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# The influence of horizontal and vertical product attribute information on decision making under risk: The role of perceived competence

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ABSTRACT

Classical decision theory assumes that risk is negatively associated with the attractiveness of an option. Thus, it is not surprising that individuals may seek to reduce the level of risk associated with a purchase by choosing a product based on information that allows a direct evaluation of objective value. This research proposes that, under risk, individuals prefer to utilize information that they perceive themselves to be more knowledgeable as a result of a tendency toward favorable perceptions of their own competence, which could lead to choices with negative implications for one's own experienced utility. We demonstrate that, under higher levels of risk, decision makers increase their reliance on attributes that reflect their own personal preference (i.e., horizontal attributes) rather than on attributes that unambiguously indicates a superior product (i.e., vertical attributes) when making a choice. This result is reversed when knowledge about vertical attributes is increased.

## 1. Introduction

Imagine an individual shopping for a refrigerator. The choice of refrigerator may depend on a variety of factors, including product attributes that directly indicate the objective quality of the product (e.g., energy consumption), as well as product attributes that capture one's personal preference but do not necessarily indicate the objective quality of the product (e.g., appliance color). Imagine also that this individual may face a trade-off between these two classes of features. For example, given a fixed budget or product availability, he or she may need to choose between a more energy efficient refrigerator featuring a color this buyer deems less desirable, and a less energy efficient refrigerator featuring a color this buyer deems as more desirable. Now assume that this purchase decision occurs during a clearance sale where all sales are final, a situation that raises the perceived risk associated with the choice situation. Would the individual in this example choose the refrigerator that is more energy efficient but with a less desirable color, or the refrigerator that is less energy efficient but featuring a more desirable color?

The situation above describes a consumer facing a trade-off between two very distinct classes of product attributes that have long been of interest to researchers in economics (Gabszewicz & Thisse, 1986; Sutton, 1986; Tremblay & Polasky, 2002) and more recently in marketing (Spiller & Belogolova, 2016), namely vertical and horizontal attributes. Vertical attributes are those for which there is a general consensus among all consumers over the preference ordering of attribute levels, and thus provide a basis for individuals to objectively rank products based on quality (Chen, 2009). For instance, if 100 consumers were asked to rank bed sheets ranging from 150 to 400 thread count in terms of softness (an objective quality[1]), the vast majority of consumers should rank the sheets closer to a 400 thread count at the top of the ranking and the ones closer to a 150 thread count at the bottom of the ranking. Assuming that softness of bed sheets is a desirable feature that positively correlates with thread count, the ranking of preference for sheets should strongly and positively correlate with the ranking of thread count. Alternatively, horizontal attributes are those for which the preference ordering depends on the particular consumer and, as a consequence, rankings are strongly influenced by personal taste (Anderson, 2008). For instance, if the same 100 consumers were asked to rank bed sheets in terms of desirability of the color or pattern of the fabric, it is very likely that there would be a great level of disagreement in the final ranking given that some consumers may prefer taupe over grey whereas other consumers may prefer the opposite.

In this research, we propose that the answer to the question about

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[1] We use the term "objective quality" to remain consistent with the terminology used in the economics literature when discussing vertical versus horizontal attributes. In the context we study, quality implies attribute performance with respect to delivering the benefit rather than the extent to which the product is poorly/well made.

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the choice between the two refrigerators in the opening example depends on how one makes decisions when the decision invokes a perception of risk, defined as one's perception of the level of uncertainty and undesirability regarding the consequences of a decision (Cox & Rich, 1964; Dowling, 1986; Dowling & Staelin, 1994; Fedorikhin & Cole, 2004). Given that the standard assumption in the literature of decision making under risk implies that risk is negatively associated with the attractiveness of an option (Gao, Sirgy, & Bird, 2005; March & Shapira, 1987; Weber, Anderson, & Birnbaum, 1992), one way an individual can reduce perceived risk is by focusing on information that increases the precision of estimates regarding the quality of each product's objective value relative to all other available options (Conchar, Zinkhan, Peters, & Olavarrieta, 2004; Erdem & Swait, 2004; Park, Lennon, & Stoel, 2005; Peterson & Merino, 2003; Taylor, 1974). Based on this line of reasoning, it is plausible to expect that decision making under risk is more likely to be based on information that provides an objective ranking-based standard for product evaluation (e.g., energy efficiency, a vertical product attribute) rather than on information that does not allow for an objective product evaluation (e.g., refrigerator color, a horizontal product attribute). As a result, the consumer in the opening example should be more likely to choose the more energy efficient refrigerator with the less preferred color when facing higher (vs. lower) levels of risk.

An alternative account of how one would go about choosing between the refrigerators when facing risk is based on ambiguity aversion (Ellsberg, 1961; Heath & Tversky, 1991; Klein, Cerully, & Monin, 2010). This effect suggests that the tendency to have favorable perceptions of their own competence may drive individuals to more positively value an attribute that reflects their own preference (i.e., one that they may perceive themselves to be more knowledgeable about) when making a decision under risk, as such information can help increase one's feeling of certainty that the consequences of the decision are favorable (Cox, 1967). As a result, greater levels of perceived risk could lead the consumer in the opening example to more heavily base their purchase decision on the color of the refrigerator than on energy efficiency, increasing the likelihood of choosing the less energy efficient refrigerator with the more preferred color.

In this research, our goal is to broaden the knowledge about how perceived risk influences the decision-making process when facing a trade-off between horizontal attributes and vertical attributes. We derive novel predictions stemming from the literature on information evaluability and value sensitivity (e.g., Conchar et al., 2004; Hsee & Zhang, 2010) and find in four experiments an increased reliance on horizontal (vs. vertical) attribute information as perceptions of risk increase. This shift is consistent with the predicted competence mechanism (directly tested in Experiment 1B and 2), even though individuals perceive vertical attributes as more valuable in increasing the chance of choosing the product that provides the highest utility (pretest). Our results also show that this shift is robust to varying types of product categories, horizontal attributes, and vertical attributes. Taken together, these results are novel to the literature and provide a parsimonious account that can improve our knowledge of the boundaries of information utilization and decision making under risk.

