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THE ANTECEDENT ROLE OF PERSONAL ENVIRONMENTAL VALUES IN THE RELATIONSHIPS AMONG TRUST IN COMPANIES, INFORMATION PROCESSING AND RISK PERCEPTION

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Abstract:

Trust and risk perception are important issues for industries such as petrochemical companies, typically considered "less trustworthy" because of the hazards associated with their activities. In this context, individual's trust in companies may have influence on information processing mode individual adopts to reach a judgement such as risk perception associated with industrial hazards. We take the heuristic-systematic theory (HSM) as the model for processing information about industrial risk, with trust in companies as its antecedent and risk perception as its consequence. However, this process may be influenced by factors such as personal specific values. This paper analyses, to our knowledge for the first time, the antecedent role of personal values towards environmental issues in the HSM of information processing.

The model was tested using data from interviews with 992 residents in an area of the province of Castelló (Spain) close to a petrochemical complex. Structured equation models (SEM) were used to analyse the data.

The results demonstrate the proposed relationships. The main contribution of this paper is the corroboration of the direct and indirect effects of personal environmental values on the variables that make up the trust in companies-HSM of information processing-risk perception sequence.

Finally, we recommend that the companies of the petrochemical complex consider the frank, open and bidirectional communication with the residents as the key element to break the association among pro-environmental values, distrust in the companies and perception of the risk.

Keywords: Environmental values, trust in companies, risk perception, heuristic-systematic model, petrochemical complex.

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INTRODUCTION

The expansion of scholarly interest in trust has reached new disciplines such as risk studies (Bronfman et al. 2008; Gamero et al. 2011; Huang et al. 2013; Terpstra, 2011). Accordingly, a significant body of literature has emerged during the past decade that analyses the influence of trust on the information processing mode individuals adopt to reach a judgement such as risk perception (Griffin et al. 2004; Kahlor et al. 2003; Trumbo and McComas 2008).

In this academic context, an information-processing theory that hails from social psychology is of particular note: the heuristic-systematic model, HSM (Chaiken 1980; Eagly and Chaiken 1993). This model is based on the assumption that attitudes are formed and modified as people gain information about attitude objects. As such, it is well suited for use in studies of risk because it can link how people deal with risk information with how this may influence their subsequent risk perception (Trumbo 2002; Trumbo, McComas, and Besley 2008).

However, this process may be influenced by factors such as personal values, which have the capacity to affect the degree to which an individual is motivated to reach an accurate judgement about a given situation (Giner-Sorolla and Chaiken 1997). In this sense, this paper analyses, to our knowledge for the first time, the possible influence of personal specific values towards environmental issues on the HSM in order to reach a judgement on the risk associated with an industrial activity.

Likewise, this paper aims to discover whether people base their trust in companies that are likely to generate risk to the environment and health on an assessment of the degree to which their behaviour is in line with specific values and beliefs towards concrete issues (Whitfield et al. 2009). So, we analyse if the impact that trust in companies has on the information processing that an individual adopts (Koh and Sundar 2010; Trumbo and McComas 2003, 2008) may be influenced by his/her personal specific values towards environmental issues.

The objective of our research is to study the antecedent role of personal environmental values in the relationships among trust in companies, HSM, and risk perception. In short, we hope to learn whether citizens' specific values affect the persuasive capacity of the HSM.

For this purpose, our study is set in the context of residents in an area of the province of Castelló (Spain) close to a petrochemical complex with an oil refinery and related chemical and petrochemical companies. This kind of industry generates benefits for the area in terms of jobs, higher per capita income or better infrastructures (Chertow, Ashton, and Espinosa 2008; Neffke et al 2011), although it also creates negative externalities such as atmospheric pollution, excessive noise, pollutant wastes to the sea or explosion hazards, with the consequent risk to the health of the residents (Morris, Barker, and Legator 2004; Signorino 2012). This context allows us to analyse the relationships proposed in the research.

The paper is structured as follows: in the next section we review the literature on the HSM of information processing, risk perception and people's trust in companies, and we analyse the relationships among them. We then examine the antecedent role of personal

environmental values. This is followed by an explanation of the method and results. Finally, we discuss the main implications of the results and major conclusions.

Review of the literature

The heuristic-systematic model and its relationship with risk perception and trust in companies

The heuristic-systematic model following other previous information models examines information processing as an antecedent to judgement (Smerecnik et al. 2012; Trumbo and McComas 2008; Trumbo, McComas, and Besley 2008). Similar to the elaboration-likelihood model with its central and peripheral routes (Petty and Cacioppo 1981), the HSM posits two modes to social judgement and persuasion, namely, the systematic and the heuristic modes (Eagly and Chaiken 1993).

