PREFERENCES INDUCED BY ACCESSIBILITY: EVIDENCE FROM PRIMING

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Abstract

In one experiment, we studied risky preferences using a semantic-priming paradigm where accessibility is manipulated independently of beliefs about the frequencies of risky events. We compared the risks taken for precautionary decisions primed by relevant information (enhancing accessibility to relevant events) with those taken for unprimed decisions and decisions primed by irrelevant information. We found that both priming and the subjective frequency of beliefs independently influence decision-making. The results indicate that decisions are the result of an integration of influences derived from both the description (specified probability) and experience (accessibility to pre-experiment beliefs about event frequencies and temporarily activated relevant events) of risks. People's risk preferences are influenced by the accessibility of events in memory; such that increasing accessibility causes risk aversion to a potential loss to increase. Our research findings are not anticipated by the descriptive invariance axiom of expected utility theory, which states that equivalent formulations of a choice problem give rise to the same preference order.

Keywords: probability, accessibility, risk, priming, precautionary decisions

Several prominent theories of decision-making have achieved universal acceptance for their premise that all decisions can be modeled with the same generic representation (e.g., von Neumann & Morgenstern, 1947; Tversky & Kahneman, 1992). A common assumption is that all decisions can be represented as monetary gambles with specified probabilities and values for all the outcomes. Since the development of the leading economic theory (Expected Utility Theory, EUT; von Neumann & Morgenstern, 1947), psychologists (e.g., Edwards, 1954; Kahneman, Slovic & Tversky, 1982; Kahneman & Tversky, 2000; Tversky & Kahneman, 1992) and more recently economists (Grether & Plott, 1979; Kagel & Roth, 1995) have been testing its descriptive accuracy and finding discrepancies between the normative predictions and people's actual behavior, prompting the development of descriptive theories of decision-making.

Both EUT and psychological descriptive frameworks (e.g., Prospect Theory, PT; Tversky & Kahneman, 1992) share a common assumption: people's risk preferences, and decisions under risk and uncertainty are independent of task. For example, the decision contemplated by an individual deciding whether or not to insure his or her luggage worth £500 for a cost of £5 where the risk of loss is 1% is presumed to be identical to the decision to either pay £5 or take a gamble where she or he has a 1% chance of losing £500. While a choice between monetary gambles may present a real dilemma, the gambles themselves typically do not have any features that have any meaning for the decision-maker - other than their essential structural properties (probability of winning/losing and amount to win/lose). By contrast, hazards that one

might insure against have all sorts of other semantic characteristic associated with them other than the probability of winning/losing and the amount to win/lose.

A consistent claim from behavioural decision researchers is that, contrary to the assumptions of classical economics, preferences are not stable and inherent in individuals but are constructed 'on the fly' and are strongly influenced by context and the available choice options (Slovic, 1995). For example, the preference reversal phenomenon (Lichtenstein & Slovic, 1971) suggests that no stable pattern of preference underlies even basic choices - in other words consistent trade-offs between lotteries with different probabilities and values are not made.

Previous research has also indicated that affect and cognition constitute independent influences on preference. For example, Zajonc (1980) showed that mere exposure to stimuli increased their familiarity and consequently their attractiveness and famously claimed that "preferences need no inferences". Zajonc's work suggests that affective judgments may be fairly independent of the sorts of perceptual and cognitive operation commonly assumed to be the basis of people's preferences.

According to the accessibility framework (Kahneman, 2003; Koriat, 1993, 1995; Koriat & Levy-Sadot, 2001; Kusev, Tsaneva-Atanasova, van Schaik & Chater, in press; Kusev & van Schaik, 2011; Kusev, Ayton, van Schaik, Tsaneva-Atanasova, Stewart & Chater, 2011; Kusev, van Schaik, Ayton, Dent & Chater, 2009; Tulving & Pearlstone, 1966), people's judgments are based on the amount of and intensity of processing the information accessed in the course of a particular task. Reliance on such sources may have some validity (cf. Hertwig et al., 2005), but may sometimes induce erroneous feelings that some sorts of risk are more frequent than others (e.g., Lichtenstein, Slovic, Fischhoff, Layman & Combs, 1978; for a review see the *familiarity bias* reported by Fox and Levav [2000]). Empirical evidence revealed that people's knowledge of event frequencies *leaks* into decisions even when event

likelihood information is explicitly provided – an effect not anticipated by EUT and PT (Kusev et al., 2009). Fitting these data to Tversky and Kahneman's (1992) PT model Kusev et al. (2009) found that the weighting function required to model precautionary decisions differs markedly from that required for equivalent monetary gambles. They thus established that accessibility has a strong measurable impact on the risky decisions that respondents made in the decision-making phase of the experiment.