## 2. Conceptual development

The selection of products and services often involves dealing with risk as one chooses a single option from a large number of available alternatives for which the consequences of the choice are generally unknown (Taylor, 1974). In addition to the inherent risk associated with the selection of an option, choosing one of the alternatives often requires decision makers to make trade-offs between product attributes (Bettman, Luce, & Payne, 1998). Generally speaking, the literature provides two distinct streams of research that shed light onto our understanding of consumer decision making that involves value trade-offs and risk. In the following sections, we provide the theoretical arguments from both perspectives (i.e., information evaluability vs. ambiguity aversion), and develop two competing hypotheses based on the predictions derived from each theoretical argument.

### 2.1. Decision making under risk: Information-evaluability perspective

One general assumption in the literature on decision making under risk is that individuals tend to prefer larger over smaller expected returns and smaller risks over larger risks (Pratt, 1964), resulting in a stronger preference for alternatives that provide the highest estimation of product utility in the face of greater levels of risk. Indeed, it is well established that individuals may try to reduce the perceived risk associated with an expected outcome by evaluating information that can be helpful in making more precise estimates of product value (Conchar et al., 2004; Erdem & Swait, 2004; Lee, Herr, Kardes, & Kim, 1999; Park et al., 2005; Peterson & Merino, 2003).

When estimating product value, decision makers can rely on a multitude of product attributes that can be broadly classified into horizontal and vertical product attributes. Horizontal attributes are defined as those for which the preference ordering of attribute levels depends on the particular consumer (i.e., it reflect one's personal preference), and does not necessarily indicate the objective quality of the product (Gabszewicz & Thisse, 1986). To illustrate, whereas someone may prefer a black finish on a refrigerator or a modern design for a watch, the performance of these products in terms of the ability to store and preserve food or to function at deeper sea depths does not vary relative to a white refrigerator or a watch featuring a traditional design. In contrast, vertical attributes are those for which there is a general consensus among all consumers over the preference ordering of attribute levels, thus providing a clear ranking-based standard for evaluating the product's performance (Sutton, 1986; Tremblay & Polasky, 2002). For example, all else being equal, very few people would disagree that a digital camera featuring 18.0-megapixel photo resolution provides higher quality images than one featuring 13.0-megapixel resolution. Overall, the key difference between these two types of attributes lies in whether there is a variance in individuals' judgments about the relationship among different attribute levels.

Although the marketing literature has often used the term objective/subjective attributes in parallel with horizontal/vertical attributes, we believe there is an important theoretical distinction between the two. Specifically, objective/subjective product attributes primarily relate to perceived unambiguity in the interpretation of information (Pan & Lehmann, 1993). On the other hand, horizontal/vertical product attributes primarily relate to perceived consensus of information, which is conceptually different to the ‘concreteness’ of information with regards to how they are interpreted (e.g., people objectively know what $400 is, but whether they interpret that as expensive or cheap is subjective), as it involves judgments about the relationship among different attribute levels. Prior research in lateral position effects (e.g., Chae & Hoegg, 2013; Romero & Biswas, 2016) further illustrates the importance of examining the way in which consumers mentally organize and rank information about product attributes. For example, Chae and Hoegg (2013) find that the visual positioning of images leads to a significant difference in consumer attitude toward the advertised products, as the relative location of the information (e.g., high-low, left-right) is used during product evaluation.

With the distinct characteristics of each class of product attributes in mind, a case can be made that decision makers should show increased sensitivity to vertical attribute information rather than horizontal attribute information in the face of greater levels of risk, because such attributes allow one to objectively identify the product with the highest utility. Hsee and Zhang's (2010) General Evaluability Theory also provides a theoretical basis for this prediction in the context of joint evaluations. Corroborating the core tenets of this theory, Hsee, Zhang, Wang, and Zhang (2013) find individuals to be more sensitive to pieces of information that allow for a direct comparison of their relative

magnitude when comparing multiple options simultaneously, rather than evaluating each option individually. To be specific, attributes for which there is a general agreement of the desirable directionality of values (e.g., when larger values are always better than smaller values, as is often the case for vertical attributes) exert greater influence when people compare options simultaneously because these attributes make it is easier for one to judge which is the better option (Hsee, Loewenstein, Blount, & Bazerman, 1999). Following this line of reasoning, it can be hypothesized that:

**H1.** Decision makers' reliance on vertical (horizontal) attributes should increase (decrease) as perceived risk increases

### 2.2. Decision making under risk: Ambiguity aversion and the competence hypothesis

Alternatively, prior research has proposed information-processing limitations that may hinder the decision-making process in terms of accurately estimating the utility of each available option and selecting the option that most likely maximizes product value (Bettman et al., 1998). For instance, when choice formulations involve a trade-off between risk and expected return, it has been found that decision makers tend to prefer an option with fewer unknown elements than one with many unknown elements (Bao, Zhou, & Su, 2003; Ellsberg, 1961; Heath & Tversky, 1991; Klein et al., 2010). This phenomenon, often referred to as ambiguity aversion (Ellsberg, 1961), implies that individuals prefer known-risk over unknown-risk alternatives. In other words, the final choice not only depends on the degree of risk involved but also on the amount of precision with which the expected return can be assessed (Ellsberg, 1961). While ambiguity aversion also assumes that risk is negatively associated with the attractiveness of an option, it makes unique predictions with respect to choice under risk. According to this phenomenon, people prefer alternatives in which the estimation of expected outcomes provides greater clarity *regardless of the actual outcome* (Ellsberg, 1961) because such alternative increases an individual's subjective feeling of certainty that the consequences of the decision may be favorable (Cox, 1967).

One popular account for ambiguity aversion is the competence hypothesis (Heath & Tversky, 1991). According to this hypothesis, ambiguity aversion results from people having favorable perceptions of their own competence (i.e., one's general knowledge or understanding of the relevant context), as it allows people to better justify their decisions regardless of the actual outcome. Such perceived competence may influence decision making under risk because people generally prefer outcomes over which they perceive to exert control (Goodie, 2003; Howell, 1971; Klein & Kunda, 1994), which also leads to optimism about the outcomes resulting from controllable situations (Harris, 1996). This prediction is supported by research showing that people are more likely to bet in domains with which they are more familiar (Brun & Teigen, 1990) and in contexts where they consider themselves more knowledgeable (Heath & Tversky, 1991; Klein et al., 2010).