The HSM contends that one of the information processing modes individuals adopt – the systematic mode – is a comprehensive and analytic orientation in which people access, scrutinise, and integrate all useful information to reach their judgement (Smerecnik et al. 2012; Yang et al 2010). Although it can vary in its extensiveness, prototypical systematic processing refers to the upper end of a data-seeking-analysis-integration continuum. In contrast, the heuristic mode involves the use of learned knowledge structures in the form of simple decision rules, or cognitive heuristics, to reach judgements (Zuckerman and Chaiken 1998). Simple decision rules might be manifested as a result of an agreement with experts' opinions, a tendency to agree with perceived social consensus, or a willingness to rely on currently held information. This mode, therefore, requires less effort and fewer resources (De Dreu and Beersma 2010; Kahlor et al. 2003; Koh and

Sundar 2010). Some papers argue that people adopt heuristic processing when they rely on risk assessments from experts such as public authorities or industrial firms (Cvetkovich et al. 2002; Fukuyama 1996). The HSM assumes that people will engage in a systematic mode when they are not confident about the judgements they reach through the heuristic mode and when they want to maximise confidence in their judgement; in the literature this kind of motivation is called accuracy motivation (Chaiken 1980, 1987). Therefore, past research has shown that systematic processing of risk information may lead to more stable attitudes that are resistant to change (Griffin et al. 2002; Yang et al. 2010).

For all these reasons, relevant papers have suggested that HSM may be adequate to describe how people use information to make a judgement about risk associated with industrial companies (Griffin, Dunwoody, and Neuwirth 1999; Trumbo 2002). Within this model, risk perception is typically defined as a function of the individual's cognitive and affective estimations of the probability of experiencing harm from a given hazard (Trumbo, McComas, and Besley 2008). Probably the most fruitful area of research in risk perception is that which has yielded insight into how people respond to a single, real hazard (Huang et al. 2013; Signorino 2012). In this context, risk literature traditionally has defended that people who think systematically will reduce unnecessary overreactions to risk (Trumbo, 1999). However, some contributions provide empirical evidence that heuristic processing, based on simple decision rules such as agreement with expert opinion (for example, a company's opinion), seems to be associated with judgement of lower risk; and systematic processing, based on the analysis of all useful information from sources other than the company itself (such as civic group associations), with

judgement of greater risk (Trumbo 2002, Trumbo and McComas 2003, 2008). These relationships could be explained by the fact that people who systematically process the information on these real hazards arrive at the conclusion that there is something to be concerned about, and they do not trust the information coming from experts (Trumbo 2002). For this reason, our study proposes hypotheses on the possible causal relationships between heuristic processing, based on simple decision rules (for example, agreement with companies' opinions), and systematic processing, based on accessing, scrutinising and integrating all useful information from different sources, on risk perception:

H_1: Systematic processing of the risk associated with the companies of a petrochemical complex adopted by an individual has a direct, positive and significant influence on his/her perception of risk.

H_2: Heuristic processing of the risk associated with the companies of a petrochemical complex adopted by an individual has a direct, negative and significant influence on his/her perception of risk.

One of the most widely studied subjects in the HSM literature is the antecedent role in the model of an individual's trust in the sources (for example, companies) that may cause hazards (Trumbo and McComas 2003, 2008). Specifically, trust is considered to be an information cue affecting systematic and heuristic processing, and as such, it has been corroborated that in the case of high trust sources, individuals are less motivated or able to process information and will likely fall back on pre-existing attitudes to guide their opinions – akin to heuristic processing (De Dreu and Beersma 2010). In contrast, in the case of low trust sources, individuals are more likely to process the information

systematically. Based on this argument and on the findings of Koh and Sundar (2010) and Trumbo and McComas (2003, 2008), we propose the following hypotheses:

H_3: An individual's trust in the companies of a petrochemical complex has a direct, negative and significant influence on the systematic processing of the risk associated with them.

H_4: An individual's trust in the companies of a petrochemical complex has a direct, positive and significant influence on the heuristic processing of the risk associated with them.

In addition, trust has received growing attention in risk-related research (Chryssochoidis, Strada, and Krystallis 2009; Earle 2010). A general assumption in this academic context is that most people do not have sufficient scientific and technological knowledge to be capable of judging the risk, cost and benefit associated with an industry (Gregory and Miller 1998; Kim and Paek, 2009; Siegrist, Gutscher, and Earle 2005). As a consequence, people have to rely on others, such as industry or governments (ter Huurne and Gutteling 2009), which is why trust becomes so important (Siegrist, Cvetkovich, and Gutscher 2001). Without trust, without its positive expectations and its reduction of complexity, society could not function (Chryssochoidis, Strada, and Krystallis 2009).