In this paper, we address/define accessibility of events in memory in terms of the subjective ratings of their frequency (high- or low-frequency risks, from Kusev et al., 2009). Specifically, we predict that accessible events (e.g., high-frequency events) will be viewed with an increased perceived likelihood, whereas less accessible events (e.g., low-frequency events) will not be, leading to more risk aversion (Kusev et al., 2009). Research on risk perception and choice has demonstrated that a variation in decision content produces variation in preferences for risk. For example, previous studies (e.g., Teigen, Brun, & Slovic, 1988; Kusev et al., 2009) have established that people in different countries have different views as to the riskiness of various events; accessibility (measured by judged frequency) has a measurable impact on participants' risk. Specifically, there is an association between differences in accessibility and resulting differences in the patterns of risk preferences.

Here, we further investigate the validity of the accessibility framework by studying the factors that affect people's responses to presented probabilities in described real-world decision prospects. One obvious approach, adopted here, is to test the effect of accessibility on human preferences by varying the accessibility of event information independently of beliefs about event frequency. We attempt to achieve that by developing a semantic-priming paradigm for risky decision-making. Subject to numerous psychological debates, the priming paradigm has been typically defined in

memory research as a process of activating particular connections or associations in memory before an action or task is carried out (e.g., Bruner, 1957; Cramer, 1968; Higgins & King, 1981; Higgins, Rohles, & Jones, 1977; Mitchel, 2006; Tulving, 1983). The associations occur when a certain stimulus or event increases the accessibility of a specific informative category, which influences information-processing and, as a result, affects decision-making (e.g., Erb, Bioy & Hilton, 2002; Gilad & Kliger, 2008; Schacter, 1992; Tulving & Schacter, 1990; Tulving & Schacter,1992; Tulving, Schacter & Stark, 1982).

In this study, we develop a novel priming manipulation for risky choices, and predict that accessibility to relevant temporary activation (immediately preceding decision-making context) will influence risk preferences in insurance decision-making scenarios. Unlike previous accounts of accessibility, commonly relying on long-term memory representations (Kusev et al., 2009; Kahneman, 2003), here we explore the idea that temporary activation – semantic priming (immediately preceding decision-making context) – could offer "additional" accessibility, independent from the pre-experiment accessibility (memory for events with high and low judged frequencies; explored by Kusev et al., 2009). Our results provide evidence for this prediction.

Relevant to our concerns here, we suggest that the accessibility of information influences the decision to purchase (or not) a particular insurance product. We define the accessibility of information as its ease of retrieval either from long-term memory or the immediately preceding decision context (cf. Kahneman, 2003). Therefore, in our account, two sources of accessibility need to be distinguished: the accessibility of memory for the events (as investigated in Kusev et al., 2009) and the accessibility of situation-specific environmental cues (investigated here, using semantic priming). Here, we investigate whether experience (accessibility from priming and from pre-

experiment beliefs) affects decision-making even when information in the decision description (probability information) is manipulated independently from subjective frequency beliefs.

The memory-based account for risk preferences (e.g., Kusev et al., 2009; Kusev & van Schaik, 2011) assumes that the frequency of encounters with risky events in everyday life affects participants' preferences in characteristic ways not anticipated by most theories of decision-making. Most prominent theories (i.e., EUT and PT) assume that all risky choices are expressible as - indeed, equivalent to - choices about monetary gambles. By contrast, our memory-based account implies that, when making risky decisions, human preferences are affected by decision content - specifically the accessibility of events in memory - even after outcome values and probabilities are known (see also Jones & Oaksford, 2011). Kusev et al. (2009) found that decisions about events rated as being relatively highly frequent differed from decisions about events rated as relatively highly infrequent and from decisions about monetary gambles because high-frequency events cue accessible features in memory, while low-frequency events and monetary gambles do not. Accordingly, we hypothesize that with relevant priming events can be temporarily activated and therefore made more accessible. If the prime question and the choice question refer to the same risky event, the event would be responded to as if it were perceived as more likely – in other words as an *exaggerated risk* (cf. Kusev et al, 2009).