We argue that favorable views of one's own competence can lead to important shifts in preferences when decision makers face trade-offs between horizontal and vertical attributes. Given that horizontal attributes capture one's subjective valuation that is reinforced through increased familiarity and experience with the given context (Carpenter & Nakamoto, 1989; Kahneman & Snell, 1988; Tversky & Kahneman, 1974), they may be perceived as information about which individuals deem to be more valuable in increasing the level of certainty that the consequences of the decision may indeed be favorable. Based on the rationale underlying the competence hypothesis, we thus propose that individuals' tendency to have favorable perceptions of their own competence may lead them to place greater emphasis on horizontal attributes that reflect their own preference rather than vertical attributes that provide relative and objective values.

**H2.** Decision makers' reliance on horizontal (vertical) attributes should increase (decrease) as perceived risk increases.

We test these contrasting predictions in four experiments. In Experiment 1A, we find that the preference for products featuring a more desirable horizontal attribute and a less desirable vertical attribute increase as the level of perceived risk increases, providing support for Hypothesis 2. In light of this evidence, we directly test the competence mechanism in Experiment 1B by showing that reliance on certain product attributes stems from favorable perceptions of one's own competence in making a purchase decision. As prior research asserts that an individual's feeling of competence may be enhanced via increased knowledge in the given context (Heath & Tversky, 1991), we provide additional evidence for the competence mechanism in Experiment 2 by showing that reliance on certain product attributes may change when perceived competence is enhanced through information acquisition. In Experiment 3, we rule out alternative explanations based on post-decision utility maximization and social biases.

## 3. Experiment 1

Experiment 1 was designed to test whether individuals shift the focus of their decision from horizontal attributes to vertical attributes or vice versa as the risk associated with the purchase increases. To conduct this test, we presented participants with a choice between two refrigerators, featuring a trade-off between different appliance colors (horizontal attribute) and varying amounts of monetary savings associated with energy efficiency (vertical attribute). If reliance on vertical attributes increase in the face of greater levels of perceived risk, as predicted by Hypothesis 1, we should observe an increase in the proportion of participants who choose the refrigerator offering a larger amount of savings associated with energy efficiency but featuring the less preferred color. Alternatively, if reliance on horizontal attributes increase in the face of greater levels of perceived risk as predicted by Hypothesis 2, we should observe an increase in the proportion of participants who choose the refrigerator featuring the preferred color but offering a smaller amount of savings associated with energy efficiency.

### 3.1. Experiment 1A

#### 3.1.1. Participants

Seventy-three participants (average age = 32; 52% female) were recruited from Amazon's Mechanical Turk (MTurk) in exchange for monetary compensation.

#### 3.1.2. Design, procedure, and stimuli

Participants were randomly assigned to one of the two conditions of the between-subjects perceived risk-level factor (high vs. low). We manipulated perceived risk via retailer return-policy leniency, which is based on actual return policy statements currently used by major retailers. Whereas multiple types of risk may exist (i.e., performance, financial, social, psychological, and physical; Jacoby & Kaplan, 1972), our risk manipulation was developed to better reflect financial and performance risk, which is known to explain more variation of overall perceived risk than any other type of risk (Kaplan, Szybillo, & Jacoby, 1974). Participants in the high-risk condition were presented with a stringent return policy (i.e., exchange-only policy with no cash refunds, return period within 14 days from the date of purchase, original receipt required, return shipping charges and restocking fees the responsibility of the customer). Participants in the low-risk condition were presented with a lenient return policy (i.e., full cash refund, return period within one year from the date of item receipt, no receipt information required, no payment of shipping charges or restocking fees).

The two levels of appliance color selected were black versus white, and the two levels of annual energy savings were $219 versus $279.

Since it is critical that participants face a trade-off between the horizontal and the vertical attribute to test the competing hypotheses, we asked participants for their color preference (masked with multiple questions regarding preferences for other refrigerator features to decrease attribute salience) when purchasing a refrigerator prior to the risk manipulation and used that information to create trade-offs between the product options. The choice of levels for the vertical attribute was based on a pretest that showed a stronger preference for refrigerators with an annual energy savings of $279 than for refrigerators with an annual energy savings of $219 ($z = 3.85$, $p < .001$). Accordingly, the resulting product profiles between which participants made choices were a refrigerator featuring the less desirable color that generates annual energy savings of $279, and a refrigerator featuring the more desirable color that generates annual energy savings of $217. We also asked participants to recall their preferred appliance color at the end of the experiment as an attention check.

The cover story informed participants about a shopping scenario involving the purchase of a refrigerator. Participants were asked to imagine that they were shopping for a refrigerator and had the chance to consider various models. Participants were then informed that, after examining several refrigerators, they were able to narrow down their choice set to two refrigerators that were within their budget and most closely matched the energy efficiency specifications and appliance colors they had in mind. Participants then reviewed the return policy and product information and were asked to choose between the two refrigerators.

The refrigerators were shown side by side on the computer screen, and the presentation included information about the color of the appliance and the amount of annual energy saving. The order of the side of the screen on which each product and its respective description appeared was randomized per participant. Immediately following the presentation of information about the return policy and the two refrigerators, participants were asked to assume they had the financial resources to buy the refrigerator and indicate the refrigerator of their choice. Following the choice, perceived risk associated with the purchase was assessed on a scale ranging from 1 (not at all risky) to 7 (very risky).

#### 3.1.3. Results

Seven participants failed the attention check by incorrectly recalling their preferred appliance color and were removed from the sample because they might not have faced an actual trade-off between the vertical and horizontal attribute. The proportion of participants who failed the attention check did not vary systematically across levels of the risk factor ($p > .60$). An analysis of the perceived risk showed that participants in the high-risk condition perceived higher levels of risk involved in the purchase situation ($M_{\text{High\_Risk}} = 4.62$) than those in the low-risk condition ($M_{\text{Low\_Risk}} = 2.31$; $t(64) = 7.24$, $p < .001$), indicating a successful manipulation of perceived risk. The analysis of choice proportions revealed a statistically significant effect of the risk factor on the choice of refrigerator, with participants choosing the refrigerator with the more desirable color and smaller amount of energy savings more often in the high-risk condition (52.9%) than in the low-risk condition (28.1%; $\chi^2$ (1) = 4.20, $p < .05$). Overall, this result lends support for Hypothesis 2, which predicts increased reliance on horizontal (vs. vertical) attributes when one faces greater levels of risk.

