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The relationship between information processing style and information seeking, and its moderation by affect and perceived usefulness: Analysis vs. procrastination

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ABSTRACT

We examined the relationship between information processing style and information seeking, and its moderation by anxiety and information utility. Information about Salmonella, a potentially commonplace disease, was presented to 2960 adults. Two types of information processing were examined: preferences for analytical or heuristic processing, and preferences for immediate or delayed processing. Information seeking was captured by measuring the number of additional pieces of information sought by participants. Preferences for analytical information processing were associated positively and directly with information seeking. Heuristic information processing was associated negatively and directly with information seeking. The positive relationship between preferences for delayed decision making and information seeking was moderated by anxiety and by information utility. Anxiety reduced the tendency to seek additional information. Information utility increased the likelihood of information seeking. The findings indicate that low levels of anxiety could prompt information seeking. However, information seeking occurred even when information was perceived as useful and sufficient, suggesting that it can be a form of procrastination rather than a useful contribution to effective decision making.

1. Introduction

Information seeking is a critical component of effective decision making (Griffin, Dunwoody, & Neuwirth, 1999), yet information seeking can be a mechanism for delaying decisions (Jepson & Chaiken, 1990). Hence, a process model must be applied to understand the difference between information seeking as an analytical strategy versus information seeking as procrastination. This study examined the relationship between information processing styles (how decisions are made) and information seeking (the extent to which information is sought), and its moderation by anxiety and information utility. We integrate insights from the risk and information seeking and processing theory (RISP, Griffin et al., 1999), dual process theory (Epstein, 1990; Epstein, Pacini, Denes-Raj, & Heier, 1996), and broaden-and-build theory (Fredrickson, 1998, 2001) to develop and test a model that accounts for individual-level information seeking behaviour, and the contingencies that lead to information seeking as a form of procrastination.

1.1. Information processing styles

Information processing styles, typically characterised as tendencies to use analytical or intuitive (heuristic) approaches to choice (Dane & Pratt, 2007) influence decision processes and outcomes. Analytical processes are required for novel, complex problems whereas intuitive or heuristic processes are applied to numerous daily choices (Bargh, Chen, & Burrows, 1996; Epstein, Lipson, Holstein, & Huh, 1992). Theories of analytical and heuristic thinking rest on the dual-process concept which proposes two parallel, interactive systems of thinking (Epstein, 1990; Epstein et al., 1996). System 1 is intuitive, affect-laden and rapid. System 2 is cognitive, resource intense and requires time. Both systems yield positive outcomes. Analytical thinking is associated with effective decision making due to logical reasoning and fewer decision biases (Stanovich & West, 2002), and ability to focus on important aspects

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of information relevant to decisions rather than non-relevant contextual information (McElroy & Seta, 2003). Intuitive thinking is associated with expertise (Dreyfus & Dreyfus, 2005) and effectiveness in solving everyday problems (Todd & Gigerenzer, 2007).

1.2. Individual differences in information processing and information seeking

While the dual-process model has universal application, the extent to which System 1 and System 2 are applied, and the situational contingencies that influence their use, are subject to individual differences (Epstein et al., 1996). Therefore, theories that rest on dual-process modelling need to take into account individual-level antecedents and moderating factors. Employing this approach, Griffin et al. (1999) developed the risk information seeking and processing (RISP) model. They proposed information seeking is driven by individual differences in perceived information sufficiency, and continues until the point of sufficiency is reached. Griffin et al. (1999) placed information seeking and information processing together as the dependent variables in their model, and proposed that they combine to produce four decisions styles relating to routine/non routine and heuristic/systematic processing.

However, recent research into decision processes, also building on dual process models, has added a second information processing style: regulatory processes that influence whether a decision should be made immediately or delayed Dewberry, Juanchich, and Narendran (2013a) proposed both cognitive information processing (rationality vs. intuition) and regulatory information processing have direct effects on decision outcomes. For example, when faced with a decision about whether to eat food that could harbour harmful bacteria, there are choices about whether to go with past experience, i.e. if eating the food has been alright before then it will be alright at this decision point (heuristic processing); or, whether to find out more about the likelihood of bacteria being present in the food product (analytical processing). There are also choices regarding whether to find out the relevant information now (preference for immediate decision making), or whether to put off information seeking until a later date (preference for delayed decision making). Therefore, we propose that perceived information sufficiency, and preferences for analytical and delayed decisions will be associated directly and positively with information seeking. Conversely, we propose that preferences for heuristic and immediate decisions will be associated directly and negatively with information seeking.