Experiment

In the experiment, participants were instructed to perform a binary decision-making task that involved a choice between two options (one probabilistic and another one certain). A semantic prime presented immediately before a decision is made may influence the decision. Priming is hypothesised to increase the perceived probability of a previously contemplated scenario that is related to the choice items

(risky events) in the decision-making task. The primes were in the form of a question requesting participants to make a judgment about the relative risks of a risky event in two different cities. Accordingly, the experiment was designed to compare the pattern of people's risk preferences for precautionary choices following relevant priming (where the prime question and the choice referred to the same risky event) with the pattern exhibited for choices following irrelevant priming (where the prime question and the choice referred to different risky events) and a control (non-prime) condition. In particular, as an implication of previous work on the priming paradigm, we predict that relevant priming will result in higher accessibility and, in turn, more risk aversion than irrelevant priming or no priming, independent of accessibility due to long-term memory representations.

Method

Participants

The Web-based experiment was completed by a total of 90 participants, recruited through a marketing company (37 female, 53 male). We ran the experiment on line, to maximize demographic spread of participants. Mean age was 45 (*SD* = 9.11). Participants received store points (club-card points) worth about £3 as payment for their time.

Design and Procedure

A 3×2×(9) mixed design was used, with the between-subject independent variables semantic priming (whether the prime question and the choice referred to the same or different risky event: relevant, irrelevant or none) and subjective-frequency belief (decision scenarios with high-frequency risks or low-frequency risks; taken from Kusev et al., 2009), and probability of the uncertain outcome as the within-subject variable (.01, .05, .10, .25, .50, .75, .90, .95, and .99). At the start of the session, task instructions and then an example scenario with illustrative choices were presented.

On each primed trial, participants were asked to consider which of two cities (there were twelve cities in total) had a higher risk of a specified risky event, and then they made an insurance decision, for example:

High-frequency insurance risks with relevant semantic priming:

Over the past 12 months were there more thefts of personal belongings inside cars per head of the population in

A: London

or

B: New York

There is a 1% chance of losing your personal belongings inside your car which are worth £300. Would you buy insurance at a cost of £30 to insure against the loss (theft) of your personal belongings inside your car?

A. Yes

or

B. NO

High-frequency insurance risks with irrelevant semantic priming:

Over the past 12 months were there more accidents during leisure time per head of the population in

A: London

or

B: Liverpool

There is a 1% chance of losing your personal belongings inside your car which are worth £300. Would you buy insurance at a cost of £30 to insure against the loss (theft) of your personal belongings inside your car?

A. YES

or

B. NO

Low-frequency insurance risks with relevant semantic priming:

Over the past 12 months were there more accidents during leisure time per head of the population in

A: London

or

B: Liverpool

There is a 1% chance of an accident to occur during your holiday; the cost of medical expenses is £300. Would you buy insurance at a cost of £30 to insure against the risk of an accident during your holiday?

A. YES

or

B. NO

Low-frequency insurance risks with irrelevant semantic priming:

Over the past 12 months were there more thefts of personal belongings inside cars per head of the population in

A: London

or

B: New York

There is a 1% chance of an accident to occur during your holiday; the cost of medical expenses is £300. Would you buy insurance at a cost of £30 to insure against the risk of an accident during your holiday?

A. YES

or

B. NO

Stimuli and Equipment

An interactive computer program for binary decision-making was used. Six types of binary decision-making situation (scenario), each corresponding with one of six experimental conditions, were included: 1) relevant semantic priming for high-frequency insurance risks[1] (e.g., buy insurance against loss of your luggage or take the risk, with a specified probability, of a loss of your luggage); 2) irrelevant semantic priming for high-frequency insurance risks; 3) relevant semantic priming for low-frequency insurance risks[2] (e.g., buy insurance against damage to your property by aircraft or take the risk, with a specified probability, of damage to your property by aircraft); 4) irrelevant semantic priming for low-frequency insurance risks; and 5) no priming for high- and 6) low-frequency insurance risk.

