invites more punitive action when broken. Therefore, we suggest the following:

1. Smart products, especially those aimed at increasing safety compared to their simple counterparts, should make transparent commitments about their primary aims. That way, consumers will be less likely to incorrectly blame themselves for the product's failure and more likely to report such incidents.
2. The degree of a smart-product's autonomy, and, relatedly, the minimum responsibilities resting with the consumer (e.g. conditions under which it can be left unsupervised) should be clearly communicated. Thus, consumers who take less precautions based on the autonomy of a smart product will not erroneously assume responsibility in the event of failure.

Future work is needed to identify in more detail the properties of smart products and the patterns of usage that lead to responsibility misattributions. Specifically, we suggest the following directions:

1. Compare responsibility attributions for the failure of smart products that differ in terms of their autonomy.
2. Study how people assign responsibility for the failure that results from the interaction of two or more smart products that make different safety-related claims.
3. Examine shifts in responsibility when consumers fail to take precautions, depending on how common these precautions are in the usage of the simple counterpart.
4. Study how perception of responsibility changes during the lifespan of a smart product and how initial instructions interact with consumers' repeated first-hand experience.

References

1. Lagnado DA, Channon S. Judgments of cause and blame: The effects of intentionality and foreseeability. *Cognition*. 2008;108(3):754-770. doi:10.1016/j.cognition.2008.06.009
2. Gerstenberg T, Ullman TD, Nagel J, Kleiman-Weiner M, Lagnado DA, Tenenbaum JB. Lucky or clever? From expectations to responsibility judgments. *Cognition*. 2018;177:122-141. doi:10.1016/j.cognition.2018.03.019
3. Bartling B, Fischbacher U. Shifting the blame: On delegation and responsibility. *Rev Econ Stud*. 2012;79(1):67-87. doi:10.1093/restud/rdr023
4. Rijdsdijk SA. Smart Products - Consumer evaluations of a new product class. Published online 2006. Accessed June 15, 2021. <http://resolver.tudelft.nl/uuid:4de26144-3a89-4050-bec1-b6af72188634>
5. Rijdsdijk SA, Hultink EJ, Diamantopoulos A. Product intelligence: its conceptualization, measurement and impact on consumer satisfaction. *J Acad Mark Sci*. 2007;35(3):340-356. doi:10.1007/s11747-007-0040-6

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