#### 3.1.4. Discussion

The results of Experiment 1A provide initial evidence indicating that participants facing greater levels of risk were more likely to make a choice based on horizontal product attribute information (i.e., appliance color). Overall, this finding is consistent with the competence account (H2) and inconsistent with the information-evaluability account of choice under risk (H1).

Although the evidence from Experiment 1A is consistent with the claim that individuals rely on information that is perceived to be more valuable in increasing the subjective feeling of certainty that the consequences of a decision may indeed be favorable when a choice is made in the presence of risk, the evidence supporting the proposed mechanism (i.e., perceived competence) may not be unequivocal. To further examine the proposed underlying mechanism, Experiment 1B aimed to show that reliance on certain types of attributes stems from favorable perceptions of one's own competence in a given context.

### 3.2. Experiment 1B

In Experiment 1B ($N = 251$; average age = 34; 57% female), we further examined the proposed underlying mechanism through moderation by showing that reliance on horizontal product attribute information indeed stems from favorable perceptions of one's own competence in making a purchase decision. Specifically, we included a question in the later part of the survey that captures one's level of perceived competence with respect to purchasing a product (adapted from Williams & Deci, 1996), measured on a seven-point scale ('1 = Not at all true' to '7 = Very true') following the questions "I am capable of buying a good quality product," "I am able to achieve my goals in buying a good quality product," and "I am able to meet the challenges of buying a good quality product."

Although our use of a self-selection procedure (i.e., indication of color preference) in Experiment 1A was driven by the importance of having participants face a trade-off between the two product attributes, it could be possible that pre-exposure to the horizontal attribute information increased the salience of this attribute, thus increasing the selection of the product with a preferred color when faced with greater levels of risk. Similarly, it may also be the case that, under greater levels of risk, the likelihood of cognitive dissonance may increase, resulting in participants having greater levels of preference for the horizontal attribute in the high-risk condition to maintain consistency with their previous answers. To reduce the concern associated with these issues, we included a five-minute filler task in between the self-selection of preference for the horizontal attribute and the refrigerator-purchase scenario in which we gave participants a number of tasks to complete (e.g., writing about their day yesterday).

Finally, one other potential alternative to the findings in Experiment 1A could stem from the fact that perceptions of risk makes consumers want to treat themselves to something of their liking (e.g., choosing the color they like). Specifically, under high-risk conditions, consumers may choose a product that is aligned with their hedonic preferences, whereas in low-risk conditions, they may choose a product that provides utilitarian value. To rule out this alternative explanation, we asked participants to categorize their choice of refrigerator as 'primarily utilitarian' (i.e., useful, practical, functional, something that helps achieve a goal), as 'primarily hedonic' (i.e., pleasant, fun, something that is enjoyable and appeals to the senses), as 'both utilitarian and hedonic', or as 'neither utilitarian nor hedonic' (adapted from Dhar & Wertenbroch, 2000).

#### 3.2.1. Results

Twenty participants failed the attention check by incorrectly recalling their preferred appliance color and were thus removed from the sample because they might not have faced an actual trade-off between the vertical and horizontal attribute. The proportion of participants who failed the attention check did not vary systematically across levels of the risk factor ($p > .20$). An analysis of the perceived-risk measure (return policy) showed that participants in the high-risk condition perceived higher levels of risk involved in the purchase situation ($M_{\text{High\_Risk}} = 4.09$) than those in the low-risk condition ($M_{\text{Low\_Risk}} = 2.59$; $t(229) = 7.10$, $p < .001$), indicating a successful manipulation of perceived risk. For the measures of perceived competence, we created a composite mean score variable following a factor analysis, which showed that all items loaded on a single factor (eigenvalues indicated that the first factor explained 84.30% of the

variance) and a reliability analysis that indicated a high level of internal consistency (Cronbach's $\alpha > 0.90$).

A generalized linear model with a binary logistic link function analysis of the choice of refrigerator revealed a significant interaction between the risk factor and perceived competence[2] (Wald $\chi^2(9) = 17.32$, $p < .05$). To explore the nature of the interaction, we compared whether there were significant differences across the risk conditions at both low and high levels of perceived competence. As perceived competence is a continuous measure, we followed the procedures recommended by Krishna (2016) and performed a spotlight analysis at plus and minus one standard deviation from the mean of perceived competence using the software PROCESS by Hayes (2017). The planned contrast for participants at low levels of perceived competence ($M_{Low\_PC} = 4.90$) showed no statistically significant difference in their preference for the refrigerator with the more desirable color and smaller capacity between the high-risk condition (40.8%) and the low-risk condition (52.0%; 10,000 bootstrap samples, $\beta = 0.45$, SE = 0.39; bias-corrected bootstrap 95% confidence interval [CI] = −0.32 to 1.22). More importantly, the planned contrast for participants at high levels of perceived competence ($M_{High\_PC} = 6.80$) showed that participants displaying high levels of perceived competence were more likely to choose the refrigerator with the more desirable color and smaller amount of energy savings in the high-risk condition (61.1%) than in the low-risk condition (41.5%; $\beta = -0.79$, SE = 0.39; CI = −1.56 to −0.03), as shown in Fig. 1.

