Adaptive Decision Making and Patterns of Risk Orientation to Potential Gains and Losses in Emotionally & Behaviourally Disturbed Adolescents: Implications for the reduction of dangerous risky-behaviour

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Abstract

Objectives

Adolescent risk-taking behaviour was reviewed from the perspective of decision-making theory. Patterns of risk-orientation for potential gains and losses, and adaptive decision-making amongst adolescents with, and without, emotional and behavioural disturbance were predicted. These were tested in two computer-based tasks.

Design & Methods

The design used was quasi-experimental. 130 early adolescents took part (internalizing, N=13, externalizing, N=11, and control sample, N=106). Participants were matched according to age, sex and score on Raven's Progressive Matrices. Participants completed the *Multidimensional Measure of Children's Perception of Control,* the *Need for Closure Scale* and an abbreviated version of Schneider & Lopes' (1986) *Lottery Selection Task,* a measure of risk seeking and risk aversion to potential losses and gains. Participants also played a computer game designed by the author which tests adaptive decision-making where both information and intervention have systematically varying costs.

Results

Internalizing adolescents were found to have higher external locus-of-control than other groups.

Group differences in risk-orientation to potential losses and gains were observed. Internalizers showed risk seeking for potential gains and risk aversion to potential losses. Externalizers showed the reverse pattern. The control group showed intermediate behaviour. External locus-of-control was predictive of risk-orientation to gains but not losses.

There was evidence that higher ability adolescents make more use of information and that, convergent with their risk-orientation patterns, externalizers are less prepared to endure a cost to gain information. Need for closure measures showed no effects.

Conclusions

That externalizers should be risk averse and internalizers should be risk-seeking for potential gains appears counter-intuitive. The results are understood in terms of Lopes' (1993) two-factor model of decision-making and highlight the importance of framing effects in preventative work with, and treatment of, adolescents exhibiting risky behaviour.

Acknowledgements

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The thesis is my own, original work, and has not previously been submitted towards the award of any other educational qualification.

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Roger A. Davies

Chapter 1. Introduction

Adolescence, particularly male adolescence, as it is currently constructed in the popular media, is seen as a time of particular turbulence. The adolescent is stereotyped as a risk taker, eager to explore new experiences and to experiment with various ways of being, in a struggle to establish autonomy. Research in more recent years qualifies the negative aspects of this popular perception (Offer & Schonert-Reichl; 1992). Most people pass through adolescence without major problems. However there are a significant minority for whom adolescence truly is a crisis.

This research takes a behavioural decision-making perspective on adolescent decision-making. After a brief survey of the extent of problem risky behaviour and the motivation for this research, I present a description of developments in theoretical approaches to decision-making with particular emphasis on the aspects of relevance to the current study. Next, risk-taking behaviour of adolescents is reviewed from this perspective with a view to demonstrating the potential for such an approach in better understanding behaviour which adults consider risky and problematic.

The current study compares groups of early adolescents attending schools for emotionally and behaviourally disturbed pupils with a sample of mainstream pupils. Externalizing and Internalizing pupils were separately compared with the control group for differences in risk seeking and risk aversive behaviour for potential gains and losses in a computer task. In a further computer control simulation experiment information seeking behaviour was

compared. Measures of cognitive ability, locus of control and need for cognitive closure were expected to predict group differences.

1.1 Adolescent Risky Behaviour and At-Risk Groups

Adolescence has been conceptualised as a time of identity formation (Erikson; 1982) and autonomy striving during which adolescents take on more responsibility for their own judgements and decision-making and when the peer group becomes increasingly influential (Berndt; 1979). As novice decision-makers, adolescents are seen to experiment with taking risks. For a sub-group these risks are a cause of serious concern to adults, a known risk factor for death, injury, ill health, long term psychological disturbance and, they may compromise educational achievement and disrupt the transition to adulthood (Rutter; 1995).

In early adolescence a marked increase in the prevalence of risky behaviour is observed (Jessor; 1998). For instance criminal behaviour involvement in the USA increases tenfold from the age of 12 to the age of 17, and, by age 30 has declined to about a quarter of the adolescent peak (Allen, Moore & Kuperminc;1997). There is general concern about teenage drinking, illegal drug use, cigarette smoking, sexual activity, and aggression (Jessor, 1998). The incidence of suicide and self-harm also increases dramatically in adolescence (Diekstra; 1995). The bulk of current research within the mental health field has adopted the framework of developmental psychopathology to improve understanding of the bio-psychosocial developmental processes which underlie

risky behaviour, and to identify risk and protective factors (Jessor; 1998, Rutter, Giller & Hagell; 1998). An area of research, much neglected, is the attempt to understand the processes which lead to the decline in such behaviours in adulthood (Allen, Moore & Kuperminc;1997).

Achenbach (1991) conceptualises children's psychological problems along two primary dimensions. The first dimension concerns emotional behaviours such as tearfulness, withdrawal and worry. Since they are seen as being primarily problematic for the child this dimension is called *internalizing*. The second dimension concerns aggressive and delinquent behaviour such as fighting, criminal behaviour and disobedience. Since others usually experience the problems with these behaviours, the relevant dimension is called *externalizing*. Children or adolescents with extreme scores on either of these dimensions would typically meet the diagnostic criteria for an ICD-10 disorder (WHO; 1993). Whilst this classification does allow for mixed problems with both internalizing and externalizing features (Achenbach; 1991), for the purposes of this research raters were given a forced choice of assigning the clinical participants to one or other category.

The ICD-10 (WHO; 1993) criteria for conduct disorders and Achenbach's Child Behaviour Checklist externalizing scales (CBCL, Achenbach; 1991) includes a range of problem behaviours that are risky and dangerous to self and others. Internalizing adolescents are at risk of suicide, self-harm and substance abusers are known to show increased rates of internalizing problems (Diekstra; 1995, Luthar, Cushing, McMahon; 1997). Kazdin (1995), reviewing conduct problems, notes that they have been found to

account for from a third to a half of all referrals to child and family clinics. Delinquency, as defined by the criminology literature has considerable overlap with Conduct Disorder and adolescents with either label may be in contact with the juvenile justice system and / or the mental health system. Allen et al (1997) cite estimates of $2.8 billion dollars per annum merely to detain convicted juveniles in the USA, and an expected loss in lifetime earnings for each year's school dropouts of $260 billion. Robins (1966) demonstrated that conduct disorder was highly predictive of criminal behaviour and psychological disturbance in adulthood even 30 years later. The prognosis is therefore poor. Almost half of his sample was found to have an anti-social personality disorder in adulthood, and 84% received a psychiatric diagnosis. Conduct problems are also more likely to be found in the children of adults who had conduct problems in childhood (Kazdin; 1995). Given the costs, both to the individuals concerned and to wider society, understanding the developmental processes underlying conduct problems with a view to prevention and treatment is a priority.

Much research has focussed on community, family, and peer group influences on problem behaviour. The interaction of attachment styles and family discipline practices has been shown to be predictive of antisocial behaviour. A host of individual characteristics have been implicated of which Impulsivity and Attention Deficit Disorder are particularly noteworthy in the context of this study (Jessor; 1998). Intelligence is known to be a protective factor, yet the mechanisms by which intelligence operates are poorly understood. Little attention has been paid to the relevance of the cognitive psychology of adolescent decision-making under risk (Fischhoff; 1992, Furby & Beyth-

Marom; 1992). There is an enormous wealth of research investigating adult decision-making but surprisingly little looking at the development of competence through childhood and adolescence. There are even fewer studies using the methodologies of behavioural decision science on atypical populations within adolescence.

This research sets out to investigate if there are significant differences in the decision-making processes of internalizing and externalizing adolescents in order to formulate an understanding of the different patterns of risky behaviour they adopt compared with their peers. Clinically, I will argue, this is important in developing appropriately differentiated prevention and treatment strategies that take into account the different ways adolescents perceive, and act on their perceptions, of risk. Of more general interest to psychologists, participants who use more extreme decision-making processes may provide a clearer view of the range of decision-making styles prevalent in the adolescent population.

