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A Critical Realist Perspective on Decisions Involving Risk and Uncertainty

Abstract: *The relevance to decision research of recent advances in the philosophy of social science is considered. The critical realism of Roy Bhaskar argues for the identification of contextually contingent explanatory mechanisms at multiple levels based on concepts grounded in intersubjectively shared reality. Using examples from the author's and other's research on the psychology of decisions involving risk and uncertainty, this paper explores the implications of taking a critical realist approach. It is argued that critical realism has the potential to advance and unify disparate experimental and naturalistic lines of research. Furthermore, a diverse range of experimental, process-tracing and observational methods can play important complementary roles in developing fruitful critical realist explanations of decisions involving risk and uncertainty.*

Key words: *decision making, critical realism, risk, uncertainty*

A Critical Realist Perspective on Decisions Involving Risk and Uncertainty

The term critical realism has been used in a number of different ways. In general, a critical realist philosophy is critical of the traditional realist view of science and social science, in particular the assumption that the objective study of the physical and social world is achievable. Rather, it accepts that human conceptions of the world are altered or distorted by people's mental processes in different ways. Nevertheless, unlike relativism, it does not go as far as to argue that that all such conceptions are completely subjective and relative. The particular variant of critical realism discussed in this article is the philosophy developed by Roy Bhaskar and his colleagues since the 1970s (Archer, Bhaskar, Collier, Lawson, & Norrie, 1998). In this case, the name was derived from Bhaskar's general philosophy of social science that he called transcendental realism, and a more specific one known as critical naturalism (see Archer, 1998).

The structure of this paper is as follows. The next section presents a brief overview of the fundamental assumptions of critical realism as defined above. Following this, a critical realist approach to decision research is sketched out in more detail, using examples of decisions involving risk and uncertainty in both experimental and real world contexts. Mainly, the cognitive processes and mental representations underlying such decisions are discussed, as this is central to a critical realist perspective at the psychological level. Finally, some of the challenges that a decision research programme taking a critical realist approach might face are discussed, and it is compared to alternative broad approaches to decision research.

Critical Realism

The ontological and epistemological assumptions of critical realism are introduced in Robson's (2002) methodological textbook a book and in an edited volume by Bhaskar and his colleagues (Archer et al., 1998). A basic

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ontological question for social and psychological science is whether or not various social and psychological structures and phenomena exist. Essentially, the realist assumption is that they do, and the alternative, constructionist assumption is that they do not: they are constructed in the minds of both the layperson and the social scientist. So, as the name implies, critical realism takes a realist ontological position. Two basic assumptions concern the complexity of reality. The first is the *complexity of multiple levels* of reality, and the second can be called *contextual complexity*. Neither of these are new ideas in themselves, nor are they particularly contentious. With respect to the first, a critical realist approach accepts and seeks to build on the traditional analysis of social and psychological reality as consisting of different levels. Sociological analyses are particularly interested in the interaction between social structures and individual agents, whereas a cognitive-psychological analysis would focus on the interaction between the conscious experience of individuals and sub-conscious mental processes. The second assumption, of the contextual complexity of reality, has also been acknowledged previously, for example in naturalistic decision making research (Lipshitz, Klein, Orasanu, & Salas, 2001). One consequence of placing contextual complexity as a fundamental assumption is that it becomes necessary to clarify and make explicit the ways in which research findings might generalise, and the limits and constraints on generalisation.

A fundamental epistemological assumption of critical realism is that non-observable elements of social and psychological reality are knowable, and furthermore, that a central goal is to develop concepts and theories which model such aspects of reality. Theoretical concepts such as subjective probability, utility and decision making are seen as real mental entities. To give an example at the psychological level, consider the concept of a decision. Some decision researchers, even 50 years after the cognitive revolution in psychology, are resistant to incorporating decisions as mental entities into decision theories. They take the behaviourist, positivist position that social and psychological science should confine itself to describing and predicting the observable. Therefore, their focal phenomenon is decision behaviour, that is, the observable act of executing a decision.