Following these arguments, in a review of the literature on trust in the risk management field, Earle (2010) shows that most of the papers he analysed on the consequences of trust included risk perception. These studies found a negative effect when the referent of trust was responsible for managing the hazard. More specifically, in the field of industrial risks, the literature has shown that a person's trust in the companies responsible for

managing the hazard has the effect of reducing his/her risk perception (Bronfman et al. 2008; Jungermann, Pfister, and Fischer 1996; Sjöberg 2000; ter Huurne and Gutteling 2008; Trumbo and McComas 2003). Based on the results of these papers, our study proposes the following hypothesis:

H_5: An individual's trust in the companies of a petrochemical complex has a direct, negative and significant influence on his/her perception of risk associated with them.

The antecedent role of personal environmental values in the relationships among trust in companies, HSM and risk perception

According to the HSM, motivation is one of the elements that may affect the information processing an individual adopts (Chaiken 1980, 1987; Yang et al. 2012; Zuckerman and Chaiken 1998). Motivation can be defined as the individual's desire to form an opinion on the specific risk issue. Motivation for processing is determined by the gap between the actual confidence in one's judgement and the level of desired confidence, with the objective of reaching an accurate judgement of risk. Because systematic processing is assumed to be generally more effective in increasing subjective confidence than heuristic processing, this principle implies that systematic processing will occur when heuristic processing cannot close the actual–desired confidence gap (Chaiken 1980; Chaiken and Maheswaran 1994; Zuckerman and Chaiken 1998). Thus, any factor that increases this gap should increase systematic processing. For example, the importance citizens attach to the possible environmental and health costs of an industrial activity may increase their level of desired confidence in their judgement about its risks; according to this argument, the individual thinks that an incorrect judgement may have more severe consequences.

The present research is concerned with heuristic and systematic processing under accuracy motivation derived from personal values (Zuckerman and Chaiken 1998). Values are beliefs related to a final condition of desired conduct (motivation) that guides individuals' behaviours (Kahle 1996; Rokeach 1973). They can be conceptualized at different levels of aggregation and with different levels of specificity (Soyez 2012; Soyez et al. 2009). For example, according to Schwartz (1994), national-cultural values are collectively held values at a general level that reflect different solutions that societies evolve to the problems of regulating human activities; on the other hand, domain-specific values are individually held beliefs which describe the psychological dynamics of conflict and compatibility that people experience in the course of pursuing their different values in everyday life. Environmentalism is commonly considered as an individual or personal domain-specific value orientation (Steenkamp and de Jong 2010).

In this academic context, personal environmental values are defined as individual beliefs about the significance, importance and well-being of the natural environment and how the natural world should be viewed and treated by humans (Reser and Bentrupperbaumer 2005). Our study distinguishes people who have a positive attitude towards environmental issues (with real environmental concern) from those who do not, and are genuinely apathetic or antagonistic towards it (Park et al. 2008). We consider environmental apathy from Thompson and Barton (1994) to study the influence of personal specific values towards environmental issues on the information processing adopted by individuals when considering the risk associated with the companies of a petrochemical complex.

In this vein, and in light of previous findings (Trumbo 1999, 2002), we posit that apathetic individuals will adopt a heuristic processing mode. The gap between an individual's actual and desired confidence in risk judgement is small, so individual tend to avoid asking and looking for too much information on possible risks (Gamero et al. 2011). In consequence, environmental apathy explains why an individual does not adopt a systematic processing, since he/she is not sufficiently motivated to access, scrutinise and integrate all the useful information about environmental costs and health risks associated with the companies' activities. We therefore propose the following hypotheses:

H_6: An individual's environmental apathy has a direct, negative and significant influence on the systematic processing of information about risk associated with the companies of a petrochemical complex.

H_7: An individual's environmental apathy has a direct, positive and significant influence on the heuristic processing of information about risk associated with the companies of a petrochemical complex.

Social psychology literature has revealed the influence of personal human values on environmental attitudes (Grob 1995; Milfont, Duckitt, and Wagner 2010). Thus, social adaptation theory argues that values are a type of social cognition that functions to facilitate adaptation to environment (Homer and Kahle 1988). Because values are the most abstract social cognitions (reflect the most basic characteristics of adaptation) they influence specific values and, thereby, attitudes and behaviours (Soyez 2012; Stern, Dietz, and Kalof 1993).