1.2 The Decision-Making Perspective

1.2.1 Defining Risk Taking

Furby & Beyth-Marom (1992), in the context of adolescent risk taking, choose to define *risk* as the chance of a loss and *risk taking* as action (or a failure to act) which leaves a person open to a potential loss. This definition is problematic because it omits developmentally crucial issues of taking risks for potential benefits. Trying something new may be risky but it need not entail loss. The risk may be purely that one foregoes maximum gain. Further, when speaking of loss or gain, one implicitly sets a reference

point against which the loss or gain is measured. Psychologically, it is not clear, a priori, that the reference point should be taken as the current state (Loomes & Sugden; 1982). This is of crucial importance when considering risk taking in the context of adolescent development. Reference points are based on self-conceptions of what would be normative given the individual's circumstances. For example, a fourteen year old girl may or may not believe it is normative to stay out late regardless of whether she is allowed to do so. When the opportunity arises it may be experienced as a gain or discounted as normative, and when removed may be experienced as a loss or discounted as normative relative to the individual's reference. The inclusion of gains is important because it recognises that some choices will balance two potentially different gains with, perhaps, different outcome likelihoods. For example, will I prefer this or that film given that I will probably like both? Reference points may also be displaced into the future. The critical issue may be whether I will experience regret if I take a chance, or, omit to do so (Loomes & Sugden, 1982)?

Fischhoff (1992) in discussing the developmental aspects of decision-making adopts a more inclusive definition: risk taking is defined as any action with uncertain outcomes. However, Fischhoff construes all decisions as deliberate voluntary choices. In contrast, Furby and Beyth-Marom (1992) consider that risk taking may be undertaken consciously or unconsciously, with or without deliberation, in ignorance or with information, or with varying degrees on these continua. For the purposes of this study I will adopt Fischhoff's definition broadened to include less deliberative, but voluntary, choices. This is a broad definition, which, one might argue, is over inclusive as all behaviour requires one act to

be preferred over alternatives. Usually such alternatives will exist and the outcome of behaviour in the social field is rarely fully determined. One might therefore be led to conclude that all behaviour is the result of a decision under uncertainty. However, it is not certain that fundamental processes in risk perception are fully explicit in early adolescence so it is important to consider more implicit processing. This will be discussed further when I consider current knowledge of adolescent behaviour from the decision-making perspective.

1.2.2 The Decision-Making Process

In making a decision one selects from amongst potential courses of action. Normative models of decision-making specify the procedures people should adopt to guarantee optimal decisions (e.g. Raiffa; 1968, Von Winterfeldt & Edwards; 1986). After a discussion of these processes I will return to a discussion of what is meant by optimal. My breakdown of the decision-making process follows Furby & Beyth-Marom (1992).

Step 1: What are all the possible options?

The decision outcome must, necessarily, depend on the list of options generated. A restricted range of options may lead to the optimal response not being available for consideration. Fischhoff, Slovic & Liechtenstein, (1978) have shown that changing the problem representation can bias the estimates of outcome likelihood. People distribute

probability according to the outcomes and options considered and, thus, incomplete problem representation may lead to sub-optimal decisions.

Step 2: What are all the consequences of each of the possible options?

Again, normatively, it is important to list all the consequences even if some are common to all options as in each case the likelihood of the outcome may vary for different options. Increasing awareness of the potential costs of risky behaviours is the focus of much public health education (for example, smoking, drug use, unwanted pregnancy). Omission of potential consequences will necessarily bias the decision-making processes.

Step 3: How desirable is each of the consequences?

Consequences may have negative or positive valence relative to some personal reference point. Clearly, it is important to note that failure to choose will also have consequences and should be included as an option. Normative theories usually assume a utility function, representing the desirability of an outcome. In economics, for instance, the utility of money is held to decrease with amount. Bernoulli (1738/1967) proposed the principle of diminishing marginal utility. It amounts to a theory that the ratio of utility to absolute value decreases as a function of the absolute value. If one has £1000 a further £1000 is of less utility than if one has nothing. This observation also implies risk aversion for gambles with potential gains, since a bet for £100 with probability 0.5 has less utility than £50 with certainty, and therefore would be avoided by a rational decision-maker.

This is what is found experimentally (Kahnemann & Tversky; 1979). The degree to which people will accept gambles sheds some light on the shape of their personal utility function, as, theoretically, the shape of their personal utility function, all else being equal, determines a person's orientation to risk. For example, £100 to an adolescent with no income has greater utility than it might have to an adult with substantial savings and therefore an adolescent might be more likely to gamble on winning £100 for the same odds and stake.

Problems with this formulation are evident. There are particular difficulties in the comparison of incommensurable quantities both for individuals and between people. What metric is appropriate for increased self-esteem, guilt, regret, pleasure or sadness? How are these to be compared with more readily measured financial measures of outcome? Do psychological constructs also obey a principle of diminishing marginal utility? These issues, though important, are beyond the scope of this review. The reader is directed to Neumann & Politser (1992) for a critique of utility theory.

Step 4: How likely are each of the consequences given the action entailed by the choice?

Normatively, these are conditional probabilities in the interval zero to one. For a risky decision at least one such likelihood should be greater than zero and less than one. In the absence of actuarial data the likelihood must be estimated by the decision-maker, to give the subjective probability that the outcome will happen. Note this implies that different people may differ in risk judgement because they have different expectations of the

likelihood of consequences, even though they agree on the desirability and existence of the same consequences and options. What an adult experiences as risky, an adolescent may not.

Step 5: Combine the above information using a suitable decision rule.

There are a number of possible approaches to choosing a decision rule. Formally, "rational" behaviour within a normative framework requires the maximization of well being. One method, the maximization of *subjective expected utility* (SEU), prescribes that for each option the potential well being is defined as the sum of all the outcome desirabilities, measured in a standard personal metric (the utility function), each weighted by their likelihood. The option with the maximum value should, according to this rule, be chosen.

This is but one possible decision rule. It has the advantage that it is fully *compensatory*. That is, it balances all the positive and negative potential consequences to reach a globally optimal choice. It is not the only possibility, and it can be computationally extravagant if all possible options and outcomes are to be considered.

Meta-cognitive Factors in Decision-Making

As Simon (1981) has noted "what a person cannot do he will not do no matter how much he wants to do it". Human rationality is bounded by the processing limits of the human

brain. There are many simple heuristics that may give adequate if not optimal choices and clearly the disutility of the decision-making process itself must be accounted for in the calculus of normative decision-making. It is arguable whether it is reasonable to expect that people will seek to optimize the outcome of a decision. In trivial decisions finding an option that is just good enough to meet one's needs may be adequate; this is a decision heuristic which Simon (1955) called *satisficing*.

Payne, Bettman & Johnson (1993) provide evidence that people are *adaptive decision-makers*. They use meta-rules to decide whether to abbreviate the process when under time pressure, when making decisions of little import or when an exhaustive process would be intractable. For instance one might edit the possible options by rejecting options that fail to reach a threshold on one particular attribute, consider only consequences with a minimum likelihood or eliminate (or select) an option based on a salient consequence, ignoring likelihood or other information. These strategies vary on a continuum from fully compensatory to non-compensatory. It is important to note that if the initial decision parameters of consequences and options are poorly specified there may be little advantage in using the full mechanics of SEU. Indeed, in some instances it has been shown that using more sophisticated decision rules with inaccurate data can lead to poorer choices (Arkes, Dawes & Christensen 1986). Thus, domain knowledge is also a crucial component of good decision-making.

At all of the preliminary stages in the decision-making process people have to generate from memory or find in the environment information considered relevant to the decision.

This, in itself, has costs and a rational decision-maker must balance the cost of information search and processing with the importance of potential outcomes (Keeney & Raiffa; 1976). Kruglanski and his colleagues have proposed a related personality construct, *The Need For Closure* (Kruglanski, Webster & Klem ; 1993, Webster & Kruglanski ; 1994). People with high *need for closure* do not tolerate ambiguity well, are more decisive, and in decision-making are apt to foreclose the decision-making process based on limited information.