In general, all researchers agree that the *decision act* is a core phenomenon to be understood. However, not all researchers accept that the intention to act – let us call it *decision intention* – is a real entity that should form part of a theory of decision making. Although it may be acknowledged as a real entity, it is assumed to be an unknowable real entity, except in so far as it is manifest in the form of observable decision behaviour. In contrast, for critical realism a decision intention is a real mental entity to be understood. Thus, it shares with other traditions in decision research, such as process tracing approaches, the goal of modelling mental states and phenomena.

Other epistemological assumptions of critical realism are consequences of ontological ones. The assumption of contextual complexity leads to the research goal of understanding the context dependencies of mental states and processes, a goal also shared with other decision research traditions. Similarly, a consequence of the recognition of multiple levels of reality is the epistemological goal of understanding the relations between levels, for example, the relationship between the conscious experience of the individual decision maker and subconscious mental processes.

In the above, some of critical realism's assumptions and goals concerning the description of social and psychological reality were outlined. However, fully understanding a phenomenon involves explanation as well as description, and this is the ultimate goal of critical realism. Although this is the goal of most decision research, it is argued that critical realism's account of explanation is potentially very useful.
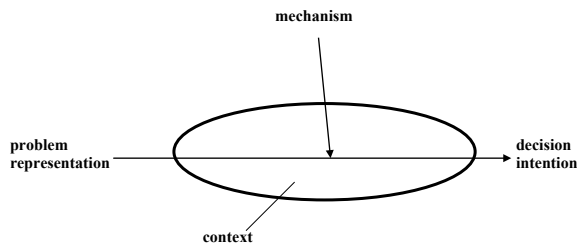
With respect to explanation, a central goal of critical realism is to explain the occurrence of a phenomenon at a given level of reality in a specific context. It is assumed that phenomena will often not be replicated across contexts, and so the goal is to construct valid theories of what might cause a phenomenon in a particular context. To this end, alternative theories are constructed, from entities assumed to be real, which include specific mechanisms that would produce the phenomenon. William Outhwaite (1998, p.292) defines the critical realist notion of explanation as 'an attempt to represent the generative mechanisms that bring about the explanandum'. (The 'explanandum' is simply that which is to be explained). He argues that in social science generative mechanisms could be either physical causes, as generally understood, or psychological causes, i.e. the reasons or thoughts of an agent. Since reality is complex, it is to be expected that many generative mechanisms would be complex and involve multiple levels, although simple mechanisms may operate in some contexts.

Critical realism has a distinctive position with respect to prediction. It accepts that because of the complexity of social and psychological reality and because it is an open, rather than a closed system, theories cannot always predict phenomena. Although prediction is seen as possible in controlled conditions and an important objective, the ultimate goal is explanation. That is, it is more important to explain than to predict, and prediction itself cannot be said to provide a complete understanding unless it is accompanied by a valid explanation. On the other hand, valid explanation without successful prediction can be said to make a valuable contribution to knowledge. Thus, whereas much social and psychological research places prediction on a pedestal, as the gold standard by which the quality of a theory is to be judged, critical realism rejects the blind pursuit of prediction without explanation. The epistemological assumption being made here is that many aspects of social and psychological reality are simply not predictable.

The representation in Figure 1 (adopted from Robson, 2002, p. 31) illustrates a critical realist explanation of a decision intention. One important point is that general explanations are not possible, only specific ones, grounded in specific contexts. However, social and psychological science traditionally aims to identify general principles
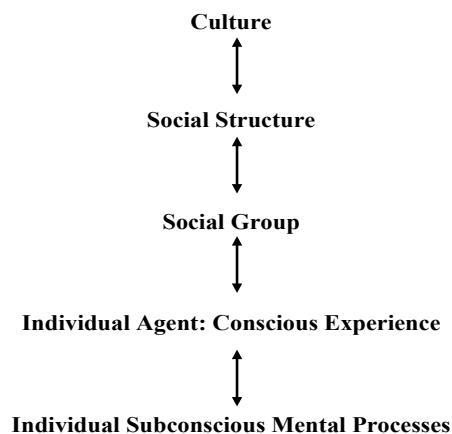
of causation. In what ways might critical realist theories do this, or do they reject such aspirations altogether? The answer is that a generative mechanism identified in one context may be triggered in another context or it may not: In the second context there may be inhibiting or facilitating conditions that may attenuate or amplify the operation of the mechanism. The critical realist's ultimate explanatory goal, therefore, is to identify which mechanisms operate in which contexts and what are the common features of such contexts.