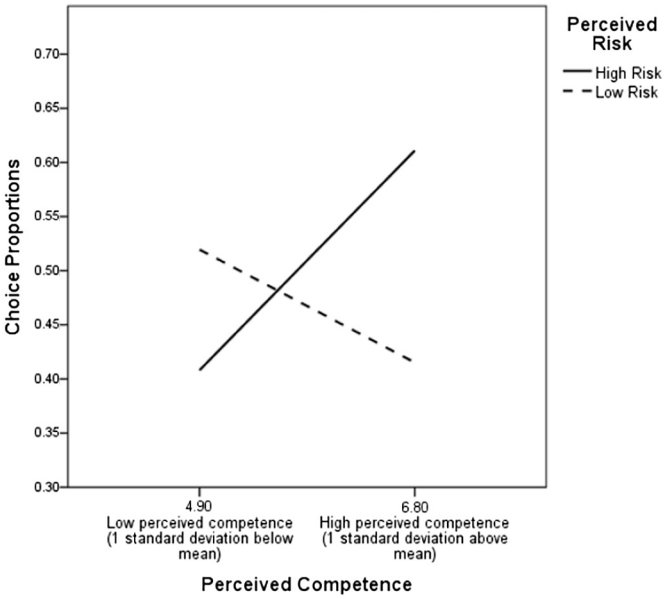


**Fig. 1.** Choice proportions for refrigerator with more desirable color and smaller amount of energy savings.

Interestingly, the main effect of perceived risk on consumer choice found in Experiment 1A was not replicated, in that the proportion of participants choosing the refrigerator with the more desirable color and smaller amount of energy savings in the high-risk condition (50.4%) did not differ significantly compared to the low-risk condition (49.6%; $\chi^2(1) = 0.36$, $p = .55$). Upon further examination of the data, we find that this result may be attributed to the choice decision of participants with low levels of perceived competence. More specifically, as participants became aware of one's own level of competence in purchasing a product while answering the perceived competence question in the survey, participants may have been reluctant to place a greater emphasis on horizontal attributes that reflect their own preference. As a result, there was a strong reversal in their choice decision (i.e., 59.2% chose the refrigerator with the less desirable color and larger capacity in the high-risk condition), which negated the overall effect of risk when combined with the choice proportions of participants with high levels of perceived competence. While the results of Experiment 1B show support for the underlying mechanism, this particular finding (i.e., reversal of choice proportions) calls for further investigation in future research, which we address in the 'Conclusions' section (i.e., could it be beneficial for firms to communicate with their consumers in a way that *reduces* their level of perceived competence?).

With regards to product classification in terms of utilitarian/hedonic benefits, there was no statistically significant difference ($\chi^2(2) = 2.10$, $p = .35$) between the classification of participant's choice of refrigerator in the high risk condition (primarily utilitarian = 57.3%, primarily hedonic = 8.5%, both utilitarian and hedonic = 34.2%) and the low risk condition (primarily utilitarian = 64.0%, primarily hedonic = 4.4%, both utilitarian and hedonic = 31.6%), providing evidence that rules out the alternative explanation of a greater preference of consumers in selecting a product that aligns with their hedonic (utilitarian) preferences under higher (lower) levels of risk.

#### 3.2.2. Discussion

The results of Experiment 1B provide evidence that supports the underlying mechanism (i.e., competence hypothesis) by showing that consumers' reliance on horizontal product attribute information indeed stems from favorable perceptions of their own competence. Experiment 1B also provides further support for Hypothesis 2 by ruling out the alternative explanation based on hedonic/utilitarian preferences.

## 4. Experiment 2

The goal of Experiment 2 was to provide additional evidence supporting the competence hypothesis and further examine the proposed underlying mechanism by showing that decision makers' reliance on certain product attributes may change via enhancements in one's own perceptions of competence. In general, the underlying rationale for Hypothesis 2 is that, as the level of risk increases, decision makers are more likely to rely on information that they consider themselves to be more knowledgeable or competent (Heath & Tversky, 1991). Thus, if the competence mechanism indeed drives choice under risk as predicted, we could also expect that an enhancement in perceived competence via increased knowledge (Heath & Tversky, 1991) of the vertical product attribute may lead to an attenuation of the pattern of results in Experiments 1A and 1B, as consumers would then utilize both horizontal and vertical attributes when attempting to increase the level of certainty that the consequences of the decision may indeed be favorable.

### 4.1. Pretests

Since we intended to manipulate competence with respect to the vertical attribute, we replaced the energy-efficiency attribute with a storage-capacity attribute given the difficulty of manipulating competence about monetary savings from energy efficiency. Additionally, as the support for either of the competing hypotheses relies on the assumption that the use of vertical-attribute information increases the chance of choosing the product that provides the highest utility, we ran a series of pretests to check whether individuals' lay theories indeed align with this assumption.

Results from the first pretest ($N = 17$; MTurk) showed that, all else equal (e.g., price, quality), overall capacity provided greater confidence of a good purchase than did appliance color ($M_{Overall\_Capacity} = 5.41$, $M_{Appliance\_Color} = 2.65$; $t(16) = 5.19$, $p < .001$), as measured by a

[2] To address the issue of quasi-complete separation due to the existence of empty cells in some combinations of the risk factor and perceived competence, we collapsed the following categories of perceived competence: 0 through 3.67, 4.33 and 4.67.

seven-point scale following the question "How confident would you feel that you made a good purchase if you based the purchase decision on the 'Appliance Color (Overall Capacity)' alone?" A second pretest ($N = 15$; MTurk) also confirmed that participants believe that the overall capacity attribute is more diagnostic in terms of predicting product performance. When asked "Which product feature helps you better predict that one refrigerator will perform better than the other?", participants' ratings were statistically significantly lower than the midpoint of the scale ($M = 2.27$, $t(14) = 4.84$, $p < .001$) on a scale ranging from 1 (definitely overall capacity) to 7 (definitely appliance color). Overall, these results show that participants' lay theories about their own expected choice behavior are consistent with the information-evaluability perspective, in that vertical-attribute information is more useful than horizontal-attribute information when attempting to objectively identify the product that offers the highest utility.

### 4.2. Method

#### 4.2.1. Participants

Eighty-two participants (average age = 38; 54% female) were recruited from MTurk in exchange for monetary compensation.

#### 4.2.2. Design, procedure, and stimuli

Participants were randomly assigned to a condition within the two levels of risk (high vs. low) by two levels of learned competence (learning vs. no-learning) between-subjects design. A key difference in the selection of stimuli compared to Experiment 1A was that we changed the levels of the horizontal attribute to increase the likelihood that participants would face a true trade-off without the need to collect upfront color preference to avert self-selection biases. For the horizontal attribute, the refrigerator colors were black and stainless steel, whereas for the vertical attribute the storage capacities were 24.1 cubic feet and 31.0 cubic feet. This selection was based on a series of pretests that showed a greater proportion of participants preferring a refrigerator with a stainless steel finish (81.0%) rather than a black finish (19.0%; $z = 5.12$, $p < .001$), and a refrigerator featuring larger storage capacity (31.0 cubic feet; 87.1%) rather than smaller storage capacity (24.1 cubic; 12.9%; $z = 6.16$, $p < .001$).