1.2.3 Descriptive Models of Human Decision-Making

Probability Judgements

Researchers seeking to develop cognitive models of people making decisions have documented a range of systematic biases compared to the prescriptions of normative models. Underlying this tradition, usually referred to as the *heuristics and biases* approach, is the idea that people either cannot, or are not motivated to perform exhaustive decision analysis in the normative mode. Rather, people have heuristics which they use at each stage in making a decision. These simplify the procedure sufficiently to enable the right decision to be made most of the time. As with all heuristics, they have a domain where they work and areas where they fail. When these heuristics are examined in detail

in the laboratory they reveal systematic biases which may lead to incorrect judgements from the point of view of normative theory.

Tversky & Kahneman (1974) show that people assess the likelihood of an event or the frequency of some property by the relative ease with which they can bring to mind instances when the event occurs or the property appears. Mostly this, the *availability heuristic,* works well, because more common events and properties are more easily brought to mind. However, availability, essentially a property of memory, goes awry when considering the frequency of extreme but rare events that are easily imagined or remembered. Extreme events are salient in memory and therefore more easily recalled. For example, the death of an adolescent from drug use is likely to be salient in parents' minds because of the news coverage such events attract. Consequently, parents may overestimate the frequency of such tragedies. An adolescent drug user may never come across such a death over a protracted period of use and so may have a more accurate sense of its low probability and this will affect judgements as to the actual risk of such behaviour. Objectively it may be the case that adolescents frequency judgements are, in some cases, normatively more accurate than those of adults. However, one expects that experience helps to calibrate the use of availability and so adults might be expected to show fewer biases in such probability judgements. Here it is important to note that the use of more accurate probability judgements does not ensure that the overall judgement of risk is more accurate. Without consideration of consequences, judgement of risk is incomplete from a normative perspective.

Another example of a normally useful heuristic that leads to biases is the *representativeness heuristic*. Briefly, the likelihood of an event, or an element being from a particular group, is estimated from its similarity to a known event, or archetypal class member familiar to the decision-maker. The resultant frequency or probability judgement of the specific case is estimated through referral to what is known about the class of which the specific instance is a representative. Two biases related to the representativeness heuristic have been extensively researched. Tversky & Kahneman (1982) demonstrated the conjunction fallacy. This is the judgement that logical A *and* B are more likely than logical A because statement B is a more representative exemplar of the item to be rated. The classic example used by Tversky & Kahneman (1982) was a description of a 31 year old woman who had concerns about discrimination and attended anti-nuclear demonstrations. Participants in their study rated her to be more likely to be both a bank teller and a feminist than just a bank teller because the story made her appear more like a feminist stereotype of the time. Since the more closely specified option is a subset of the looser specification this is, formally, an error of logic. Further experiments suggested that this is not merely an artefact of linguistic pragmatics (Tversky & Kahneman; 1982).

The *representativeness heuristic* also may lead to *base rate neglect*. Kahneman & Tversky (1973) demonstrated this by first giving base rate information about the proportion of engineers and lawyers in a group and then asking people to assess the probability that a person described in a stereotyped or a neutral way was one or the other. In the absence of further information people used the base-rate information. With further

information they failed to make use of the base rate information. For example a neutral description elicited estimates of 0.5 for the probability despite unequal groups in the base rate data because a neutral description is equally representative of both professions.

There remains considerable debate as to when people show biases in their probability judgements. Gigerenzer (1991,1994; Gigerenzer & Hoffrage; 1996) has repeated some of the classic experiments in the heuristics and biases programme giving the probability information in a frequency representation. He has found that the biases largely disappear. Gigerenzer (1996) maintains that people are not equipped to deal with probability representations, rather we are adapted through evolution to assimilate frequency data and where we have such data we are less susceptible to bias. There are two important consequences of this for the purposes of this study. Firstly, tests of decision-making will be more ecologically valid and more rigorous if participants are presented information in a frequency representation. Secondly, one would expect greater ecological validity for decisions that are repeated so participants can build an implicit representation of frequency information through experience.

Framing Effects in Utility Judgements

In questionnaire surveys it has long been known that the way a question is framed can greatly alter the answers respondents give (Schuman & Presser; 1981). Essentially in such questionnaires the reference point for the judgement is given by the context set up in the question. Similar effects abound in decision-making. Tversky & Kahneman (1981)

asked participants to choose between one of two treatment options to prevent deaths from an infectious disease, expected to kill 600 people if it went untreated. One option guaranteed 200 lives would be saved. The other option offered a probability of 1/3 that 600 lives would be saved and 2/3 that no lives would be saved. When the question was framed as the potential saving of a life 72% preferred the certain option. The question was also posed as a potential loss. The first option would lead to 400 deaths, whereas the second option would lead to no deaths with probability 1/3 and 2/3 probability that 600 people would die. Formally the two frames are identical in terms of their expected utility. When the question was presented in terms of the number who would die the riskier option was chosen. This is an example of risk orientation reversal. People tend to be risk averse when asked to choose amongst options where a potential gain is at stake. However, when the same choice is framed as a potential loss they will elect for the risk seeking option.

Reflection of risk orientation due to framing effects have been found in many domains. Wilson, Kaplan & Schneiderman (1987) describe them in healthcare decision-making. McNeil, Pauker, Sox & Tversky (1982) report that radiologists were susceptible to framing effects when posed a question about whether surgery or radiotherapy for lung cancer was advisable. When framed in terms of the likelihood of survival, surgery was more frequently preferred. When framed in terms of the likelihood of death, radiotherapy was more often preferred.

Risk orientation reflection is dependent on the individual's utility function. It indicates that utility functions, when elicited in simple forced choice experiments, are not symmetric when a problem is recast from potential for gain to potential for loss. Generally people are held to be risk averse with respect to potential gains and risk seeking with respect to potential losses. However, where gains are at stake, increasing the potential gain, with constant probability, eventually makes it worthwhile to take a risk. Equally, if the potential loss increases in utility, eventually people will refuse a gamble where losses are at stake. It is important to note that risk aversion and risk seeking are descriptions relative to normative models and one also expects individual differences in the degree that people show these departures from the normative model. Within the decision-making perspective this would be held to reflect differences in their utility functions.

In order to account for these effects, which would not be predicted by expected utility theory, Kahneman and Tversky (1979) proposed Prospect Theory. I will now describe the aspects of Prospect Theory relevant to this study.

Prospect Theory

Prospect Theory (Kahneman & Tversky; 1979) starts with the premise that people edit and represent the parameters of a decision, the *prospects*, relative to a fixed reference point. The notion of utility is replaced with that of *value*. Value is defined in terms of deviations from a reference point and the function accounts for reported risk-orientation reversal through asymmetry for losses and gains. A sample value function adapted from

Kahneman, Slovic & Tversky (1982) is presented in figure 1.1a . Risk-orientation reversal arises because there is a point of inflection at the reference point (second order derivative becomes zero at the origin). For losses the curve is concave rather than a continuation of the convex function, used in expected utility theory, which remains valid for potential gains. It can be seen that the expected value of large losses does not rise in proportion to the actual loss and thus potential large losses will be discounted when deciding to take a chance to avoid a loss. The same devaluing of potential gains leads people to be risk aversive when choosing to take a chance to make a potential gain.

Prospect Theory also accounts for biases in probability judgements through a decision weighting function, an example of which is presented in figure 1.1b. Of note is the overestimation of small probabilities and the underweighting of probabilities in the mid-range. The curve is not extended to certainty because of the *certainty effect.* A reduction in probability from certainty has more effect than if there were already some uncertainty (Tversky & Kahneman; 1981). The effect of this is to increase the perceived prospect of a certainty, relative to a gamble. This will tend to increase risk aversion to potential gains, and decrease risk seeking for losses, where one option is certain. The certainty effect also accounts for commonly observed aversion to ambiguity, particularly topical in the current climate as new technologies in food production are introduced.