Figure 1.

The complexity of multiple levels of psychological and social reality implies the necessity of what Collier (1998) has called 'stratified explanation', that is explanations drawing on mechanisms operating at different levels. Therefore, rather than the simple mechanism described above, a complete explanation of a phenomenon is likely to involve a complex generative mechanism involving multiple levels. A conventional classification of multiple levels of psychological and social reality is illustrated in Figure 2. The tendency in many decision research traditions is to focus on explanations at a single level. In contrast, the critical realist perspective advocates the integration of single-level explanations across levels. Examples of research integrating conscious and subconscious cognitive mechanisms underlying decisions (Zakay & Tuvia, 1998), and the higher levels of culture, social structure and the social group (Pidgeon, Kasperson & Slovic, 2005) are discussed in the final section.

Figure 2.

What does all this imply for research strategy and methodology? Robson (2002) gives useful examples of research strategies adopting critical realist explanatory methodologies to address specific applied research problems such as investigating the effectiveness of surveillance cameras on car park crime. Essentially he argues for a pragmatic, eclectic approach to methodology somewhat loosely guided by the epistemological goals of critical realism. All rigorous research methods are candidates for inclusion in the critical realist's methodological toolbox, since any method is useful if it can play a role in the development of practical explanatory theories.

Decisions Involving Risk and Uncertainty

In this section, in order to make the argument more concrete, elements of a critical realist research strategy for a specific research domain, individual decisions involving risk and uncertainty, will be outlined. In any mature area of research such as this there is already a substantial body of knowledge. Therefore, the first step should be to review the literature from a critical realist standpoint. This means trying to determine the extent to which previous research has contributed to the critical realist goals of description and explanation. This orientation is a little different from a review undertaken from a more traditional perspective. For example, less weight would be attached to the predictive validity of any theories evaluated and more importance given to high-quality descriptions of behaviour and experience. A critical realist literature review of an area of decision research should examine the extent to which the following has been achieved.

1. *The description of decision behaviour and experience in specific contexts*, to include
   a. Predecision behaviour and verbal reports
   b. Observable decisions; concomitant thoughts and feelings
   c. Postdecision behaviour and reports
   d. Cultural, societal, institutional and social group contexts

2. *The identification of possible generative mechanisms underlying decisions*, at
   a. Psychological levels (cognitive and emotion-based mechanisms)
   b. Social levels.

3. *Tests of context-specific hypotheses about the operation of different mechanisms*

4. *The construction of practical theories incorporating*
   a. An understanding of which mechanisms operate in which contexts and for whom
   b. An understanding of inhibiting and facilitating conditions for these mechanisms
   c. Stratified explanation integrating multiple levels.

The conclusion of the literature review should, as usual, direct the research agenda towards filling the gaps in current knowledge and resolving any inconsistencies identified. The conclusions drawn and priorities identified would be somewhat different to a more traditional review. To illustrate this approach further, let us consider three specific decision contexts: the experimental lottery paradigm; an experimental sports gambling context; and a typical consumer credit decision problem.

Lottery Decisions: 1. Basic Strategies

From a critical realist perspective, an argument can be made for continuing to study the artificially created 'small world' of the experimental lottery. First, much is known about decision acts and predecision processes in this context. Second, it provides a convenient environment to develop practical explanatory theories and test the validity of alternative generative mechanisms underlying both previously reported and new decision phenomena. However, the extent to which mechanisms relevant to lottery decisions generalise to other contexts is an important research question. For example, Huber and Kühberger (1996) investigated the extent to which a probability judgement mechanism might be relevant to non-lottery decisions involving risk. They argued that in some cases it was not, since their research participants did not ask for information relevant to the probability of negative outcomes in some contexts. This illustrates the need to extend research to a range of naturalistic decision environments, as Huber and his colleagues have been doing in recent years (Huber, 1997, 2007). They have found, as expected from a critical realist perspective, evidence of different generative mechanisms to those underlying lottery decisions.