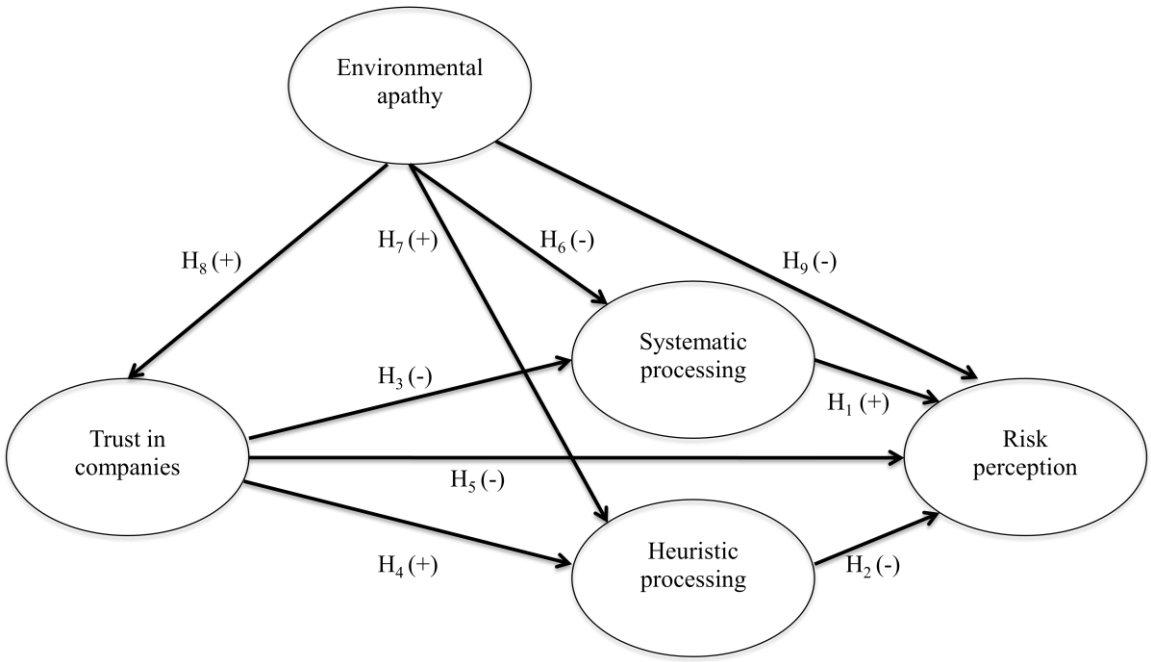
One of the main purposes of this research is to analyse the influence of personal environmental values on attitudes to the petrochemical complex and its possible risks. We consider individuals' trust in the companies and their risk perception as indicators or expressions of attitude (Poortinga and Pidgeon 2005). Individuals' features and values influence trust (Chryssochoidis, Strada, and Krystallis 2009), so they base their trust in an institution and, subsequently, their risk judgement on an assessment of the degree of congruence between their personal values towards relevant issues and the basic principles that guide the decisions and actions of the institution regarding these issues (Whitfield et al. 2009).

Although there is a persistent belief (among practitioners and researchers alike) that value congruence matters in relatively few, close trusting relationships (e.g., close business partners), positive attitude is based on value congruence for all stakeholders (Earle 2010), including citizens. In other words, stakeholders of all types are interested in associating with organizations with whom they can identify, and with whom they perceive a match in values. Based on this approach, we argue that an apathetic resident will not worry about environmental issues and will minimise the possible negative consequences and possible health risks associated with the industrial activity of the companies of a petrochemical complex. He/she will have a greater degree of trust in the companies and will not perceive relevant risk in their activities. In this line, several studies find a relationship between environmental apathy and positive attitudes towards companies and their activities (Park et al. 2008; Thompson and Barton 1994). In light of the above, the following hypotheses are proposed:

H_8: An individual's environmental apathy has a direct, positive and significant influence on his/her trust in the companies of a petrochemical complex.

H_9: An individual's environmental apathy has a direct, negative and significant influence on his/her perception of risk associated with the companies of a petrochemical complex.

The following figure shows the research model with all the proposed hypotheses.



Method

Sample and measures

The data analysed in this study were collected in a residential area of the province of Castelló (Spain) close to a petrochemical complex (an oil refinery together with chemical and petrochemical companies). This type of industrial complex generates positive consequences (agglomeration economies) for the surrounding area, such as employment, income, or better infrastructures (Chertow, Ashton, and Espinosa 2008; Neffke et al.

2011), but it also produces costs such as air pollution, noise, solid and liquid waste, or hazards (Morris, Barker, and Legator 2004; Nadal, Schuhmacher, and Domingo 2004). At the time of the data collection, several news items appeared in the media (diariocriticocv 2010; europapress 2011) concerning various incidents of pollution and risk to the health of the residents living near the industrial complex studied, causing an atmosphere of uncertainty in the community. However, according to the companies in the industrial complex, the negative effects of their activity on the environment and health are minor.