The experiment began by informing participants that they would take part in a series of unrelated studies. As a cover story, we introduced the first portion of the survey as a study aimed to assess how people process information they encounter in daily life. In the learned-competence condition, participants were asked to examine information about appliances (information extracted from a consumer buying guide). Each participant was presented with three pieces of information related to the purchase of a refrigerator, including information about the vertical product attribute (e.g., average storage capacity needed based on family size, number of shelves, and bins). The other two features, included to disguise the goal of the learning task, referred to style and design (e.g., the difference between alternative designs, such as side-by-side or French door), and the efficiency of refrigerators (e.g., what it means to be Energy Star certified). The goal of this learning phase was to improve participants' perceived competence about the vertical attribute by making them knowledgeable that a larger refrigerator capacity translates into an ability to store greater amounts of perishable items, which is an obvious improvement in product performance for a refrigerator (an assumption confirmed by the pretest which demonstrated stronger preference for larger storage capacity). In the no-learning condition, we asked participants to take part in a filler task unrelated to the key portion of the experiment that was calibrated to take roughly the same amount of time required to complete the learning task (i.e., a survey that involved a service recovery scenario of a telecommunications company).

Following the introductory task, participants were asked to take part in a second study involving the choice of refrigerator as in Experiment 1A using a shopping scenario with a risk manipulation based on return-policy leniency. Following this choice, we asked participants to rank order 10 product attributes they felt most knowledgeable about [ranging from 1 (most knowledgeable) to 10 (least knowledgeable)] when using the attributes to make a suitable purchase decision. In addition to the two target product attributes (color and capacity), we included eight other filler attributes (e.g., number of doors, ice maker, and Energy Star qualification) for participants to rank. The goal of this measure was to capture the participants' level of perceived knowledge about refrigerator attributes, particularly with regards to storage capacity.

### 4.3. Results

#### 4.3.1. Manipulation check

An ANOVA on the perceived risk measure showed no effect of the learning manipulation on risk ($F(1,78) = 0.65$, $p > .40$) and no interaction between the learning and the risk factors ($F(1,78) = 1.49$, $p > .20$). There was, however, a statistically significant effect of the risk factor on perceived risk with participants in the high-risk condition perceiving higher levels of risk involved in the purchase situation ($M_{\text{High\_Risk}} = 4.79$) than those in the low-risk condition ($M_{\text{Low\_Risk}} = 1.85$; $F(1,78) = 98.17$, $p < .001$), indicating a successful manipulation of perceived risk.

#### 4.3.2. Choices

A generalized linear model with a binary logistic link function analysis of the choice of refrigerator revealed a significant interaction between the risk and learning factors ($\beta = -2.49$, Wald $\chi^2$ (1) = 6.06, $p = .01$). In the no-learning condition, participants were more likely (marginally significant) to choose the refrigerator with the more desirable color and smaller capacity in the high-risk condition (45.0%) than in the low-risk condition (20.0%; Wald $\chi^2$ (1) = 3.07, $p = .08$), a result consistent with Hypothesis 2 and with the pattern of results found in Experiments 1A and 1B. In contrast, when participants' competence about the vertical product attribute was raised, we observed an unexpected reversal of the choice proportions found in Experiments 1A and 1B. Participants were less likely to choose the refrigerator with the more desirable color and smaller capacity in the high-risk condition (18.2%) than in the low-risk condition (45.0%; Wald $\chi^2$ (1) = 3.76, $p = .05$; Fig. 2). We had originally expected an attenuation of the effect in the learning condition, given that both the horizontal and the vertical attributes are now information about which participants consider themselves to be more knowledgeable or competent. However, we believe the reversal of choice proportions can be explained by the key properties of the vertical product attribute, in that the attribute provides a basis for individuals to objectively rank products based on

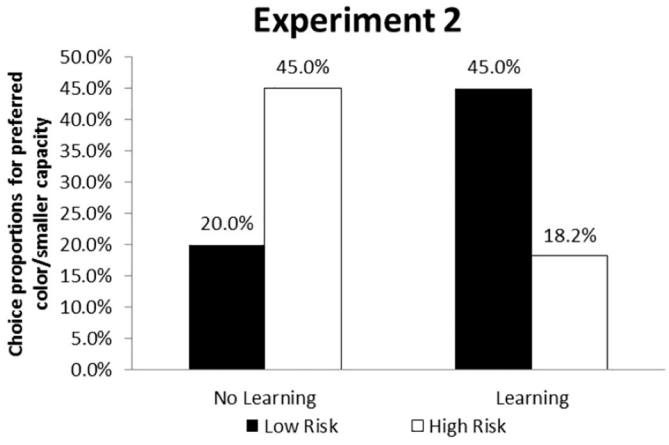


**Fig. 2.** Choice proportions for refrigerator with more desirable color and smaller capacity.

quality. In other words, given that the vertical product attribute with increased knowledge provides both an indication of a better quality product (unlike the horizontal attribute) and a subjective feeling of certainty that the consequences of the decision may be favorable (similar to the horizontal attribute), it could be the case that one's choice decision under higher levels of risk may be based on the vertical attribute when perceived competence about both attributes is judged to be similar.

#### 4.3.3. Process measure

To test the role of one's perceived competence on choice, we ran an ordinal logistic regression on the ranking of perceived knowledge about the vertical attribute (i.e., overall capacity). Ordinal logistic regression was used given that the dependent variable is ordinal and the magnitude of differences between ranks (e.g., first and second versus ninth and tenth) is likely non-constant. This analysis revealed a significant interaction between the risk and learning factors ($\chi^2$ (1) = 5.66, $p < .05$). An examination of the predicted probability of an upward increase in attribute ranking showed that, in the learning condition, overall capacity had a marginally significant probability of being ranked higher in the high-risk condition (49.6%) than in the low-risk condition (25.9%; $\chi^2$ (1) = 3.35, $p = .07$). In contrast, in the no-learning condition, overall capacity had a marginally significant probability of being ranked higher in the low-risk condition (37.5%) than in the high-risk condition (19.7%; $\chi^2$ (1) = 2.63, $p = .10$). This pattern of perceived knowledge of the vertical product attribute, along with the reversal in choice proportions across learning conditions, is consistent with the competence hypothesis.