Cognitive mechanisms can be represented using the information-processing operator analysis introduced to model problem solving by Newell and Simon (1972) and first applied to decision making by Huber (1986, 1989) and Johnson (1979). It provides a useful system for representing some of the real mental entities (cognitive processes and states) assumed to underlie decisions. In order to develop the argument let us consider a number of basic observations in the lottery literature.

Observation 1. Ward Edwards (1969) and others showed in the fifties and sixties that the general pattern of experimental lottery decisions is compensatory with respect to the main risk dimensions (gains, losses and their associated probabilities) and is broadly predictable by the Subjectively Expected Utility (SEU) model. This applies to gambles across a range of complexity, including the simplest case shown in Table 1, which has just two risk dimensions, possible gains or winnings (SW) and their probabilities of occurrence (PW). The SEU model was conceived as a structural model designed to express the conjunction between these basic risk dimensions and decision behaviour. However, let us consider the cognitive mechanisms that it embodies. At the same time we can consider those derivable from original prospect theory (Kahneman & Tversky, 1979), since they are similar. The

main difference is that original prospect theory assumes an initial phase consisting of editing operations that can be applied to decision alternatives to mentally restructure them.

Table 1. Three simple gambles in which either an amount of money, SW, can be won with probability PW (otherwise SW is not won).

Gamble	A	B	C
Win outcome (SW)	260	200	140
Probability (PW)	6/24	8/24	10/24

Three cognitive mechanisms consistent with both structural models are: (1) outcome evaluation; (2) probability judgement or weighting; and (3) multiplicative integration. For convenience we can use the familiar notation of prospect theory to represent the first two mechanisms, that is, 'v' and 'π' respectively. If there is no prior editing of the gambles presented, the above three mechanisms can be represented as follows, with a fourth representing the maximization decision criterion:

Strategy 1: Compensatory, within-alternative, multiplicative integration

1.
Outcome evaluation: $v(SWA) \rightarrow WA$; $v(SWB) \rightarrow WB$

2.
Probability judgement: $\pi(PWA) \rightarrow PA$; $\pi(PWB) \rightarrow PB$

3.
Multiplicative integration: $mult(PA, WA) \rightarrow X$; $mult(PB, WB) \rightarrow Y$

4.
$max(X, Y) \rightarrow Decision$

This is one series of mechanisms that could underlie observation 1. Now let us consider some classic work by Tversky (1969).

Observation 2. Certain binary choice patterns reflect intransitive preferences: Gamble A preferred to B; B preferred to C; but C preferred to A. Tversky argued that both the lexicographic semi-order (LS) heuristic and an additive difference model could account for such patterns of decisions, although the SEU model could not. Later, Kahneman and Tversky (1979) argued that prospect theory could account for the observed intransitivity if an editing operation was included whereby small differences are discarded prior the evaluation of prospects. In his original study, however, Tversky discussed how the additive difference model could be translated into an underlying cognitive mechanism. Using an information-processing operator approach, this is:

Strategy 2: Non-linear additive difference (NLAD)

1.
Difference evaluation: Diff(SW A, SWB) → DSW
                             Diff(PW A, PWB) → DPW

2.
Difference comparison: Comp(DSW, DPW) → Decision

The strategy 2 mechanisms could generate both of the above observations, whereas Strategy 1 can only explain the first, and the LS heuristic can only explain the second. Therefore, using conventional hypothesis-testing logic, the evidence supports the validity of Strategy 2. It is important to point out, though, that from the critical realist perspective, the strategy 1 hypothesis would not be considered falsified by these observations. It may not have been triggered in this specific context because inhibiting conditions may have been present. Finally in this analysis, let us consider the contribution of verbal reports to the quest for valid cognitive mechanisms underlying lottery decisions.