Following several contributions on the HSM (Griffin, Dunwoody, and Neuwirth 1999; Meijinders, Midden, and Wilke 2001; Trumbo 1999; Trumbo and McComas 2003), current research uses psychometric methodology outside the laboratory. This methodology provides a strong foundation for describing how individuals react to a single, real hazard. A reliable set of survey questions is therefore available to measure this reaction in such contexts (Trumbo, McComas, and Besley 2008).

All the questionnaire items (see appendix) were taken from earlier academic contributions: environmental apathy (Thompson and Barton 1994); trust in companies (ter Huurne and Gutteling 2009); systematic-heuristic processing (Trumbo and McComas 2003, 2008); and risk perception (Trumbo and McComas 2008). The items were measured on a 5-point Likert scale where 1 represented very low and 5, very high.

Based on this literature review, we developed an initial questionnaire for consultation with eight experts representing different stakeholders (employees from the petrochemical complex, representatives of the fishing sector, and members of a neighbourhood association in the residential area studied). An initial version of the questionnaire was

drafted following these interviews. Once the results from these interviews had been processed, the final questionnaire was presented to a small sample of 18 residents from the area to ensure it was easily understandable (the final version of the questions is given in the appendix).

Finally, the fieldwork was carried out during March and April of 2011. A total of 992 valid responses were obtained, which were sampled using a random procedure. Spanish Institute of Statistics (2011) figures for that period reported a total population of residents in the area of 42,086, which for a confidence level of 95% yielded a sample error of +/- 3.10% (p=q=50%). The sample figures are representative of the total population of the residential area, with more females, 542 (54.6%), than males, 450 (45.4%). Young respondents, from 18 to 25 years old, accounted for 128 (12.9%); respondents between 26 and 45 years, 480 (48.3%); those between 46 and 65 years, 286 (28.8%); and respondents older than 65 years, 98 (9.9%). Finally 307 respondents (30.9%) had a lower educational level, 521 (52.5%) an intermediate level, and 164 (16.6%) a higher level of formal education.

Statistical procedure

The empirical validation of the model was carried out using structural equations modelling (SEM). SEM allows for the introduction of latent variables that can only be measured through observable indicators (Byrne 2006). In this research, environmental apathy, trust in companies, systematic processing, heuristic processing and risk perception are variables that cannot be directly observed. Moreover, SEM takes into account the existence of measurement error, and offers the possibility of simultaneously

estimating all the relationships proposed, thus yielding a complete representation of the model (Bou-Llusar et al. 2008).

SEM allows us to follow a two-step approach (Anderson and Gerbing 1988). The first step was a confirmatory measurement model that specified the relations of the observed measures to their posited underlying constructs. Several analyses were conducted to ensure that all the criteria met the desirable characteristics of dimensionality, reliability and construct validity (convergent and discriminant). Therefore, the Lagrange multiplier test (LMTEST) was used to introduce modifications in the scales until the fit indices reached improved values according to the recommended limits. The second step was a confirmatory structural model that analysed the causal relations of the constructs, with several statistics used to evaluate the goodness-of-fit (Browne and Cudeck 1993).

In these analyses, we used the statistical software EQS 6.1 (Bentler 1995), and the maximum likelihood estimation method. To protect our results for possible deviations of normality assumption, all the chi-square values reported correspond to Satorra and Bentler (1994) scaled goodness-of-fit statistics.

Results

Scale validation

According to the results of the confirmatory factor analysis, seven items were deleted because they had a factor loading lower than 0.7 (Fornell and Larcker 1981); these items are marked with an asterisk in the appendix[1]. We introduced two modifications in the

[1] It should be noted that only one item had a significant loading on the heuristic scale, but the construct was retained because its exclusion from the model would have affected the content validity. Previous research papers have also considered one item to represent this construct (Trumbo 2002; Trumbo and McComas 2003).

scales following the results of the Lagrange Multiplier Test (LMTEST): the error correlation between the items P2.2 with P2.3 and the items P3.4 with P5.2 (all of them with very similar content for the residents of the sample). The final measurement model showed an acceptable fit (Satorra-Bentler χ^2= 214.181, df = 79, p-value < 0.001, RMSEA = 0.042, CFI = 0.984), with all the indices above the recommended cut-off values. The factor loading was higher than 0.7 and the t-test was significant (t>1.96) for all the items (table 1). Composite reliability (Fornell and Larcker 1981) was used to assess reliability of the scales, all of which were above the 0.7 threshold (table 1).