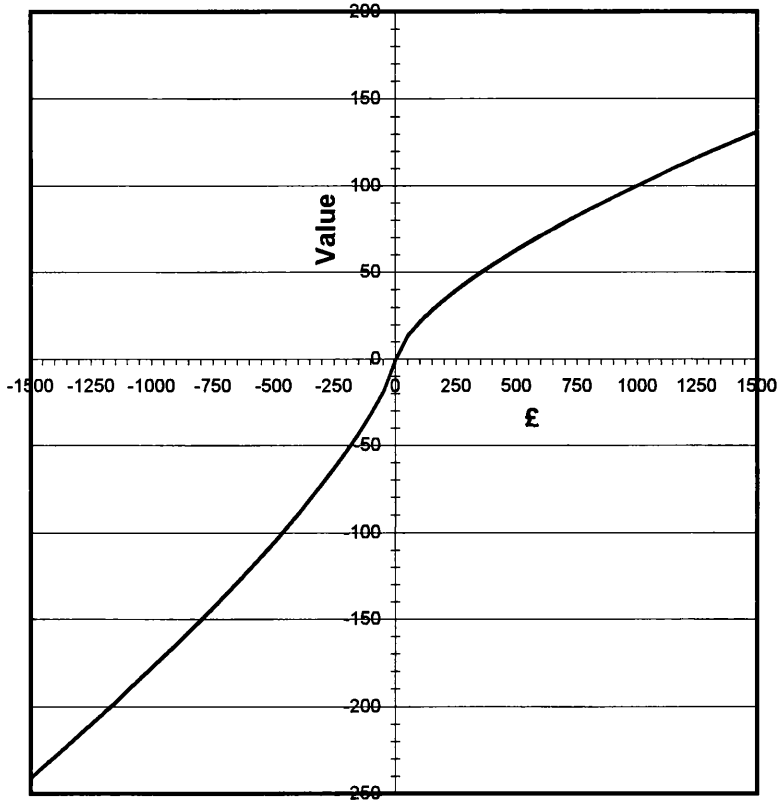
Problems with Risk Orientation Reversal

The centrality of risk orientation reversal within Prospect Theory has been the subject of empirical and theoretical debate. Whilst at the group level it has been demonstrated, when the details of individual performance are examined, it is clear that not everybody exhibits risk orientation reversal. In the original experiments (Kahneman & Tversky; 1979) one group of people chose the risk averse option in the gain condition whereas a different group chose the risk seeking option in the loss condition. In a fully within groups study, Hershey & Schoemaker (1980) showed that risk orientation reversal was unreliable both at the group and individual level and that all four permutations of risk orientation towards potential losses and gains were observed when a number of two option choices were administered. Nonetheless, overall, the modal orientation was for people to be risk aversive for gains and risk seeking for losses.

Schneider & Lopes (1986) have examined risk orientation reversal for pairs of multi-outcome lotteries in which the relative frequencies of each outcome were presented graphically. They pre-selected risk seeking and risk aversive subjects from a large initial sample on the basis of their risk orientation to five two-outcome lotteries with the potential for gain. All the lotteries used had equal expected utility but were rank ordered by expected value within Prospect Theory. They found that risk-orientation reversal only happened reliably when one of the lotteries in the pair was a *sure thing*, i.e. a guaranteed gain or loss. In other pairs preferences were observed in all four possible permutations for gain and loss lotteries. Risk-orientation reversal from risk seeking for gains to risk

aversion for losses was observed in a minority, all of whom had been previously classified as risk seekers. Lopes has proposed a two factor model of risky choice to explain these findings and to address other problems with Prospect Theory. This will be described in the next section.

(a) Prospect Theory Value Function



(b) Prospect Theory Decision Weight

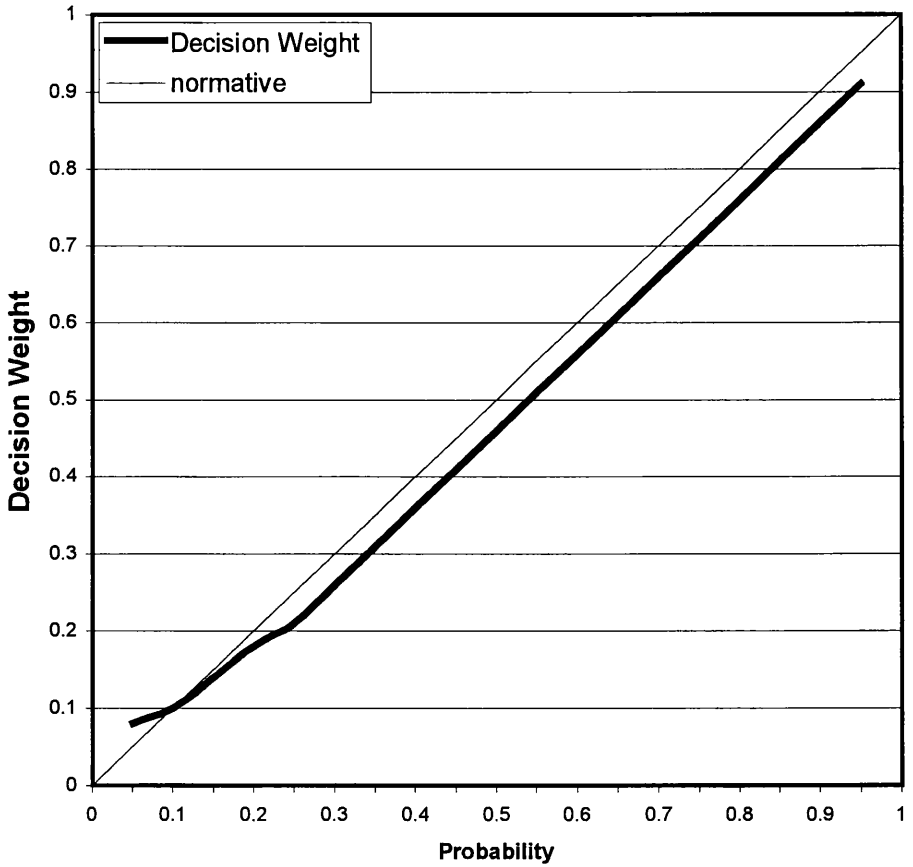


Figure 1.1

Lopes' Two Factor Model of Risky Choice

If a person is offered the choice to enter one of two lotteries, adding a constant value to both lotteries should not affect their choice, according to both prospect theory and SEU. Lopes & Huckbody (1988) however found that participants shifted to more risk taking. A protocol analysis revealed the reason. Participants are more willing to take a chance because they have a guaranteed gain equal to the size of the constant increment to the lotteries. Therefore, an alternative explanation for risk-orientation reversal is required.

Lopes (1984) argues that risk averse people tend to pay attention to security, that is avoiding the worst outcomes, whereas risk seeking people tend to pay attention to the potential provided by the best possible outcomes. This provides one dimension on which people differ in their decision-making. However, in contrast to Prospect Theory where risk orientation reversal is accounted for by differences in the curvature of the value function, Lopes argues that the security - potential continuum is reflected in the decision weight function. The values are a function of both the actual probabilities and the values of the outcomes to which they are attached (Lopes; 1987). There need not be any error in estimating the likelihood of an outcome, rather the weights are used to bias the decision to reflect individual differences in risk preference. Lopes considers security - potential to be a dispositional continuum reflecting individual differences in goals rather than in probability estimation.

Clearly, risk averse people will, under certain circumstances take a risk and similarly, risk seeking people will, at times, refuse a risk. Lopes (e.g. Lopes; 1993, 1994) reintroduces the *aspiration* as a situational variable that also determines risk preference. Following Atkinson (1983) writing about motivation in risky decision-making, she argues that aspiration addresses three issues. Firstly, what is it safe to aim for in this situation? Secondly, what is a reasonable aspiration in the context of the other choices available? Finally, external factors may influence the level of aspiration. For example Lopes (1994) reports that towards the ends of an experimental game, in one study, players who were in a difficult position knew that only by taking a chance could they win. They were more likely to take the chance than at an earlier part of the game when less risky strategies offered hope of success. Contingently, they raised their aspiration levels. In summary, risk aversion and risk seeking are always in relation to a context.

The model explains the observed pattern of lottery choice in Schneider & Lopes' (1986) earlier experiment with multi-outcome lotteries. Two examples of the lotteries are presented in figure 1.2 to aid the explanation.