Observation 3. Montgomery (1977) and Ranyard (1982) found that in binary choice tasks where lotteries were presented simultaneously, compensatory verbal reports of differences predominated. This was illustrated in Ranyard's paper as shown in Table 2, with two examples from Montgomery's study. Some verbal reports explicitly compared differences in winning amounts and probabilities, and others expressed evaluations of differences on one of the risk dimensions. Statements such as these, as well as overall preference patterns, were consistent with strategy 2 (NLAD) rather than the LS heuristic. Furthermore, the verbal reports were not consistent with either Strategy 1 or its prospect theory variation. With respect for the latter, some statements could be construed as editing by discarding small differences. However, there was little that could be interpreted as supporting the notion of multiplicative integration of probability and value as an underlying mechanism of binary decisions.

Table 2. Five types of verbal report of choices from two simple gambles (from Ranyard, 1982)

1. *Explicit or strongly implied comparison of differences on each risk dimension*
    a. "With option 1, you'd win 260 and that's significantly higher than the 220 you'd win with option 2, and the difference in the chance really doesn't make any difference"
    b. "Option 2, because the chance is nearly doubled and the difference in the winnings is only 60, so it would be worth going for the 7/20 chance"
    c. From Montgomery (1977): "I'll take option B because the decrease in the chance of winning does not correspond to a proportional increase in the payoff"

2. *Qualified relative judgements on only one risk dimension, small magnitude pw*
    d. "Option 2, a bigger win and similar chances to Option 1"
    e. From Montgomery (1977), "I'll take the one with the larger sum of money because the probabilities of winning look almost the same"

3. *Qualified relative judgement on only one dimension, large magnitude pw*
    f. "Option 1, more than twice the chances, less money than the other one"

4. *Qualified relative judgement on one dimension, large magnitude sw*
    g. "Option 2, win nearly twice as much as Option 1 while the chance is reasonable"

5. *Qualified relative judgement on one dimension, small magnitude sw*
    h. "Option 2, more chances for a similar amount of money"

Lottery Decisions: 2. Multistage Models

Gonzáles-Vallejo (2002) more recently developed the stochastic difference model, which is a variant of Tversky's (1969) additive difference model with the addition of a decision threshold and random judgment error. She made a powerful argument for attribute difference judgements being a basic cognitive mechanism underlying binary decisions, as argued earlier, and for context-sensitivity with respect to which attributes have the greater impact on choice. On the positive side, then, algebraic process models such as Gonzáles-Vallejo's contribute to critical realist explanations to the extent that their algebra represents valid models of underlying cognitive mechanisms. Lopes (2000) has previously made the same point, strongly arguing for the importance of algebra modelling process. On the negative side however, current algebraic process models have several limitations. First, they perpetuate the futile quest for constant conjunctions between environment and decision behaviour. Furthermore, their proponents perpetuate the pointless restriction on what is authenticated as admissible evidence. In particular, they continue to insist that only decision behaviour is to be explained, or to be accepted as evidence, as do current algebraic theorists (e.g. Birnbaum & Bahra, 2012; Regenwetter, Dana, & Davis-Stober, 2011). Finally, contemporary algebraic process models embody a limited conceptualisation of the nature of cognitive mechanisms underlying decisions. They are usually single-stage process models proposing a 'one-size-fits-all' evaluative mechanism.

In contrast, the process tracing approach views strategies such as the non-linear additive difference mechanism as just one component of a complete specification of the generative mechanisms underlying lottery decisions (Bettman, Luce & Payne, 1998; Huber, 1986, 1989; Montgomery, 1983; Payne, 1982; Payne, Bettman & Johnson, 1993; Svenson, 1996, 2003). For example, other mechanisms, such as editing heuristics, involve the restructuring of presented lottery information. This was one of Kahneman and Tversky's (1979) insightful contributions with original prospect theory. Extensive evidence of editing heuristics has been elicited from verbal reports of more complex lottery decisions (Ranyard & Crozier, 1983; Ranyard, 1987, 1989, 1995).