Convergent validity was assessed using the Bentler-Bonett normed fit index, BBNFI (Bentler and Bonett 1980)[2]. A BBNFI greater than 0.9 indicates a strong convergent validity. Considering this cut-off value, a high level of convergent validity was found, as reported in table 1.

Table 1
Dimensionality, reliability and convergent validity of the scales of the model

Items	Mean	Standard	Factor Loading	t-Test	AVE	Composite

[2] BBNFI is the ratio of the difference between the model chi-square for the given model minus the model chi-square for the null model (i.e., the independence model in which all of the correlations are zero), divided by model chi-square for the null model (Ahire et al. 1996).

		Dev.	(standarised)			Reliability
Environmental apathy					0.72	0.87
P1.1	1.96	1.16	0.830	Fixed		
P1.2	1.73	1.01	0.910	94.215*		
P1.4	1.65	0.93	0.735	32.338*		
Trust in companies					0.79	0.94
P2.1	2.27	1.22	0.864	Fixed		
P2.2	2.15	1.32	0.872	66.341*		
P2.3	2.22	1.22	0.947	77.007*		
P2.4	2.84	1.38	0.773	40.545*		
P2.5	2.06	1.16	0.893	77.733*		
Systematic processing					0.78	0.90
P3.1	3.36	1.35	0.848	Fixed		
P3.3	3.50	1.26	0.899	38.075*		
P3.4	3.11	1.40	0.867	96.498*		
Heuristic processing					1	1
P4.2	2.15	1.18	1	Fixed		
Risk Perception					0.78	0.90
P5.1	3.51	1.47	0.862	Fixed		
P5.2	3.04	1.52	0.833	26.665*		
P5.3	3.57	1.46	0.904	11.681*		
Fit of the model: Satorra-Bentler chi-squared = 214.181, df = 79, p-value = 0.000, RMSEA = 0.042, CFI = 0.984; BBNFI = 0.976; BBNNFI = 0.979						

*Significant at $p < 0.001$

Finally, discriminant validity was also supported, since the square root of the average variance extracted ($AVE^{1/2}$) of each factor was higher than the correlation between factors (table 2).

Table 2
Discriminant validity of the scales

Factors	(1)	(2)	(3)	(4)	(5)
(1) Environmental apathy	0.850				
(2) Trust in companies	0.405*	0.888			
(3) Systematic processing	-0.128*	-0.254*	0.886		
(4) Heuristic processing	0.315*	0.284*	-0.361*	1	
(5) Risk perception	-0.323*	-0.461*	0.570*	-0.315*	0.882

Diagonal: square root of AVE
Below the diagonal: Pearson correlation coefficients between factors.
*Significant at $p < 0.001$

Structural relationships of the model

The five scales with a total of fifteen items, obtained from the scale validation process, were used to estimate the structural model. The values of all the statistics used to evaluate the goodness-of-fit showed its adequacy for the sample data (table 3).

The analysis of the results corroborate all the hypotheses proposed except the influence of the heuristic processing on risk perception (H_2) and the role of environmental apathy as an antecedent of the systematic processing (H_6). The higher influence on risk perception is from the systematic processing (0.472; H_1). Therefore, risk perception is influenced negatively by trust in companies (-0.275; H_5) and environmental apathy (-0.142; H_9). It is outstanding that risk perception has the higher coefficient of determination in the model ($R^2 = 0.447$). The heuristic processing is influenced directly and positively by trust in companies (0.190; H_4); and by environmental apathy (0.240;

H_7). In contrast, trust in companies has a negative effect on the systematic processing (-0.241; H_3). Finally, environmental apathy influences on trust in companies (0.405; H_8).

Table 3
Causal relationships

Direct causal effects	Parameter estimates (standarised values)	S.E	t-Test
H_1: Systematic processing → risk perception	0.472	0.026	19.796*
H_2: Heuristic processing → risk perception	-0.034	0.033	*-1.123 (n.s.)*
H_3: Trust in companies → systematic processing	-0.241	0.045	-5.871*
H_4: Trust in companies → heuristic processing	0.190	0.041	5.201*
H_5: Trust in companies → risk perception	-0.275	0.044	-7.561*
H_6: Environmental apathy → systematic processing	-0.039	0.036	*-1.283 (n.s.)*
H_7: Environmental apathy → heuristic processing	0.240	0.050	5.889*
H_8: Environmental apathy → trust in companies	0.405	0.030	14.497*
H_9: Environmental apathy → risk perception	-0.142	0.035	-5.311*
Indirect causal effects	Parameter estimates (standarised values)	S.E	t-Test
Environmental apathy → systematic processing	-0.098	0.021	-5.443*
Environmental apathy → heuristic processing	0.077	0.019	4.932*
Environmental apathy → risk perception	-0.187	0.033	-7.275*
Trust in companies → risk perception	-0.120	0.023	-6.180*
Dependent Factor	R^2		
Trust in companies	0.164		
Systematic processing	0.067		
Heuristic processing	0.130		
Risk perception	0.447		
Goodness-of-fit indices for the structural model	Satorra-Bentler chi square = 268.719, df = 80, p-value = 0.000, RMSEA = 0.049, CFI = 0.978, BBNFI = 0.969, BBNNFI = 0.971		