Consider first a risk-averse participant who has set an aspiration of winning at least 50 on the gain items and not losing more than 50 on the loss items. Security minded individuals focus on the increasing potential to gain nothing as one moves from the sure thing, through the short shot, and on to the long shot. So the risky lotteries are increasingly insecure. The aspiration level, i.e. the probability of getting more than 50,

decreases in the same direction. Therefore, choosing the sure thing meets both the need for security and the aspiration. In all cases one expects the sure thing to be chosen in preference to the other lotteries and the short shot above the long shot. The situation for losses is more complex. Security minded individuals focus on the potential to lose seriously and this increases monotonically as one moves from the sure thing to the long shot. However, aspiration, the probability of losing less than 50, is better satisfied in the gambles since the probability of losing less than the aspiration level increases as one moves from short shot to long shot. Note that the sure thing is an exception here, because there is certainty of losing more than the aspiration level. For some participants this certainty may be more desirable than taking a chance. For others it may be that their aspiration is set not to lose more than 100 and so the sure thing is a good option. This would be strange because the expected loss is 100. The important point is that security and aspiration are in conflict and so individuals have to trade off the two aspects of the choice. Schneider & Lopes (1986) argue that the individual's position in the security - potential continuum and the aspiration level they set determines the threshold at which they shift to the riskier option.

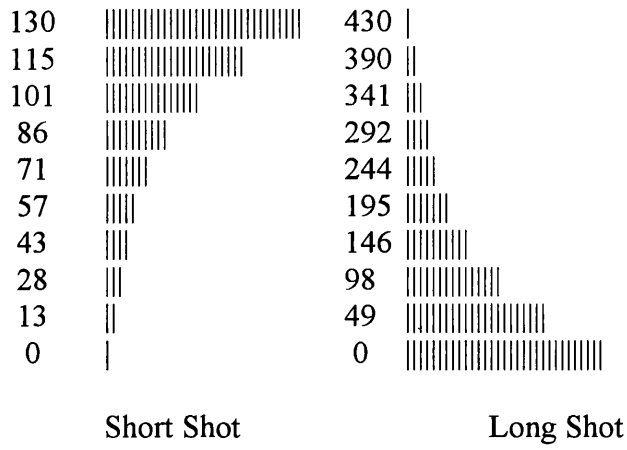


Figure 1.2. Lotteries from Schneider & Lopes (1986) Both have expected outcome of 100. The loss version is identical with the addition of minus signs before the values in the first column

Now let us consider the perspective of a risk seeker. Assume the same aspirations as before, though it is possible that risk seekers may aspire to win more on the gain items and lose less on the loss items. For losses, the potential to avoid loss increases as one moves from the sure thing to the long shot. The probability of meeting the aspiration to avoid losing more than 50 also increases in the same direction. Therefore risk seekers would be expected to choose the short shot over the sure thing and the long shot in preference to either of the other choices. The situation for gain items, however, produces a conflict between the desire to maximise potential gain and the desire to attain one's aspiration. The potential for maximal gain increases across the lotteries but the probability of meeting one's aspiration decreases. Again this assumes that aspiration is set below the level of the sure thing.

Within Lopes' (1993, 1994) model risk orientation is both task contingent and driven by personal risk orientation and motivational factors which are situation specific. The model accounts for the differences in behaviour at the group level better than prospect theory, which provides a model of average behaviour. Individuals are better modelled by a theory that sets out to account for individual differences. However, there is significant variation even from Lopes' model. The justification for assuming that people's risk orientation is the same regardless of whether the situation is one where losses are at stake or where gains are available has not been addressed. Patterns of response to the Schneider & Lopes (1986) task suggest that it is possible that some people will show risk aversion in

losses and risk seeking in gains though they will adjust within each domain according to their aspiration level. In this study an abbreviated form of the Schneider & Lopes task was used to assess individual risk orientation to losses and gains as a way of exploring differences amongst internalizing, externalizing and a control sample of early and middle adolescents.

1.2.4. Interpersonal Differences

Before considering developmental issues in decision-making, I will first extend Lopes' consideration of individual differences in decision-making. Of interest and relevance to this study is, firstly, information acquisition, which is a part of most naturalistic situations in which risk is managed. In appraising risk, accurate information is essential. Individuals are known to have a varying need for cognitive closure, that is, the individual's imposition of order on an ambiguous decision problem (Webster & Kruglanski; 1994). Premature closure may interfere with adequate information seeking behaviour to facilitate decisions. Secondly, measures of self-perceptions of control would be expected to predict both risk preference and information seeking behaviour. Liverant & Scodel (1960) found that people who attributed rewards to external loci were more likely to choose risky gambles. A belief in external locus-of-control would, a priori, make the gathering of information less relevant, since if the outcome is independent of one's own actions then understanding the contingencies would be wasted effort. General cognitive ability would also be expected to be associated with

information seeking behaviour: the more able would be better able to use the information. However, it is less clear whether intelligence and risk preference should be associated, though it is likely that higher ability people will better judge the level of risk. For instance, Stanovich & West (1998) found that educational attainment predicted use of base-rate information in a frequency judgement task. However, well-calibrated probability judgements may not alter people's willingness to accept risk.

Minimal information use and cognitive effort in decision-making is one way of understanding the term *impulsivity*. More traditionally, measures have been constructed to measure cognitive aspects of impulsivity, evident in neuropsychological deficits in frontal-lobe function, and behavioural disinhibition (White, Moffitt, Caspi, Bartusch, Needles & Stouthamer-Loeber; 1994). White et al (1994) have used confirmatory factor analysis with a number of instruments designed to measure impulsivity and isolated these two factors. Neuropsychological tests most heavily loaded on the cognitive component. They found that cognitive impulsivity was negatively correlated with IQ, but did not predict delinquent behaviour once IQ, socio-economic status and behavioural impulsivity had been entered into a regression model. Behavioural impulsivity was predictive. The problem with this approach would appear to be that by first controlling for IQ they have removed all the variance that might be attributed to cognition in controlling impulsive behaviour. From a decision-making perspective there can be explanations of impulsive action, that is, action without adequate consideration and evaluation of options. If collecting or using information is subjectively insufficiently important, or, the decision-

maker has not the means to use the information, then immediate environmentally contingent response may be the most rational behaviour.

Another explanation for impulsivity in criminal offenders that has been offered is that they have an inability to delay gratification (Newman, Kossan & Patterson; 1992). Within decision-making theory this effect is called temporal discounting. At least since Keynes' (1973) *General Theory of Employment, Interest and Money* economists have recognised that people value future gains less highly than immediate gains and this effect will be both more rational and increased where there is uncertainty in the marketplace. Individuals differ in the rate at which they discount the future. I will return to temporal discounting when I discuss adolescents' evaluation of consequences. Here I just note that impulsivity is, in principle, understandable within behavioural decision theory. Furthermore such a theoretical framework provides a way to understand and formulate hypotheses about impulsivity within cognitive theory rather than accept it as an irreducible trait.

Several studies have investigated decision-making styles in depressed adults. Reviewing the literature Mann (1992) concludes that depressed people are slower to decide, tend to give greater weight to the potential losses and lower weight to the potential gains. They also show tend to show risk avoidance. When offered a risky choice they tend to require a higher utility before they will accept it and this effect has been shown to increase with their Beck Depression Inventory Score (Costello; 1983).

Garety and her colleagues, (e.g. Garety & Freeman; 1999) have presented evidence that people who suffer from psychotic delusions are more likely to "jump to conclusions" than control participants in making judgements of probability. A task analysis of the paradigm used in most of the studies to support this assertion suggests that those with delusions make their judgements in line with the normative rule provided by Bayes Theorem. It is the control subjects who are reluctant to use the base rate information provided.

1.3. Decision-Making: Development

There has been little empirical research examining the development of the skills needed for competent decision-making. Considering the issues, Fischhoff (1992) wrote that all he could offer at the time was an agenda for research because:

> ".. there are so few studies to cite ... As a result there is more to say on *how* to think about developmental aspects of risk than on *what* to think about them." (p136)

Furby & Beyth-Marom (1992) make a similar point and in the intervening seven years it would be difficult to argue that the situation has changed. Indeed the impact of these authors on mainstream research in adolescent risk behaviour has been negligible and little further work on the cognitive development of decision-making

skills has been reported. A recent collection of articles of some 500 pages entitled *New Perspectives on Adolescent Risk Behaviour* (Jessor, 1998) makes one reference to a joint paper by two of these authors and sparse reference to any of the research within the adult decision-making literature. In the absence of research specific to adolescence this is, perhaps, understandable.