### 4.4. Discussion

Experiment 2 replicated the results of Experiments 1A and 1B by showing increased reliance on the horizontal attribute as perceived risk increased when participants were not exposed to information that increased their competence with regards to the vertical product attribute (no-learning condition). Interestingly, this pattern of results emerged despite participants' own intuition that their choice should be based on vertical attributes because such attributes provide an objective means of evaluating a product among the choice options and increase the likelihood of selecting the option that provides the highest product utility, as found in the pretest. In contrast, when we exposed participants to information about the vertical attribute (learning condition), we observed that increases in the level of risk led participants to rely more heavily on the vertical attribute. This resulted in an increase in the choice proportion for the refrigerator featuring a larger capacity and less desirable color, reversing the pattern found in Experiment 1. Combined with the results from the attribute rankings, the results of Experiment 2 are consistent with the view that people's favorable perceptions of their own competence play an important role in choice under risk.

## 5. Experiment 3

One potential alternative to the findings in Experiments 1A–2 is that participants were more conservative in their choice decision under a strict return policy and therefore put more weight on the horizontal attribute information. For instance, it could be the case that an additional property of horizontal and vertical product attributes is that whereas the post-decision utility for a horizontal attribute may be well known (as it reflects personal preference), the post-decision utility of a vertical attribute might only be fully revealed after the product has been purchased and used. Thus, there is always a chance that the vertical attribute may turn out to be less useful than expected, thereby creating a situation where an individual may prefer to return a product that is superior on the vertical attribute. If the costs associated with the product return are high (i.e., high-risk situation), decision makers may play it safe and assign a larger weight to the horizontal attribute in guiding their choice. Alternatively, if the costs associated with the product return are low (i.e., low-risk situation), one may be willing to try out a product that is superior on the vertical attribute, knowing that the product can be returned if that attribute turns out to be less valuable than expected.

One can also argue that the results of Experiments 1A–2 may reflect one's tendency to act to gain approval from others and avoid criticism when facing greater levels of risk, thereby shifting the decision maker's attention toward attributes that may be more favorably judged by others. For example, it could be the case that participants perceived a greater likelihood that the horizontal attribute (i.e., appliance color) would be noticed by others in comparison to the vertical attribute (i.e., energy savings or capacity). This may have led participants to choose the refrigerator that is more likely to match the preference of a broader audience regarding the horizontal attribute, a form of social approval management.

In Experiment 3, we addressed these two alternative accounts and broadened the scope of our research by replacing the refrigerator-purchase scenario with a financial-investment scenario (i.e., a non-social context where the choice outcome is unlikely to be observed by others) where risk was manipulated via investment return (i.e., pure financial risk unrelated to one's ability to return the product).

### 5.1. Method

#### 5.1.1. Participants

Ninety-one participants (average age = 31; 32% female) were recruited from MTurk in exchange for monetary compensation.

#### 5.1.2. Design, procedure, and stimuli

Participants were randomly assigned to a condition within the two levels of perceived risk (high vs. low). The procedure was similar to the previous experiments with a few key differences. First, we used a financial-investment scenario in which participants were asked to choose between a financial institution featuring a less desirable sustainability initiative (horizontal attribute) and offering larger number of monthly transactions that were free of additional charges (vertical attribute), and a financial institution featuring a more desirable sustainability initiative and offering a smaller number of monthly transactions that were free of additional charges. Second, the pairing of attributes was generated based on participants' upfront stated preference for five different levels of the horizontal attribute to ensure that participants faced an actual trade-off between the products' attributes. We asked participants to rank order five corporate social responsibility initiatives (i.e., environmental responsibility, human and workplace rights, community support, youth giving, charitable giving) with which they preferred a financial investment institution to be involved (ranging from 1 (most preferable) to 5 (least preferable)). We then used the ranking of initiatives to create a trade-off between the two product attributes. In sum, participants were asked to choose between a financial institution featuring the least desirable sustainability initiative and offering 15 monthly transactions free of additional charges, and a financial institution featuring the most desirable sustainability initiative and offering 12 monthly transactions free of additional charges (a pretest showed a statistically significant preference for 15 transactions; $z = 7.63$, $p < .001$). Third, we manipulated risk via return on investment (i.e., financial risk) using high financial risk in the high-risk condition (i.e., 0% annual return with 50% chance and 10% annual return with 50% chance) and low financial risk in the low-risk condition (i.e., 5% annual return with 100% guarantee).

### 5.2. Results

#### 5.2.1. Manipulation check

Participants in the high-risk condition perceived higher levels of risk

involved in the investment situation ($M_{High\_Risk}$ = 4.65) than those in the low-risk condition ($M_{Low\_Risk}$ = 3.38; $t(89) = 4.39$, $p < .001$), indicating a successful manipulation of perceived risk.

#### 5.2.2. Choices

An analysis of the choice of financial institution revealed a statistically significant effect of the risk factor, with participants being more likely to choose the financial institution with the more desirable sustainability initiative and a smaller number of monthly transactions in the high-risk condition (67.4%;) than in the low-risk condition (33.3%; $\chi^2$ (1) = 10.56, $p < .001$). This pattern of choice proportions is consistent with the patterns found in the previous experiments showing a participant's increased reliance on horizontal (vs. vertical) attributes when faced with greater levels of risk, even in a context involving pure financial risk and a low likelihood of social biases.

## 6. Conclusions

Understanding how decision makers process relevant purchase information (e.g., product attribute information) when choosing from a number of competing alternatives is important as it improves our knowledge about decisions on key drivers of choice. As acknowledged in most cognitive decision-making models, however, it is important not only to uncover the type of product information upon which individuals base their decision when assessing the value of the offering, but also the relative importance of these pieces of information in the final choice (Bettman et al., 1998; Drolet, 2002; Johnson & Meyer, 1984; Markman & Loewenstein, 2010; Zhang & Markman, 2001). Our research adds to this stream of literature by examining choices of products and services featuring attributes that reflect one's personal preference (but do not necessarily indicate the objective quality of the product) – horizontal attributes – and attributes that provides a clear ranking-based standard for product evaluation – vertical attributes – under risk.