Participants were required to indicate a preference between a probabilistic outcome and a sure outcome in a series of 99 trials. Using a method similar to that used by Tversky and Kahneman (1992) and Kusev et al. (2009), the trials were created by combining 1 monetary amount for the probabilistic outcome (£300) with each of 9 probabilities (.01, .05, .10, .25, .50, .75, .90, .95, and .99), and each of these combinations was presented with one of 11 monetary amounts representing the sure outcomes (linearly spaced between £1 and £300), producing $1 \times 9 \times 11 = 99$. The 99 trials were presented in random order. As in Tversky and Kahneman (1992), Tversky and Fox (1995), and Kusev et al. (2009), participants' risk preferences were based on certainty equivalent (midpoint between the lowest accepted value and the highest rejected value in the prospects). If the certainty equivalent was higher than the expected value then risk preference was classified as risk-seeking; if the certainty equivalent was lower than the expected value, risk preference was classified as risk-averse.

Results and Discussion

Descriptive statistics (see Table 1 and Figure 1) show that with relevant priming, participants were more risk-averse than the participants primed with irrelevant priming (or with no priming). In addition, with high-frequency risks, participants were more risk-averse than with low-frequency risks. Furthermore, risk-seeking increased with increasing probability of the uncertain decision option. These findings were confirmed by the results of statistical tests. A 3×2×(9) analysis of variance demonstrated the effects of semantic priming, F (2, 84) = 6.17, $p < .01$, $\varepsilon^2 = .09$, subjective-frequency belief, F (1, 84) = 11.46, $p < .01$, $\varepsilon^2 = .08$, and probability, F (8, 672) = 90.66, $p < .001$, $\varepsilon^2 = .37$, on risk preference were significant. It is essential to note that there were no significant interaction effects, indicating that the effects of immediately preceding prime, subjective-frequency belief and probability level were independent of each other. Multiple comparisons with Bonferroni's correction showed that the difference between relevant priming and irrelevant priming on risk preference, and the difference between relevant priming and no priming were significant (both $p < .05$), but the difference between no priming and irrelevant priming on risk preference was not significant ($p > .05$).

General Discussion

Consistent with our predictions, priming (accessibility based on situation-specific environmental cues) and subjective-frequency belief (accessibility based on memory) had (moderate) independent effects on people's decision-making, in addition to the very large effect of the specified probability of the uncertain outcome. With relevant priming, participants were more risk-averse than the participants primed with irrelevant primes or those with no priming. Decision-making behavior under conditions of irrelevant priming and without priming was essentially identical. Most

important, the effect of priming was the same regardless of subjective-frequency beliefs (i.e. accessibility based on memory). For subjectively high-frequency beliefs, participants were more risk-averse. As expected, there was a large effect of the probability of the uncertain outcome, as higher probabilities induced more risk aversion.

In this experiment, participants were provided with explicit information about the probabilities of events but, critically, not during the priming task. The priming task merely asked participants to consider which of two cities had a higher risk of a specified risky event, and then they made an insurance decision about that event. For relevant priming (where the prime question and the choice referred to the same risky event) participants were more risk-averse than the participants primed with irrelevant task (or with no priming). Our findings demonstrate that decision content influences subjective-frequency belief through the accessibility of information in memory even when, according to both PT and EUT, the decision is already fully specified. Thus, when making insurance decisions, participants in all the conditions were always supplied with the probability of loss, the value of loss and the cost of insurance.

In additon, the prime contained no information about the risks being evaluated. We attribute the effect of priming to the accessibility of the risk and not Bayesian updating of information. This is because, apart from affecting the accessibility of the participants' pre-existing stored knowledge, we did not provide participants with new information about the probabilities of events. We assume that there is no doubt that our primes were, by virtue of the complete specification of the decision, objectively irrelevant for the decision problem. To verify that the primes were subjectively irrelevant is rather more difficult. We would need to ask the participants, but this does not change the status of the result or the status of decision theories that assume that all decisions can be fully represented as monetary gambles and that, once the inputs are

specified, no aspect of the content of the decision will affect the decision (see also Jones & Oaksford, 2011). Our priming task shows this assumption to be false of course.

The influence of accessibility through immediate decision-making context (via semantic priming) and subjective-frequency belief is not accounted for by current prevailing models of decision-making. Our findings demonstrate that decision content influences subjective-frequency belief through the accessibility of information in memory; moreover, the content of immediately preceding primes can selectively influence decisions, presumably by enhancing the accessibility of content - independently of subjective-frequency belief.