Individual differences in age and gender also influence decision processes. Older adults are more likely to draw on their history of life experiences when making choices (Finucane, Mertz, Slovic, & Schmidt, 2005), and this increases the likelihood of greater information seeking. Moreover, women tend to be more risk averse when making decisions, and less confident in their choices than men (Graham, Stendardi, Myers, & Graham, 2002), thus increasing tendencies for information seeking. Thus we expect that older adults and women will be more likely to seek information than younger adults and men.

1.3. Moderators of the relationship between information processing and information seeking

Dewberry et al. (2013a) and Dewberry, Juanchich, and Narendran (2013b) suggested that anxiety could increase information seeking in order to delay decision making, because the point of choice causes anxiety, so putting off a decision reduces current experiences of anxiety. In a more complete modelling of the relationship between affect and behaviour, Frederickson's broaden-and-build theory (Fredrickson, 1998, 2001) proposed that positive affect has a broadening and building effect, increasing effectiveness of decisions made. Conversely, anxiety reduces thought-action repertoires and constricts decision processes by limiting access to memory and the cognitive strategies necessary for problem solving. In addition, Fredrickson's (1998) model suggests that affect moderates the relationship between preferences, perceptions and actions, and this has been confirmed empirically (Soane et al., 2013). Hence, we propose that anxiety moderates the relationships between information processing styles and information seeking because it increases tendencies to search for information that could allay anxiety, and the process delays the pressure of choice.

We also propose that information perceptions influence the relationship between information processing style and information seeking. Griffin et al. (1999) suggested that information will be sought when current information is believed to be insufficient. However there will be contingencies that influence this process. Specifically, information utility moderates the relationship between antecedent factors and information seeking (Griffin et al., 1999). Examining this contingency is important to distinguish between information seeking as analytical information processing, and information seeking as a strategy to delay decision making (Bohner, Chaiken, & Hunyadi, 1994; Dewberry et al., 2013a, 2013b). We suggest that perceptions of context-specific information utility will moderate the relationship between information processing style and information seeking.

1.4. Summary of the current study

The current study tested a model of information seeking We hypothesised that the relationship between analytical information processing style and information seeking will be positive, and moderated by anxiety, and the information utility. We also hypothesised that the relationship between heuristic information processing style and preference for delaying decisions will be negatively associated with information seeking, and that the negative relationship will be strengthened by anxiety and information utility. Finally, we hypothesised that preferences for delayed decisions will be associated negatively with information seeking, and that the relationship will be moderated by anxiety and information usefulness.

2. Method

2.1. Research context

To test the research model, we examined a widespread disease, Salmonellosis, that continues to be a threat to human health and a financial burden on society. In Europe, Salmonellosis is the second most common zoonotic disease in humans (after Campylobacter) (European Food Safety Authority, 2010). The most common way of contracting Salmonellosis is through the consumption of raw egg and raw egg products. Although Salmonella bacteria need not cause disease, the incidence of Salmonellosis indicates that changes in domestic behaviour are required to reduce its impact on society. Hence examining decision making in the context of Salmonellosis contributes to practical strategies regarding disease management as well as to understanding decision processes.

2.2. Participants and procedure

An online survey website was used to recruit 3001 participants to complete a questionnaire on food safety. Participants were emailed an invitation to participate in the research and a clickable link to access the survey. Survey responses were stored on the research team's secure server. Twenty-seven participants were

excluded from the analysis because they stated that they had an allergy to either chocolate or eggs and would not eat the chocolate mousse. Fourteen were excluded due to missing data. The final sample was 2960 (96.8% of completions). The mean age was 40.59 (range 18–82, SD = 12.95). There were 1613 men (54.5%) and 1347 women (45.5%). 1102 (37.2%) had a degree or above; 362 (12.2%) had other higher education; 580 (19.6%) had A levels or equivalent; 618 (20.9%) had GSCEs or equivalent (20.8%); 125 (4.2%) had other qualifications; the remaining 111 (3.8%) had no qualifications.

2.3. Materials

We focused on a food product, home-made chocolate mousse containing eggs, a common source of Salmonellosis and a widely consumed food item.

Age was assessed by asking participants to write their age.

Gender was assessed by self-rating 'male' or 'female'.