Research exploring risky behaviour in adolescence within Developmental Psychology typically looks at problem behaviours from the perspective of adults, for example, substance abuse, sexual activity, criminal activity, including violence, and, in the context of the United States, driving behaviour. The focus is on under-restrained, externalizing behaviour that is seen as problematic. More recently, Hagan (1998) has adopted Capitalization Theory from Economics as a framework. This suggests that through life we accumulate capital of various types through a variety of biopsychosocial processes. The analogy with the economists' view of the accumulation of physical capital is clear and even within economics the existence of non-monetary capital is increasingly accepted (Becker; 1993). In such a context it is important to recognise the objective risks that result from withdrawn or internalizing behaviour. For failure to accumulate "capital" through development is to forego potential gains. Clinically one sees the presentation of poor literacy and numeracy, low self esteem, a poor employment record and continuing emotional difficulties following a school career of sitting at the back of the class causing few problems to significant adults. This is risky behaviour from the reference point of adulthood,

though it may not have been seen as such through development.

For the purposes of this study I will summarize the programmes outlined by Fischhoff (1992) and Furby & Beyth-Marom (1992). I shall structure the discussion using the step model of decision-making presented earlier and consider possible developmental differences in adolescent decision-making and possible interpersonal differences amongst emotionally and behaviourally disturbed adolescents.

In particular I argue that a decision-making perspective offers the possibility of developing theories that explain how risk and protective factors found in developmental psychopathology are mediated by cognitive processes. Such work will, I believe, help to inform preventative and treatment interventions with at-risk groups of adolescents.

1.3.1 How might adolescents differ in their decision-making?

Step 1: Options

Adolescents may consider different options compared with adults. For instance adults might see alternative possibilities because of their greater experience. Faced with the offer of drugs, an adolescent may only conceive of acceptance or rejection. An adult

might dissemble in a way that preserves his or her position within the peer group. For example, by saying that "it's not my drug of choice". Furby & Beyth-Marom (1992) found no empirical research prior to their review and a literature search by the author has uncovered no research addressing this question. Even were it found that most adolescents do generate comparable options as adults do, it remains possible that emotionally disturbed adolescents will show differences that lead to more risky behaviour. This might be expected because literature in cognitive therapy associates cognitive styles with emotional problems, for example, dichotomous thinking and selective abstraction may serve to limit the options generated (Fennell; 1989). Patterns of behaviour may develop such that internalizing adolescents may not consider options that entail social interaction and externalizing adolescents may not consider those that require prolonged solitary concentration.

Step 2: Consequences

Consideration of differences in the generation of consequences is little better researched and overlaps with the next stage where consequences are evaluated. Lewis (1981) used vignettes to initiate thinking about important medical treatment decisions and found some evidence that very young adolescents, under aged 14, were less able to imagine risks and consequences. Also investigating competency to make informed decisions, Weithorn & Campbell (1982) found younger adolescents had particular difficulty considering several factors simultaneously.

Most research on adolescents' risk perception has provided previously generated lists of consequences for adolescents to rate. The exception to this is a study by Beyth- Marom and her colleagues (Beyth-Marom, Austin, Fischhoff, Palmgreen & Jacobs-Quadrel; 1993). They compared adults and adolescents, in the age range 12 - 18 years, generating outcomes for both one-off decisions to engage in risky behaviour and decisions to engage in repeated risky behaviour. The behaviours examined included drug use, drinking and driving, sexual activity, alcohol use and missing school. They found small differences between the potential outcomes generated by adults and adolescents. Adults generated slightly more consequences in half of the scenarios in which participants explored decisions to engage in repeated risky behaviour.

Though Beyth-Marom et al (1993) used a large sample size the wide age group who participated may have obscured developmental changes in the ability to generate consequences. Nonetheless, they observe that the effects they found were small and would not predict large differences in engagement in risky behaviour.

I have found no studies of clinical adolescent samples addressing their generation of potential consequences. Again, the cognitive behaviour therapy literature would suggest that one might expect biases in the generation of consequences.

Will internalizers focus on negative consequences, ignoring potential gains? Will externalizers show optimism bias (Burger & Burns; 1988) to a greater degree than normal adolescents and ignore potentially aversive outcomes?

Step 3 & 4: Desirability & Likelihood of Consequences

Since studies that deal with these steps have tended to address both issues I will consider them together.

Beyth-Marom et al (1993) also asked adolescents to evaluate the desirabiltiy of the consequences they perceived. There were no quantitative differences but qualitative differences in the responses were evident. Adolescents gave more consequences as opportunities lost by not engaging in the behaviour when they said they would not engage in the behaviour. This indicates a future oriented reference point with consequences framed as losses. Adolescents also mentioned peer responses more often than did adults but this effect was limited to occasions when they thought they would not engage in the behaviour. It remains a possibility, though there is as yet no evidence, that adults think that adolescents would gain more in self-worth from resisting peer pressure than adolescents themselves experience (Furby & Beyth-Marom; 1992).

Interestingly, Beyth-Marom et al (1993) found no support for Elkind's theory of adolescent invulnerability (Elkind; 1967) as both adults and adolescents saw the same likelihood of personal consequences from the respective behaviours whether they chose to engage or not.

Benthin, Slovic, & Severson (1993) looked at differences in participation and risk perception in a range of problem and non-problem risky behaviours amongst 14 to 18 year olds. They used a psychometric instrument with 14 items assessing risk perception for each of 30 behaviours. People, who reported participating in the risky behaviours reported having a greater knowledge of the risk, less fear and felt the behaviour was less risky to themselves and their peers. They rated the benefits of accepting the risk as greater than non-participants and symmetrically perceived less likelihood of serious negative consequences. Participants also experienced themselves as more in control of the risks and believed that more of their peers also participated in the same behaviour. Non-participants felt more desire for regulation by parents or the law and felt more able to avoid the activity.

Factor analyses revealed two uncorrelated dimensions. The first, which accounted for 68% of the variance, captured perceived risk, fear, and seriousness of consequences. Personal control had high negative weighting on the first factor, thereby counteracting the perceived riskiness, fear and seriousness of consequences. The second factor, accounting for 15 % of the variance, captured knowledge of the risks, peer approval and peer influence.

The finding that people who engage in risky behaviour perceive their peers as more likely to do so, is consistent with the *availability heuristic* (Tversky & Kahneman; 1973). Since participants will more easily bring to mind situations in which their peers take part in the

activity they will estimate the frequency of peer involvement to be higher. That peer influence and support is associated with involvement in risky behaviour is a well-known finding (for example, Jessor & Jessor; 1975).

Benthin et al (1993) also note that participants who reported participating in one risky behaviour were more likely to take part in multiple risky behaviours suggestive of important underlying personality differences between participants and non-participants. However this study provides an anomalous finding that requires further exploration. Participants both felt more personal control of the risk but, at the same time, less ability to avoid the risk. Clearly, there is evidence that self-perceptions of control are important in self-regulation of risky behaviour but the effects are complex.

Benthin et al (1993) have not compared adult with adolescent risk perception but their psychometric method should, in principle, be generalizable to both populations since the methodology was originally developed for use with adult participants. The disadvantage of this methodology is that it conflates expected outcome, outcome likelihood and outcome value into an undifferentiated construct of risk. For instance one question asks participants to indicate whether the *benefits* are greater or less than the *risks* of a given behaviour. From our perspective it makes more sense to contrast *benefits* with *costs*.

In the absence of direct comparisons between adults and adolescents it is impossible to know whether adults and adolescents differ in risk perception. Beyth-Marom et al (1993)

have provided some indication that there are developmental differences. Studies such as that by Phelps (1987), who found that adolescents greatly underestimate the incremental risk associated with drinking alcohol and driving, cannot draw such conclusions as they have not asked adults the same questions. Shtarkshail (1986) found that adolescents and young adults assessed new technologies, (e.g. nuclear power, pesticides....) as more risky, whilst they perceived dangerous outdoor activities (e.g. climbing, hunting..) as less risky, than a middle-aged sample. Thus one should not always assume that teenagers are uniformly likely to perceive less risk. However, an issue that also needs to be noted in any consideration of age differences is the possibility that enduring cohort effects may mask or accentuate developmental differences.