Similar concerns were prompted by Loewenstein, Weber, Hsee and Welch (2001), and empirically examined by Erb, Bioy and Hilton (2002), where participants were given lists of words to prime risk attitudes (affective prime). In the priming task, the list was comprised of adjectives with positive and negative connotations of risk-seeking or avoidance, and additional distracting adjectives. Using this prime procedure, Erb et al. (2002) were able to induce risk-seeking or risk-averse preferences across a range of decision scenarios and also showed that these priming effects could be reversed by drawing participants' attention to the priming event. Their results support claims that the formation of risk preferences can be based on preconscious processing (rather than on deliberative mental operations) as posited by several authors (cf. Bargh, 1996; Erb et al., 2002; Gilad & Kliger, 2008; Hogarth, 2008).

Similarly, our experiment indicates that participants were highly influenced by the immediate semantic context in which the insurance scenario was placed. This finding suggests that risk attitudes reflect some aspect of memory (for the frequency of events) and the current context that people are contemplating, rather than underlying

"content-free" decision processes. Hence, we conclude that equivalent formulations of a choice problem that differ in accessibility in terms of the immediate decision-making context and subjective-frequency belief, produce different preference orders, a finding not consistent with the predictions of prevailing theories of decision-making that assume decisions are "generic" and can be represented as monetary gambles.

Our results indicate that risky decisions are the result of an integration of influences derived from both the decision description (specified probability) and from participants' experience (pre-experiment beliefs about event frequencies and priming) of risks. People's risk preferences may be influenced by generic risk attitudes and by consensual utility functions, but they are also influenced by the accessibility of events in memory.

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Footnotes

[1] Based on Kusev et al. (2009), risky events subjectively judged to be of high frequency in Experiments 4 and 5.

[2] Based on Kusev et al. (2009), risky events subjectively judged to be of low frequency in Experiments 4 and 5

Table 1

Risk preference as a function of priming, subjective frequency of risk and probability

			Probability of risky prospect									
Priming	Gambles		1%	5%	10%	25%	50%	75%	90%	95%	99%	Average
Relevant	High-frequency risk	*M*	1.00	1.00	0.93	0.79	0.64	0.50	0.50	0.36	0.36	0.67
		SD	0.00	0.00	0.27	0.38	0.50	0.52	0.52	0.46	0.50	0.25
	Low-frequency risk	*M*	1.00	0.94	0.75	0.56	0.50	0.50	0.38	0.28	0.19	0.57
		SD	0.00	0.25	0.45	0.44	0.52	0.48	0.50	0.36	0.40	0.24
	Total	*M*	1.00	0.97	0.83	0.67	0.57	0.50	0.43	0.32	0.27	0.62
		SD	0.00	0.18	0.38	0.42	0.50	0.49	0.50	0.40	0.45	0.25
Irrelevant	High-frequency risk	*M*	1.00	1.00	0.60	0.70	0.53	0.37	0.27	0.20	0.13	0.53
		SD	0.00	0.00	0.51	0.41	0.52	0.44	0.46	0.32	0.35	0.26
	Low-frequency risk	*M*	0.80	0.80	0.60	0.43	0.07	0.00	0.13	0.07	0.07	0.33
		SD	0.41	0.41	0.51	0.42	0.26	0.00	0.35	0.18	0.26	0.21
	Total	*M*	0.90	0.90	0.60	0.57	0.30	0.18	0.20	0.13	0.10	0.43
		SD	0.31	0.31	0.50	0.43	0.47	0.36	0.41	0.26	0.31	0.25
No priming	High-frequency risk	*M*	1.00	1.00	0.80	0.57	0.47	0.30	0.27	0.23	0.20	0.54
		SD	0.00	0.00	0.41	0.46	0.52	0.46	0.46	0.42	0.41	0.27
	Low-frequency risk	*M*	0.93	0.93	0.60	0.37	0.13	0.13	0.03	0.03	0.00	0.35
		SD	0.26	0.26	0.51	0.35	0.35	0.30	0.13	0.13	0.00	0.15
	Total	*M*	0.97	0.97	0.70	0.47	0.30	0.22	0.15	0.13	0.10	0.44
		SD	0.18	0.18	0.47	0.41	0.47	0.39	0.35	0.32	0.31	0.23
Total	High-frequency risk	*M*	1.00	1.00	0.77	0.68	0.55	0.39	0.34	0.26	0.23	0.58
		SD	0.00	0.00	0.42	0.42	0.50	0.47	0.48	0.40	0.42	0.26
	Low-frequency risk	*M*	0.91	0.89	0.65	0.46	0.24	0.22	0.18	0.13	0.09	0.42
		SD	0.28	0.31	0.48	0.41	0.43	0.39	0.39	0.27	0.28	0.23
	Total	*M*	0.96	0.94	0.71	0.57	0.39	0.30	0.26	0.19	0.16	0.50
		SD	0.21	0.23	0.46	0.43	0.49	0.44	0.44	0.34	0.36	0.26