Effect of past experience was measured by one item adapted from Miles and Frewer (2001) which asked participants to rate the extent to which past experience has provided them with information about salmonella prevention. There was a 5-point response range from 1 'strongly disagree' to 5 'strongly agree'.

Anxiety was assessed based on Watson and Tellegen's (1985) emotion circumplex. Items were 'I am anxious about being infected with salmonella from eggs' and 'I am worried about being infected with salmonella from eggs.' There was a 5-point response range, 1 'strongly disagree' to 5 'strongly agree'.

Information sufficiency was measured by two items measuring perceived sufficiency of current information, and adapted from Trumbo and McComas (2003). 'The information I have at this time meets all of my needs for knowing about how to protect myself from salmonella from eggs'; 'I have been able to make a decision about how concerned I am about the risk of salmonella in eggs to me by using my existing knowledge'. There was a 5-point response range, 1 'strongly disagree' to 5 'strongly agree'.

Information utility was assessed using items developed for this study. Participants were presented with four pieces of information: (1) A description of the likelihood of the prevalence of Salmonella in eggs. (2) A description of the reduction of the prevalence of Salmonella in eggs in England between 1995 and 2003. (3) Percentages describing the likelihood of the prevalence of Salmonella in eggs. (4) A graph format showing the reduction of the prevalence of Salmonella in eggs in England between 1995 and 2003. After each piece of information, participants were asked how useful the information was to evaluating whether to eat the mousse or not. There was a 5-point response range from 1 'Not at all useful' to 5 'Very useful'. The scale is a mean score of all four items.

Information processing styles were measured as four distinct constructs rather than as two bipolar continua following recommendations from Hodgkinson, Sadler-Smith, Sinclair, and Ashkanasy (2009). Four types of information processing style were assessed using scales from Dewberry (2008). All items were in the form of a statement followed by a three-point response range: 1 'Disagree', 2 'Uncertain', 3 'Agree'. A sample item from each scale is included with permission from the author (Dewberry, 2008).

Analytical information processing was assessed using a three-item scale. Items assessed the extent to which information is sought prior to making a decision, for example, 'When deciding on something important, I usually stick with the information I already have rather than looking for more'.

Heuristic information processing was measured using a three-item scale. Items assessed tendencies to use current knowledge to make a decision rather than information search strategies. A sample item is 'When making an important decision, I tend to go on the facts I have before me rather than looking around for more information'.

Preference for making immediate decisions was assessed using a two-item scale. For example, 'If I have to make a decision, I start thinking about it straight away.'

Preference for delaying decisions was measured using two items. An example is 'If I have difficult decision to make, I tend to put it off'.

Information seeking behaviour, the dependent variable, was captured by offering participants four extra pieces of information which they could choose to look at. The options were: information concerning health effects of Salmonella; prevalence of Salmonella; national attempts to control Salmonella in eggs; and, individual risk reduction. Items were developed for this study. Participant access to each piece of information was recorded and used to create an index ranging from 0 to 4.

3. Results

Table 1 shows the means, standard deviations, Cronbach's alpha where appropriate and inter-scale correlations.

3.1. Confirmatory factor analysis

We then examined the model using SEM Confirmatory Factor Analysis in Amos 19. Data indicated that the model fit was acceptable (Hair, Black, Babin, & Anderson, 2009): $\chi^2 = 537.4$; $df = 114$; CFI = .98; NFI = .98; RMSEA = .04; SRMR = .04, apart from the χ^2/df value which is 4.7. However, the χ^2/df value is sensitive to large sample sizes (Hair et al., 2009) so we proceeded with hypothesis testing.

3.2. Hierarchical linear regression

Next we used hierarchical multiple regression for the first stage of hypothesis testing. All continuous variables were standardized using the Z transformation prior to analysis. Model 1 examined direct effects of age, gender, experience, information processing, anxiety, information utility and sufficiency. Model 2 added interaction terms (anxiety, utility and sufficiency × each of the information processing styles). Data are shown in Table 2.

Model 1 data showed main effect positive associations between preferences for analytical thinking, tendency to delay decision making, information sufficiency, information utility and information seeking. There were negative associations between heuristic information processing style, anxiety, and information seeking. Thus there was some initial support for our hypotheses concerning information processing style and information seeking. Moreover, women and older adults were more likely to seek information, as expected.