Although much has been discovered about the cognitive mechanisms underlying decisions in experimental lottery contexts, a thorough-going critical realist analysis is a long way from being completed. For example, the role of the following possible mechanisms could be investigated further: (1) *Initial appraisal* of each gamble; (2) *Similarity contingent editing* of the gamble set; (3) *Attribute difference*

judgements across gambles; and (4) *Differentiation restructuring* of gambles (Svenson, 1996; 2003). Similarly, although important contributions towards explaining why these mechanisms operate (for example, Payne et al.'s effort-accuracy account, 1993) further analysis would be useful. In a critical realist search for understanding, generative mechanisms themselves become the next explananda for investigation. For example, if similarity contingent editing is shown to occur, what mechanisms might underlie it?

Sports gamble decisions

As explained earlier, from a critical realist point of view it is important to describe decision processes and behaviour across a range of contexts. One of our studies compared lottery and sports gambling (Ranyard & Charlton, 2006). The idea was to keep presented information on the main risk dimensions constant across gamble context, although background information and knowledge were varied. We were interested to discover whether cognitive mechanisms identified in lottery contexts generalised to sports gambling, and also, whether any different mechanisms might be implicated. Previous studies of insurance and other non-lottery domains have shown that background knowledge triggers processes other than comparative evaluations of the main risk attributes (Hogarth & Kunreuther, 1995; Huber & Kühberger, 1996; Lipshitz, & Strauss, 1997). Figure 3 presents a typical sports gamble used in our studies. Rather than the clearly defined probabilities of the lottery, which are represented, for example, by the proportions of winning or losing tickets from a known number of tickets, the percentages presented here were described as the subjective probabilities of sports experts. In comparing decisions and verbal reports in this context with those of the equivalent lottery we found much similarity but also some differences. With respect to similarities, many verbal reports in both contexts were dominated by evaluations of differences on the main risk dimensions, as illustrated at the top of Table 3. There was evidence, therefore, that cognitive mechanisms involving evaluations of risk attribute differences generalise to this sports gambling context.

Figure 2.

BETTING UPON THE OUTCOME OF A FOOTBALL MATCH

Given the information below, indicate your choice of gamble on the sheet provided.

STAKE OF £2.00

ODDS AND WINNINGS:

A.   HOME WIN   ODDS 1/2
      YOU WOULD WIN £1.00 (+ YOUR £2.00 STAKE BACK)

B.   DRAW   ODDS 3/1
      YOU WOULD WIN £6.00 (+ YOUR £2.00 STAKE BACK)

C.   AWAY WIN   ODDS 4/1
      YOU WOULD WIN £8.00 (+ YOUR £2.00 STAKE BACK)

PERCENTAGE CHANCES:

HOME WIN	DRAW	AWAY WIN
60%	22%	18%

Table 3. Sports gambling decisions: concurrent verbal protocols (from Ranyard & Charlton, 2006)

Compensatory processing of the main risk attributes
"Home win 5 to 3, £3.33, draw 11 to 6, £3.67, away win same as A isn't it, 5 to 3. So again, looking at percentage chances of winning ... I'm gonna go for B again, because it's only slightly less, the percentage chance of winning, but there's slightly more to win. Okay, B."

Stated probability revision using team location information
"Draw odds 5 to 2, 26% ... Home win odds 7 to 5, could win £2.80. And that's the same for the away win … This time I'd like to go for the one with the highest percentage and the home win and the away win both have the same percentage but I think I'd go for the home win because there's more, there's more chance of them winning at home than away."

Protocols indicating a knowledge-based strategy
"I'm going for a … draw here, between two, between two teams, whoever they are, presumably ... great teams like Arsenal or Liverpool, who end up doing a boring … so called nil, nil draw."