In evaluating consequences, people tend to discount outcomes, be they gains or losses, if they are postponed into the future. Green, Myerson, & Ostaszewski (1999) have shown that the rate of temporal discounting decreases with age. So older people are less likely to alter a choice on the basis that reward will be delayed. As one might expect increasing the value of the outcome decreases the rate of discounting (Green, Myerson & McFadden; 1997) and this is subject to individual differences. Interestingly, Ostaszewski (1997) did not find any dependence of the rate of discounting on *sensation-seeking*, normally considered a good predictor of risky behaviour, but found that extraverts and, more predictably, highly impulsive people did show a higher rate of discounting. Gardner (1993) argues that it is normatively rational for adolescents to discount more than adults as they have less experience to help them predict what will happen in the

future. Given future uncertainty this is a manifestation of risk aversion, following the dictum: "a bird in the hand is worth two in the bush" when you don't know if you have the ability to catch the ones in the bush.

In a rare study addressing risk in a clinical sample of adolescents, Lavery, Siegal, Cousins & Rubovits (1993) found that Conduct Disordered adolescents see lower potential loss from risky behaviour than adolescents presenting with internalizing problems and a control sample who had received no diagnosis. No difference was found in perceived potential benefit. Self - reported involvement in risky behaviour was strongly predicted by benefit perception in the conduct-disordered group but not by potential loss perception. In contrast, low rating of potential loss predicted risk involvement for the remaining participants. This points to the importance of distinguishing risk orientation to gains and losses when considering the potential effects of risk orientation in risky behaviour. Lavery et al (1993) suggest that it is the difference in potential gain that drives the decision for involvement but it is only in the context of a lower perceived potential loss that this is the case.

Step 5: Choice and use of Decision Rules

Research investigating adolescent's choice and use of decision rules may be divided into that dealing explicitly within a decision-making framework, studies of individual differences and the development of meta-cognitive skills considered indicative of mature

adult decision-making.

Byrnes & McClenny (1994) constructed a simple board game where risky choices were required of adult and 13 year old participants. Participants elected to answer questions drawn from one of three piles, with varying proportions of easy and hard questions under different rules determining the points awarded for correct answers. Self-perceptions of ability to answer the questions were expected to weight the expected value for each pile. The expected value is the sum of the probability of finding each type of question, multiplied by the value of a correct answer for that question, under the rule for that trial. Byrnes & McClenny (1994) found support for a number of their hypotheses. As task complexity increased and task demands had fewer constraints on behaviour, the adults persisted with more complex compensatory strategies. There was evidence that this was attributable to working memory constraints though no conclusions could be drawn as to whether this was a memory capacity difference or as a result of the adults using more efficient coding, processing or meta-cognitive knowledge. This uncertainty reflects theoretical controversies in cognitive development research (Siegler; 1991).

Adults were found to be more optimistic in predicting their ability, especially when they considered that more skill was required and they felt they had that skill. In both age groups, ability beliefs predicted optimism and selection of the harder options in the game. Byrnes & McClenny (1994) concluded that adults and adolescents do make decisions that are adaptive to the task. Adults were more likely to choose the optimal path through the

board to maximize their chance of points. However, in one of the studies there was evidence that some adult participants chose the hard questions in trials where the points were the same for both types of questions. Protocol analysis indicated that they did this to increase the challenge of the game. The adults' aspirational focus had shifted from the one the experimenters had planned. Adolescents were also found to be more overconfident in assessing how they had done after the game was completed. Byrnes & McClenny (1994) consider this observation is important because it suggests that adolescents will be less likely to learn from their decision-making mistakes. However it is not clear how salient failure was for the participants. Further, for novices in any pursuit, it may be adaptive to overstate one's success in early experience in order to maintain motivation for continued effort. This study demonstrates the wealth of detailed hypotheses that can be tested directly within the behavioural decision-making framework.

Bauman and his colleagues elicited subjective expected utilities (SEU's) from adolescents in two studies addressing gender and ethnic background differences in sexual behaviour (Bauman & Udry; 1981) and gender differences in beer drinking (Bauman & Bryan; 1983). In the former SEU was successful in explaining self-reported differences between males and females in sexual behaviour but did not account for differences between ethnic groups in self-reported behaviour. The latter study replicated these findings for beer drinking amongst males and females. Correlations between frequency of behaviour and SEU were significant but low. In part this may be because participants were presented with a long checklist of possible negative and positive outcomes which may have biased

them to consider outcomes which they would not have spontaneously generated.

Baron, Granato, Spranca, & Teubal (1993) have taken an alternative approach. They have investigated changes in decision-making biases through childhood and adolescence. They found poor understanding of probability and frequency except in high ability and older adolescents. Lower ability adolescents were also more prone to judge an act of commission more serious than an act of omission despite the outcome in two scenarios being identical. As Baron et al (1993) note, this effect has also been observed in adults. All participants tended to generate self-serving reasons to justify, and to dismiss arguments that were counter to their decisions. This *my-side bias,* a form of cognitive closure, did not vary in the age range 5 through 15 years. There was also evidence of a sunk-cost effect, again this did not vary with age. The sunk-cost effect is the effect that built concorde: sticking with a losing strategy, purely because of the resources and emotions already invested, even though objectively the better solution is to accept accumulated losses and stop. Baron et al (1993) interpret their results as evidence that young adolescents are prone to more bias, though this declines with age. They also express concern that young adolescents should be so poor at incorporating probability arguments into their decisions. It is notable that the requirement to do so was implicit rather than explicit, and it is unclear if the age differences are a result of a failure to notice the relevance of probability to the task. The failure to spontaneously use probability arguments would remain a cause for concern. Studies such as those cited above have been clearer in demanding use of probability information and this may

explain the differences observed.

Karmiloff-Smith (Karmiloff-Smith, 1992; Elman, Bates, Johnson, Karmiloff-Smith, Parisi & Plunkett; 1996) has proposed a theory of cognitive development which synthesises post-Piagetian observations and theory with connectionist theory and modelling. Her central thesis is that development is a process of successive representational redescription within specific domains. Initial implicit cognitive representations are made successively more explicit and available as constituent sub-processes to other functional modules. That is, they generalize, and higher level processes eventually become consciously available. Event frequency sensitivity is fundamental to connectionist models and so implicit frequency representations might be expected to develop early. However, even late in development it is possible that fully explicit representations of probability may not have developed. Indeed without formal training they may never develop. However some sort of frequency representation is to be expected. The context in which such representations are elicited is likely to determine whether they are explicitly available. This sort of argument may also explain Gigerenzer's (1991) studies in which changes of representation much reduce biases held to be the result of inappropriately applied heuristics.

One further study is of interest, even though it involves non-risky decision-making. In one of the first experimental studies of developmental aspects of decision-making by Klayman (1985), 12-year-olds had to select a preferred option from a group which

differed on a number of given attributes. Relatively important and unimportant choice decisions were included. In a crossed design participants selected from one of three or six choices with three or six attributes which could be high or low (for example high versus low cost). The information the participant wished to use had to be specifically requested and information use was recorded. Klayman also assessed working memory capacity. Klayman (1985) set out to investigate whether children adapted their decision-making strategy on the basis of task complexity and importance of the decision. As I have noted earlier, adults have been shown to be *adaptive decision-makers* in the sense that they use more compensatory decision rules when faced with important decisions within the limits of their cognitive capacity (Payne, Bettman & Johnson; 1993, see the discussion above). Klayman (1985) found that information was systematically used. Decisions about what to have for lunch led to less information access than a decision about which type of bicycle to buy. As task complexity increased adults tend to use less information and this was also found amongst the 12 year-olds in this study. Participants with high memory capacity searched more thoroughly for information in important decisions when task complexity was high than they did if the decision was less important. This was not observed in participants with low memory capacity. Klayman (1985) concluded that 12 year-olds do adapt their information use according to task constraints in the light of their own information processing constraints.