3.3. Testing for moderation

Model 2 data showed six significant interaction terms. The interaction of affect and preferences for making immediate decisions was not examined further because there was no main effect of immediate decision making. The remaining interactions were examined in more detail following procedures discussed in Hayes (2013) and using the 'process' syntax. We tested whether the relationship between information processing style and information seeking was different at high and low levels of affect and information utility (1 standard deviation above and below the mean). The conditional effects were calculated using the bootstrapping procedure recommended by Preacher, Rucker, and Hayes (2007) in order to test whether the findings were robust. A T-statistic was

Table 1
Means, standard deviations, Cronbach's alpha and inter-scale correlations.

	Mean	SD	Cronbach's alpha	1	2	3	4	5	6	7	8	9	10
1. Age	40.59	12.96	–										
2. Gender	1.54	.50	–	−.16***									
3. Past experiences	3.05	1.12	–	.18***	.02								
4. Analytical style	2.58	.53	.76	.10***	.06**	.09***							
5. Heuristic style	1.70	.64	.80	−.08***	−.04*	−.02	−.50***						
6. Immediate decision	2.33	.59	.81	.12***	.03	.07***	.15***	−.04*					
7. Delayed decision	1.85	.77	.81	−.12**	.06**	−.00	.04	.08***	−.56**				
8. Anxiety	2.22	1.03	.95	−.08***	.07***	.09***	−.07**	.15***	−.06***	.12***			
9. Utility	2.30	.97	.86	−.11***	.03	.13***	.02	.04*	−.01	.06**	.35***		
10. Sufficiency	3.77	.84	.79	.19***	.02	.28***	.21***	−.14***	.13***	−.07***	−.27***	−.05**	
11. Information seeking	.54	1.29	–	.08***	.06**	.07***	.14***	−.15***	−.01	.06**	−.09***	.07***	.16***

$N = 2960$.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

Table 2
Results of hierarchical linear regression of information seeking on affect, information perceptions and information processing styles.

Variable	Standardized beta values	
	Model 1	Model 2
Age	.07**	.06**
Gender	.06**	.05**
Past experience	.02	.03
Analytical style	.04*	−.02
Heuristic style	−.10***	−.03
Immediate decision	.00	−.04
Delayed decision	.08***	.12
Anxiety	−.10***	−.06
Information utility	.12***	−.07
Information sufficiency	.10***	.14
Analytical style × utility		−.06
Analytical style × anxiety		.16
Analytic style × sufficiency		.03
Heuristic style × utility		−.23**
Heuristic style × anxiety		.20*
Heuristic style × sufficiency		−.05
Immediate decision × utility		.33**
Immediate decision × anxiety		−.21*
Immediate decision × sufficiency		−.03
Delayed decision × utility		.19*
Delayed decision × anxiety		−.21*
Delayed decision × sufficiency		−.04
R	.26	.28
R squared	.07	.08
F statistic	21.84***	10.99***
Df	10, 2949	10, 2949

$N = 2960$.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

Table 3
Bootstrapped moderation results.

Moderator	Level	Conditional effect	SE	*T*	*p*
Anxiety	High	−.13	.03	−.52	.00
	Low	−.07	.03	−2.62	.01
Utility	High	.06	.03	2.21	.03
	Low	.09	.03	3.18	.02

computed for the indirect effect. There were two significant interactions: affect × preferences for delaying decision making, and utility × preferences for delaying decision making. Data are shown in Table 3.

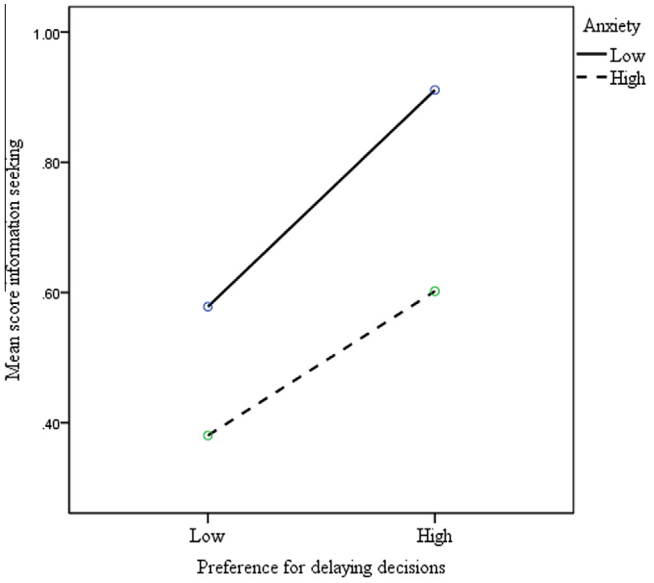

Fig. 1. Anxiety moderated the relationship between preferences for delaying decision making and information seeking.