However, verbal reports further indicated that two other cognitive mechanisms can operate in the sports gambling context, both involving background knowledge not available in the standard lottery paradigm. First, a probability revision mechanism, whereby 'home team' information was used to revise the stated home win probability, was indicated in some protocols (see the second protocol in Table 3). Second, some use of knowledge-based strategies was indicated whereby the expert probability judgements were used to infer relative team strength, as illustrated by the third protocol in the table. In this example the probability estimates of home and away win were equal, and the inference was made that the teams were evenly matched. On the basis of this inference the decision was taken to bet on a draw, even though the expert judgement was that this was the least likely outcome. Further research would be useful to explore the extent to which these mechanisms are prevalent across a different knowledge-rich contexts involving risk.

Consumer credit and payment protection insurance decisions

People face all kinds of risk and uncertainty in their everyday lives, and the financial category is very important, perhaps second only to health and safety. One of our studies investigated important aspects of people's financial decision making, those concerning consumer credit (Ranyard, Hinkley & Williamson, 2001; Ranyard, Hinkley, Williamson & McHugh, 2006). The level of personal debt is a big social issue in Britain nowadays, and for practical reasons it is important to understand how people anticipate and manage, at the point of purchase, the risk of future financial difficulties in repaying a loan. In our study we used a framework proposed by Huber (1997, 2007) as a basis for understanding this. Rather than assuming cognitive mechanisms based on evaluations of the basic risk dimensions of the problem, Huber proposed the following simple cognitive mechanism:

Risk-defusing operators are activated if the perceived probability of a negative outcome exceeds a detection threshold.

He has identified several defusing operators, including the following two:

1. *Precaution* – doing something at the time of decision which will compensate for the negative outcome if it occurs, e.g. taking out an insurance policy.
2. *Worst-case plan* – mental activity at the point of decision anticipating the negative outcome by drawing up a plan to be executed if it occurs;

Huber argues that these risk-defusing operators are cognitive mechanisms that do not arise in the lottery paradigm, although they do in many everyday decisions involving risk and uncertainty. We found evidence supporting this in our study.

We used a conversation-based process tracing method that involved presenting participants with a minimal description of a credit decision problem in which they also had to decide whether to take out payment protection insurance (PPI) to cover future repayment difficulties. (Ranyard et al., 2001). We also elicited concurrent and retrospective verbal reports. Those made in the course of PPI decisions contained several examples of risk defusing operators other than taking out PPI. Some examples of worst case plans are shown below.

1. 'Well, hopefully the car would be worth quite a bit, so I'd get rid of the car …. I'd take that chance.'
2. 'I would get a redundancy payment and I'd be able to pay off the credit repayments without having to insure it against.'
3. 'No, I wouldn't do that … 'Cos hopefully I would have somebody who would help me out there I think … you know, say, a friend who would help me out with the repayments'.
4. 'You pay a lot of money for it [PPI] and you probably wouldn't end up needing it and there'd be …. Possibly other ways around it if you couldn't keep up the repayments. You'd probably get a … I don't know, a bank loan or something to cover it, so I don't think it's worth it'.

Other risk-defusing operators involved taking measures in advance of repayment difficulties, for example, alternative precautions to PPI, either shopping around for an alternative policy, or regularly saving the equivalent of the monthly premium as a buffer against future problems:

'…. The cost is quite high, actually and you'd be better off putting the money in the bank every month rather than paying it for insurance'.

Discussion and Conclusion

Before some concluding remarks, let us briefly discuss two of the approaches to decision research mentioned at the beginning: the traditional positivist approach, focusing on testing the predictive validity of algebraic models, including single-stage process models, and the naturalistic decision making approach.

Positivist decision research. First it should be fully recognised that traditional, positivist-oriented decision research has made an enormous contribution to our understanding of human decision making, for example, by providing detailed descriptions of decision behaviour and its context dependencies using rigorous and reliable methodology. However, much of it has been limited by its over-reliance on just one decision context, the experimental lottery. Furthermore, its theoretical contribution has been limited by its reliance on algebraic models describing the conjunction between decision environment and behaviour. These may predict decision making, albeit in limited contexts, but they don't explain it. Single stage process theories represented as algebraic models are clearly a step forward, since they begin to explain decision behaviour in terms of underlying mechanisms. Typically, however, they provide over-simplified explanations based on an invariant process mediating environment and behaviour. From a critical realist perspective, the importance of such work has been to establish the extent to which simple cognitive mechanisms play a role in different decision contexts. This needs to be complemented, however, with a broader range of evidence and incorporated into more comprehensive practical theories providing more complete stratified explanations.