(n.s.) = no significant
* Significant at $p < 0.001$

According to these results, if residents follow the systematic processing mode they perceive higher risk associated with the companies of the petrochemical complex. In contrast, if they have environmental apathy and trust in companies, they adopt the heuristic processing (not the systematic) mode and they perceive lower levels of risk.

In summary, this study demonstrates that residents' specific values towards environmental issues affect their trust in the companies of a petrochemical complex, the way they process information, and their judgement of the risk associated with the activity of this type of industry.

Discussion

The conceptual form of the HSM has evolved in the literature over the past 30 years or so, but the model is still far from "closed", and requires refining and expanding further. Researchers are also discovering the potential of HSM to be adapted to a variety of applied circumstances outside the laboratory, including real risk. Following these trends, through a psychometric model, this study has attempted to enrich the HSM by including personal environmental values in the context of a real risk situation.

The empirical validation of this research supports the positive influence of personal environmental values, represented by environmental apathy, on trust in the companies of a petrochemical complex, and its negative incidence on risk perception associated with their industrial activities. According to the social adaptation theory, individuals base their attitudes to an institution on their personal values. In our study, if a resident trusts the companies of a petrochemical complex and does not perceive risk from them, it is because, following his/her personal environmental values, he/she attaches little importance to the environmental costs of the companies' activities, and possibly prioritises the economic benefits of the complex.

Another interesting result is that environmental apathy has a direct and indirect influence on heuristic-systematic processing. According to the accuracy motivation principle, if a

person does not consider environmental issues to be important, that person is not motivated to find and analyse all the available information from diverse sources about the environmental and health costs derived from the industrial activities; thus, heuristic processing among the residents is explained by their environmental apathy.

On one hand, environmental apathy does not affect systematic processing significantly, although it is true that it has a significant influence through trust in the companies; hence, the higher the level of trust, the lower the level of motivation to adopt systematic processing to judge a risk. On the other hand, if the trust is higher, the citizen will adopt heuristic processing. This result seems to corroborate the values-attitudes-performance sequence of social adaptation theory, so environmental apathy leads the individual to have a favourable attitude towards the companies, which denotes a higher level of trust and leads him/her to adopt heuristic processing since he/she is not motivated to undertake systematic processing.

This study also corroborates the direct and negative effect of trust in companies on risk perception. Both concepts are represented in the person's attitude towards the companies of the petrochemical complex, so when residents' trust in these companies increases, their perception of the risk falls.

We also corroborate Trumbo's results (Trumbo 1999, 2002; Trumbo and McComas 2003, 2008) and the assumption that attitudes are formed and modified as people gain information about attitude object, with the positive and relevant direct influence (higher weight in the model) of systematic processing on risk perception. This relationship may demonstrate that people who process information about industrial risk rationally have a higher perception of risk. According to Trumbo (2002, p.381): "A less scientific but

perhaps more humanistic rationality could easily be argued on the fact that those who have most engaged the information in these cases have arrived at the conclusion that there is something to be concerned about".

By contrast, we found no statistically significant effect of heuristic processing on risk perception. Risk perception is influenced directly and indirectly by environmental apathy and trust in companies, so their effects may overlap the antecedent role of the heuristic processing on risk perception.

In conclusion, the main contribution of this paper is its corroboration of the direct and indirect effects of personal specific values towards environmental issues on the other variables that make up the trust in companies–information processing–risk perception sequence. To our knowledge, personal environmental values have not previously been introduced into this sequence, and their effects are therefore not reflected in literature to date.

Our results may be useful to guide the managers of the companies in this petrochemical complex in their behaviour and communication policies. These managers should be concerned about the level of trust reported by residents of this research sample, since all five items of the scale representing trust in companies had a mean of below 3 (table 1). Regular negative consequences generated by a petrochemical complex such as air pollution, noise, waste, and/or sporadic episodes of petrol spills related to its activity may contribute greatly to form a poor image among residents. The interconnected relationship between trust in companies and risk perception explains the higher mean results of the indicators representing the risk perception scale (table 1). Therefore, only people with

environmental apathy may trust the petrochemical complex and have a lower perception of risk.