Fig. 1 shows the interaction between affect and preferences for delaying decision making. There was a positive association between preferences for delaying decisions and information seeking, although there was less information seeking for people experiencing anxiety. As anxiety increased, preferences for putting off decisions reduced the likelihood of information seeking.

There was a positive association between information utility and preferences for delaying decision making. Information seeking is most likely for people who perceive the information as useful, yet have a tendency to put off decision making. The relationship is depicted in Fig. 2.

Fig. 3 summarises the direct effects and moderation effects.

4. Discussion

Integrating dual process theory; (Epstein, 1990; Epstein et al., 1996) with RISP theory (Griffin et al., 1999) and broaden-and-build theory (Fredrickson, 1998, 2001), provides insights into the information seeking process. The current study has demonstrated the importance of individual differences in information processing styles on information seeking, and the susceptibility of information seeking to anxiety and information perceptions in a food-related

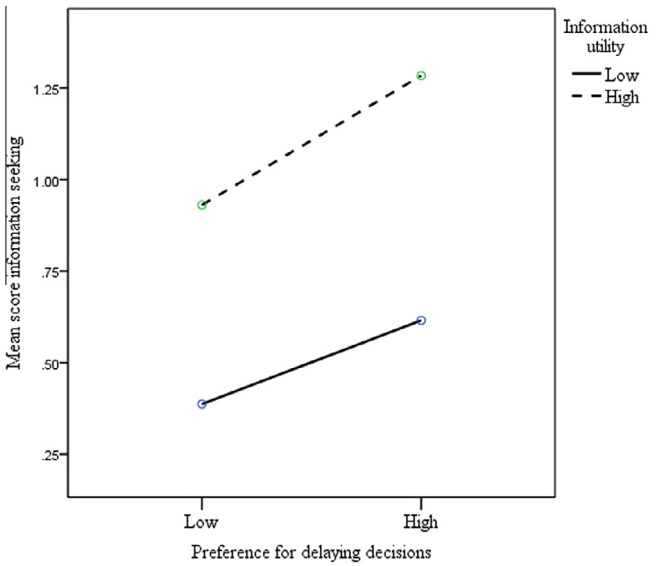

Fig. 2. Information utility moderated the relationship between preferences for delaying decision making and information seeking.

decision context. In examining these processes, we make two contributions to the literature.

First, we proposed that analytical information processing styles would be associated positively with information seeking. Data confirmed this proposal, and showed that there was a direct effect of analytical information processing style on information seeking that was not influenced by anxiety or information utility. Hence, for people with preferences for analytical information processing styles, information seeking is likely to form part of their strategy for finding and evaluating information systematically prior to making a choice. We also hypothesised that preferences for heuristic decision making would be associated negatively with information seeking, and that this relationship would be influenced by anxiety and information utility. Data showed that there was a main effect, but did not support moderation. Thus heuristic preferences were associated directly with low levels of information seeking. These findings show partial fit with Griffin et al.'s (1999) RISP model. We showed that information processing style was associated with information seeking, but there was no evidence for the complex association between the variables proposed in the RISP model. Furthermore, the data indicate that different information processing styles require specific modelling.

Our second contribution concerns the application of the regulatory dimension of information processing styles: preferences to make an immediate or delayed decision. Delaying decisions can serve a specific purpose which is to avoid choice, and this is different from the application of heuristics, a process that is concerned with making decisions faster and with less effort. Data showed that preferences for delaying decisions were associated positively with information seeking, and that this relationship was moderated by both anxiety and information utility. Participants sought more information when they experienced lower levels of anxiety. Furthermore, participants sought more information when they perceived what they had read during the study to be useful. Together, these findings suggest that, for people who find it difficult to regulate the decision process, information seeking is a strategy to delay decisions that becomes more likely when information is perceived to be useful, and less likely under conditions of anxiety.