Our central finding is that decision makers shift the focus of their decision from attributes that unambiguously signal greater product utility (i.e., vertical attribute) to attributes that reflect personal preferences (i.e., horizontal attribute), or vice versa, depending on the level of perceived risk associated with a decision. We found across four experiments that when decision makers face trade-offs between these two classes of attributes, they tend to increasingly rely on horizontal attributes as the risk associated with the decision increases. This finding is, to some extent, at odds with prescriptions of the information-evaluability perspective, which predicts that decision makers should increase their reliance on attributes that provide direct and objective means of evaluating products in regards to product performance as a strategy to lower perceived risk and the subsequent potential of a negative outcome. Instead, we were more likely to observe this pattern of behavior when participants faced lower levels of risk. We proposed and tested an alternative hypothesis that individuals systematically rely on information that they perceive themselves to be more knowledgeable when making a choice involving greater levels of risk, which results from a tendency of having favorable perceptions of their own competence. Consistent with our theorizing, we found in a series of experiments that choice proportions for products offering a more desirable horizontal attribute but a less desirable vertical attribute increased as perceptions of risk associated with the decision increased.

Our findings provide evidence that this phenomenon is robust and reliable as the effect was observed across different choice contexts (product purchase and financial services), different types of horizontal attributes (appliance color and sustainability initiative) and vertical attributes (storage capacity, amount of annual energy savings, and number of monthly transactions free of additional charges), and different types of risk manipulations (product return policy and financial investment return). Furthermore, we presented evidence for the underlying mechanism. In Experiment 1B, we measured one's level of perceived competence and showed via moderation that consumers' reliance on horizontal attributes indeed stems from favorable perceptions of their own competence. In Experiment 2, we provided additional evidence for the competence mechanism by directly manipulating the level of competence on the focal product attribute and predicting choice. We also addressed alternative explanations, including information salience, cognitive dissonance, hedonic/utilitarian preferences, post-decision utility maximization, and social bias.

We believe that our work offers several important contributions to the literature. Applied to the stream of research on consumer decision making, these findings demonstrate the importance of better understanding the shift in focus on the class of information in choice contexts where decision makers may face value trade-offs and risk. Intuitively, an inherent logic underlying the core tenets of the information-evaluability perspective is that choice under risk may be driven by information that allows one to objectively identify the product offering the highest utility because the potential for a negative outcome resulting from that choice should decrease. We also observed that, in absence of attribute trade-offs, individuals believe that they should indeed rely more heavily on information that provides a clear ranking-based standard for the evaluation of options, rather than on information that does not assess the actual performance of the options (pretest reported in Experiment 2). Despite this inherent belief, the resulting formulation of choice under risk challenges this intuition and suggests that individuals may instead prefer to reduce risk by increasing the self-assessed feeling of certainty that that the consequences of their choices will be favorable and rely more heavily on their perceived competence. As a result of this risk-reduction strategy, we observed that decision makers may potentially make choices with negative implications for their own overall experienced utility.

Applied to practice, our research also provides valuable insights to business decision makers as we offer a better understanding of how choice can be influenced by variables that are under marketers' control. Overall, the results suggest that, all else being equal (e.g., production costs), horizontal differentiation may be an effective product differentiation strategy in some circumstances. For instance, our results could be of particular importance for products and services for which the value proposition is based on vertical attributes that individuals may not feel particularly knowledgeable (e.g., internet speed, processor capacity, camera resolution). When the consumer's choice involves dealing with comparably higher levels of risk, marketers should ensure that product options based on horizontal product attributes that pertain to aspects of individual taste (e.g., color, shape, design) are readily available. This would increase the probability of individuals purchasing products and likely benefit the firm if it already possesses the capability to offer such variety of products based on horizontal attributes at a relatively lower cost. Our findings may also be of use to advertisers and advertising agencies, which often have to select a subset of features when communicating their value proposition to the market.

Although our results are consistent with a competence-based perspective of choice formulation under risk, we believe that future research should test our proposition across different types of risk. The framing of our risk manipulation is, perhaps, more relevant to a subset (performance and/or financial risk) of the five types of risk (performance, financial, social, psychological, physical) that Jacoby and Kaplan (1972) identified. Although performance and financial risk explain more variation of overall perceived risk than any other type of risk (Kaplan et al., 1974), it would be interesting to further investigate decision-making processes under different classes of risk. For example, it could be the case that a purchase situation involving a comparison between branded versus generic products presents performance risk owing to the expected variability in the quality of non-branded products. In such cases, we may see results similar to those presented in current research. However, the salience of physical risk could be heightened when individuals with a focus on healthy behavior consider consuming packaged food products (e.g., nutritional information). Also, categories highly associated with the identification of social class (e.g.,

salience of status symbols) may elicit social risk. In these cases, the increase in perception of different risks may lead to results that differ from those found in this research.

One other area of future research is in the potential salience effect of perceived competence. As found in Experiment 1B, there was a reversal of choice proportions for the product offering a more desirable horizontal attribute but a less desirable vertical attribute under greater levels of risk across participants with low- and high levels of perceived competence. Thus, it would be interesting to examine the conditions in which firms may benefit from developing a marketing communication strategy that either reduces or enhances consumers' levels of perceived competence in purchasing a product. For instance, firms that sells products with greater competitive strength in vertical product attributes (e.g., electronic products), compared to those focused on horizontal product attributes (e.g., fashion industry), may benefit from communicating with their consumers in a way that reduces their own level of perceived competence.

Also, we acknowledge that while we have presented evidence for the underlying mechanism via moderation by measuring one's level of perceived competence (Experiment 1B), and by manipulating the level of competence on the focal product attribute and predicting choice (Experiment 2), a more direct process evidence has not been presented. Future research should further explore the underlying mechanism by directly assessing consumers' tendency to have favorable perceptions about their competence, as well as how much emphasis consumers place on horizontal/vertical product attributes as they make decisions, and test via mediation to show that consumers' reliance on horizontal attributes indeed stems from favorable perceptions of their own competence.

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