Naturalistic decision making (NDM) research. In many ways the contribution of recent NDM research has been similar to the process tracing research discussed earlier in that it has explored the mechanisms underlying decision making in a wide range of real world contexts not previously analysed. It has been shown that in these contexts quite different mechanisms operate compared to the ones incorporated into theories constructed to model decisions observed in traditional experimental problems. For example, Lipshitz et al. (2001) argued that one fundamental difference is that many decisions in real life involve matching the attributes and consequences of a single decision alternative to some internal goal or plan, rather than choosing between two or more alternatives. Although such findings and their interpretation have made important contributions, from a critical realist position they are neither surprising nor controversial. It is to be expected that different mechanisms will operate in different contexts, and the discovery of new ones does not diminish the importance of what has been discovered using experimental contexts. For example, it would be surprising if mechanisms like attribute difference judgements discovered in the experimental lottery context were not relevant to some important real world contexts. On the other hand, a limitation of some NDM research is that the careful hypothesis testing necessary to rule out alternative mechanisms that may account for some decision

behaviour in naturalistic contexts has not been undertaken

Context-dependent cognitive mechanisms

In conclusion, in the previous section verbal report evidence of some of the cognitive mechanisms that may underlie decisions involving risk and uncertainty in different contexts was presented: evaluations of attribute differences, stated probability revision, knowledge-based decision strategies, editing heuristics, risk detection thresholds and risk-defusing operators such as worst case plans and precautions. This kind of evidence and analysis contributes to the critical realist explanatory goal of identifying which cognitive mechanisms underlie decisions in which contexts. Herbert Simon, in an important paper published in the Annual Review of Psychology in 1990, presented a view of psychological science that parallels critical realism in many respects, especially with regard to the context-specificity of thought that he expressed thus:

'….each kind of task to which the human mind addresses itself may be regarded as defining a different species of thought. A certain number of these species have been described in greater or lesser detail already … Since many … species of thought remain undescribed, a vast work of taxonomy and empirical exploration lies ahead … it will unearth multitudes of interesting and important phenomena and extend our repertoire of explanatory laws and invariants accordingly.' (1990, p. 4).

Clearly, only a small fragment of the taxonomy and empirical exploration that Simon envisaged has been presented here. Finally, let us briefly discuss the theoretical issue of how to develop more complete explanations from the simple mechanisms discussed so far.

Stratified explanation and complex generative mechanisms

The mechanisms discussed earlier, such as the sequence of cognitive processes comprising the nonlinear additive difference strategy, specify relatively simple generative mechanisms underlying decisions in certain contexts. There are two ways that explanations based on simple cognitive mechanisms need to be extended. The first is by clearly delineating the roles of both the conscious and the subconscious cognitive mechanisms underlying decisions. For example, some cognitive models specify meta-cognitive processes which operate on the conscious products of subconscious processes. Zakay and Tuvia (1998) have developed such a model to explain certain overconfidence biases. Second, a complete stratified explanation of individual decisions involving risk and uncertainty would need to incorporate the higher levels of social reality, namely culture, social structure and the social group. Recent research on the social amplification of risk, by, for example, Pidgeon, Kasperson & Slovic

(2005), is an important contribution to this. It suggests that if, as is likely, mechanisms of stated probability revision are relevant across a wide range of risk contexts then social mechanisms, such as group identity and social role perceptions, interact with non-social information processes to determine probability judgements. In summary, then, it is argued that our ultimate goal must be to discover the complex generative mechanisms that provide valid stratified explanations of decisions involving risk and uncertainty.

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