The research has several practical implications for policy makers and food safety risk managers. Research into risk communication has moved towards bottom-up development of information that takes lay concerns into account (Bickerstaff, Lorenzoni, Jones, & Pidgeon, 2010; Stern & Fineberg, 1996). This practical strategy could have the benefit of influencing the balance of affect and information perceptions that have a critical influence on information seeking behaviour such that people are motivated enough to read information, e.g. on websites, and educated about how to act on it to change domestic practices and reduce the risk of

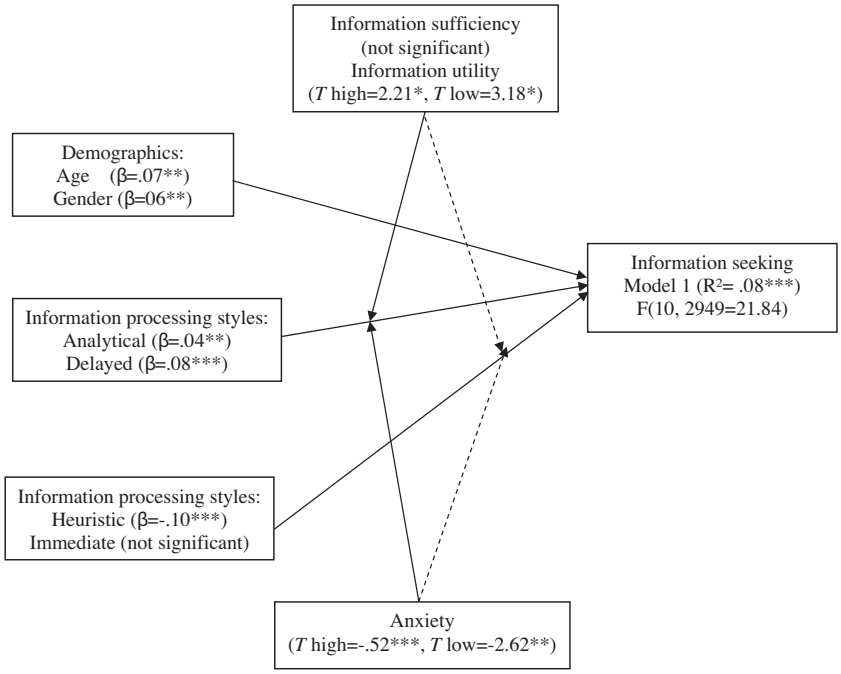

Fig. 3. The research model summarised. Data for direct effects are standardised beta weights from Model 1 analysis. The values for the specific moderated relationships are high and low *T*-values derived from the bootstrapped moderation analysis. Dashed lines indicate non-significant moderation.

infection from Salmonella. Such an approach could also avoid raising anxiety levels to the point where people avoid food safety information.

Future research could examine further the relationships between information processing styles and information seeking, and the moderating roles of anxiety and information utility. In particular, further examination of the processing that underlies delayed decision making would enable more complete modelling of the relationship, and it is possible that there are other situational moderators that interact with information processing styles. Future research could consider the relationship between information seeking and effective decision making to test for the positive and negative impact of different information processing styles, and do so in different decision contexts. There could also be further examination of the effects of age and gender on decision processes and information seeking. Epstein et al. (1996), for example, found some differences between men and women's preferences for analytical and heuristic thinking, although the findings were not consistent across studies. It is also possible that decision processes develop with age (Mata, Schooler, & Rieskamp, 2007), thus future research could consider how these demographic factors function in relation to information seeking.

The current study has some strengths, notably the assessment of information seeking behaviour rather than information processing (Kahlor, Dunwoody, Griffin, Neuwirth, & Giese, 2003) or intention (ter Huurne, Griffin, & Gutteling, 2009; Yang, 2012). However, while attempts have been made to develop a theory-driven model and test it on a large sample of adults, the current study has acknowledged limitations. We examined information seeking behaviour using online survey technology, however, a laboratory study would enable more complex information seeking behaviour to be assessed. Moreover, an experimental approach could be used to examine whether information processing styles can be influenced by priming or other contextual variables, thus providing more opportunities to examine moderation effects. Finally, different decision contexts, e.g. other kinds of everyday decisions as well as infrequent decision, or decisions with more serious consequences, would add to theoretical and practical developments.

In conclusion, this study suggests that individual differences in preferences for analytical and heuristic information processing style have a direct effect on information seeking, and influence the extent to which information is sought. In contrast, regulatory information processing styles have an indirect association with information seeking. Preferences for delaying decisions were exacerbated by information utility and attenuated by anxiety. These findings contribute to a more complete understanding of the decision processes that lead to information seeking. Moreover, the findings suggest that information campaigns could be made effective by providing sufficient information to generate an emotional need to make timely decisions.

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