The main objective of each one of the companies – and of the complex itself through combined actions – should be to focus on the citizens with environmental concerns (most of the sample) in order to show them that the companies are truly concerned about the costs and risks of their activity. In this line, the current legislation of chemical risk in Europe (Directive 2012/18/UE of the European Parliament and of the Council 2012) is only their starting point to minimise risk and improve security measures.

Indeed, the communication policy followed by these companies should attempt to promote a frank, open and bidirectional relationship with the residents. In situations of distrust, as in this case (for example, item P2.5 had a mean of below 3; see table 1), the first step must be to listen to the public's concerns before giving them new information. Attempting to increase trust by simply providing information may destroy rather than create it (Poortinga and Pidgeon 2005, 2006).

The resident's need for information depends on his/her personal environmental values, and the companies must therefore try to side with them. Specifically, the positive externalities of the complex should be highlighted, such as economic issues, in order to reinforce the positive attitudes of those residents without environmental concerns who adopt heuristic processing. Likewise, the information referring to the activity in the complex and its possible risks needs to be dealt more thoroughly in order to satisfy the motivations of those residents who adopt the systematic processing mode. The companies in the petrochemical complex must consider communication to break the association

among resident's pro-environmental values, his/her distrust in their activity and his/her perception of the risk associated with them.

As in other empirical studies, our findings and implications have limitations and should be interpreted with caution. In the first place, the model was developed and tested using the same data set. The model should be applied in other residential areas near petrochemical complexes or other industrial activities (nuclear power stations, coal mines, etc.) to validate our results and to assess its generalisability to other contexts.

Secondly, we used perceptual data to measure the variables of the model and it should be acknowledged that the perceptions of those surveyed might not provide a completely accurate view of the reality. A logical extension would be to use multiple informants from different stakeholder groups to verify perception. The study also used a generic SEM, although there may be differences in the characteristics of the residents such as gender, age, education or income level. A further extension of this paper would be to apply the model to analyse differences between countries. The sociology literature has provided evidence that the level of economic wealth in a country affects its citizens' concern for the environmental issues (Diekman and Franzen 1999; Franzen 2003); GDP per capita could therefore be used to test our model in countries that are wealthier and poorer than Spain.

Thirdly, one of the main limitations of this study is the heuristic processing scale. Previous work has also found this concept difficult to measure. A multi-item scale with better reliability and validity should ideally be developed.

An interesting line of research would be to consider motivation types other than accuracy motivation. Reformulations of the heuristic-systematic model have included two additional motives that may govern information processing: defense motivation and impression motivation (Chaiken, Giner-Sorolla, and Chen 1996). It would be helpful to analyse the possible differences in their effects on the other model variables. Finally, because of the significant role of the public sector in authorising and supervising the industrial activities of a petrochemical complex, residents' trust in public authorities could be considered to enrich the model.

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Appendix

Environmental apathy

P1.1 Habitually environmental threats such as deforestation and ozone depletion have been exaggerated.

P1.2 I think that conservation of natural resources is not as bad as many people believe.

P1.3 Most environmental problems would solve themselves given enogh time. (*)

P1.4 I do not see reasons for being too concerned about environmental issues.

P1.5 It seems to me that most environmental organizations are too pessimistic. (*)

Trust in companies

P2.1 These companies protect local residents from possible harm derived from their activities.

P2.2 I believe these firms when they affirm that they do as much as possible to minimize the risk of the residents.

P2.3 These companies are concerned about the safety and health of citizens.

P2.4 These firms know how to handle the risks derived from their activities.

P2.5 These companies listen to and are sensitive to the environmental worries of the residents.

Systematic processing

P3.1 I pay particular attention when I read information about the risk that it has for the health of those who live near a petrochemical complex as this one.

P3.2 In order to understand the issue of these risks, the more viewpoints I get the better. (*)

P3.3 When I find information of these risks I am interested, although I do not agree with them.

P3.4 I always try to learn more about the risk that living near a petrochemical complex as this one has for health.

Heuristic processing

P4.1 My personal experience allows me to think about the risk that living in this area supposes for health. (*)

P4.2 I treat in a superficial way the information related to these risks.

P4.3 There is more information about these risks than I personally need (*).

P4.4 About the risk that living in this area has for health, I follow the experts' information. (*)

Risk perception

P5.1 I believe I am exposed to risk for health living in this area.

P5.2 I am frequently worried about the risk related to living in this area.

P5.3 I am concerned that living in this area poses risks that will extend to future generations.

P5.4 The risk for health associated to living in this area are increasing in the last years. (*)