A mean value below 0.5 indicates risk-seeking. A mean value above 0.5 indicates risk aversion.

Figure Captions

Figure 1. Mean risk preference as a function of priming and probability (A mean value below 0.5 indicates risk-seeking. A mean value above 0.5 indicates risk aversion).

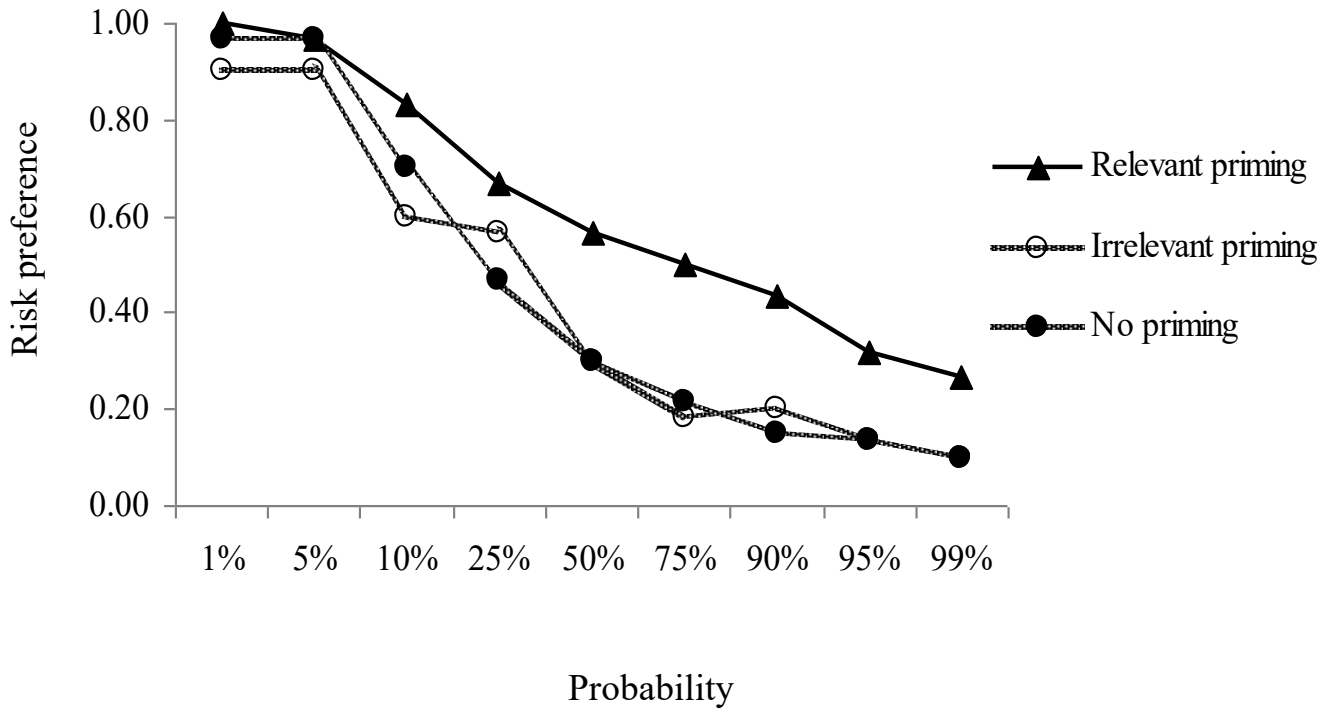

Figure 1.