Klayman (1985) found that *satisficing* was more frequently adopted in the complex task. The greater use of compensatory strategies was apparent for more important decisions, as

had been predicted, but there was evidence that participants used an initial simplification procedure and eliminated certain attributes and / or choices by setting thresholds of acceptability. In summary, Klayman (1985) has provided evidence that 12 year - olds do use decision rules strategically to adapt to task complexity. They have a sense of compensation, satisficing and adaptive information search and in comparison with adults they revert to simpler heuristics at lower levels of task complexity.

In past research I have investigated early and middle adolescents use of information in a novel dynamic computer control task (Davies; 1996). Adolescents had to balance the varying cost of using information against the varying cost of making interventions to keep a representation of a damaged spacecraft on course as it crossed the computer screen. Within the limits of their ability both groups demonstrated adaptive decision-making. Older adolescents demonstrated their ability to adapt their information search behaviour and use of control interventions to the cost contingencies in the task. However, younger adolescents were unable to make good use of the information and instead only showed adaptivity with respect to the changes in the cost of control intervention.

1.3.2. Risk Orientation Reversal in Adolescence

In the same study (Davies; 1996), the author, using an abbreviated form of Schneider & Lopes' (1986) task has shown that high achieving younger adolescents (age 13yrs 4 months S.D. 8 months, N=48) showed risk aversion for gains and risk seeking for loss choice lotteries. Older high achieving adolescents (age 15yrs 3 months, S.D. 7 months,

N=50) were risk neutral for gains and risk seeking for loss lotteries. The interaction of lottery type and age was significant implying reliable risk orientation reversal, on average, only for the younger group. Half of the younger adolescents showed the expected risk-orientation reversal, with the remaining half evenly spread across all other permutations of aversion and seeking of risk for losses and gains. The modal pattern for older adolescents was risk seeking in both loss and gain lotteries but differences amongst the permutations were not significant. The results confirmed that risk preference is better modeled by the two factor theory. Further, it suggests that there are developmental changes in risk orientation.

Since adults, examined in a separate experiment in the same study, showed a similar pattern to the younger adolescents, there is evidence for a U shaped developmental trajectory in preference reversal. Karmiloff-Smith (1992) has argued that such curves are evidence of the process of representational redescription in which the process under consideration is re-represented at a higher level of explicitness. In the new representation, the old process becomes a sub-process which may be used as appropriate. During the development of the higher level process observable behaviour may show a decline in accuracy. The classic example of this is the development of the rule governing the past participle (Brown, Cazden, & Bellugi-Klima, 1969). As the rule is learnt the treatment of exceptions, that is, irregular verbs that do not follow the new rule, and whose past participle had previously been known, may show errors due to interference by the developing rule based procedures. These disappear as the new rule is established and its

parameters are defined. It is tempting, but speculative, to propose that during adolescence implicit processing of relative frequencies becomes a volitional and explicit process for the first time and that consequently one might expect changes in risk-orientation reversal during adolescence. Certainly, the conflict amongst the research, cited above, relevant to development in the components of decision-making is suggestive of a distinction between implicit and explicit processing of probability and relative frequency information.

1.3.3 Summary of Adolescent Decision-Making Research

The few studies that have been carried out in this field suggest that adolescents use their decision-making skills adaptively, within the constraints of their cognitive ability and in response to outcome importance and task complexity. They can adapt their use of decision strategies and information search (Byrnes & McClenny; 1994, Davies; 1996, Klayman; 1985). There is evidence that younger and less able adolescents are more likely to use non-compensatory strategies at lower levels of task complexity than older adolescents and adults (Byrnes & McClenny; 1994, Klayman; 1985). Bauman and his colleagues have demonstrated that subjective expected utility theory can distinguish those who are involved in some risky behaviours, but only a limited proportion of the variance is explained by the normative model (Bauman & Udry; 1981, Bauman & Bryan; 1983).

There is mixed evidence addressing whether younger adolescents have problems

generating potential consequences. Lewis (1981) suggests that this is the case whereas Beyth-Marom et al (1993) suggest there are few quantitative differences between adults and adolescents it this regard. However, there is some evidence that adolescents frame the consequences differently and use different reference points for utility (Beyth-Marom et al;1993). Adolescents were found to be more likely to frame an outcome from a future perspective, in terms of potential losses, comparing what might have been had they taken the risk. In these terms a risk for a gain in the present is thought about as a risk for a loss in the future.

There is also evidence that adults and adolescents are apt to rate risk differently in different domains (Shtarkshail; 1986) and to grossly underestimate probability in some domains (Phelps; 1987). Baron et al (1993) provide some evidence that younger adolescents do not use probability in their spontaneous reasoning. Adolescents are known to have a higher rate of temporal discounting (Green et al;1999).

Adolescents involved in risky behaviour perceive higher potential benefits and lower potential costs. They consider themselves to be more in control of the risk and believe the behaviour to be more prevalent than those not involved with the risky behaviour (Benthin et al; 1993).

Conduct disordered adolescents have been found to perceive lower potential costs of risky behaviour (Lavery, Siegal, Cousins & Rubovits; 1993). However, their self-

reported behaviour was predicted by their perception of potential benefit, in contrast to control participants whose involvement was predicted by their perception of potential losses.

1.4 Aims of this Study

Some themes emerge in the above review of the adolescent decision-making literature. Firstly, self-perceptions of control are frequently found to predict risky behaviour. The findings are mixed. On the one hand, individuals who believe they exercise control of the risks appear to be more likely to take risks, because they underweight the probability of a poor outcome. On the other hand Liverant & Scodel's (1960) finding that people with external locus of control are more likely to choose a risky gamble. This accords with the observation that risk-takers are more likely to believe that they cannot stop recurrent risky behaviour. This study set out to try and distinguish which of these views better described participant's behaviour. Secondly, adolescents are believed to show adaptive behaviour with respect to their information collection and decision strategies. Thirdly, there is some evidence consistent with the view that externalizing adolescents are more risk taking because they focus on, and overvalue, the potential gains in a risky decision, that is, in Lopes' model they are opportunity minded. The adult research with depressed individuals suggests that we should expect internalizing adolescents to be more likely to be security minded. With these considerations in mind I have given an abbreviated version of the Schneider & Lopes (1986) task to a group of internalizing and

externalizing adolescents and a control group of mainstream adolescents. A priori, one expects internalizers to show security mindedness and externalizers to show potential mindedness. If external locus-of control predicts risk-taking then one would expect externalizers to show greater external locus-of control.

Participants also completed Connell's (1985) *Multidimensional Measure of Children's Perception of Control* (MMCPC) a measure of Locus of Control (Rotter 1966) suitable for early adolescents. There is evidence that external locus of control correlates with levels of maladjustment and powerlessness (Nowicki & Strickland; 1973) and delinquency (e.g. Kelley; 1996). This has been demonstrated with depressed samples (Weisz, Stevens, Curry, Cohen, Craighead, Burlingame, Smith, Weiss & Parmelee; 1989). There is also evidence that external locus-of control correlates negatively with aggression in adolescent boys (Halloran, Doumas, John & Margolin; 1999). Together these observations suggest that internalizing participants will have higher external locus-of control than externalizing participants but both should show elevated levels of external locus of control compared with controls. There is a clear contradiction in these predictions with what was predicted on the basis of considerations about risk. One of the purposes of this research is to understand this contradiction.

Participants also performed a computer simulation control task, which was framed as a damaged spacecraft to be controlled from earth (Davies; 1996; and see *method* section for a full description). Participants could use information that varied in cost, to aid their

decision-making in firing a rocket to control the space ship. Firing the rocket also systematically varied in cost. Participants scored points when they successfully kept the spacecraft within a safe band on the screen and lost points if they strayed outside this band. Without information, the decision to fire the rocket was a gamble which may have resulted in loss. It was expected that internalizers would use more information and externalizers less information than the control group in controlling the spacecraft. Because the task is framed as recurrent potential losses it was expected that externalizers would overcompensate by using proportionately less information when it had a cost, whereas internalizers were expected to undercompensate and not adjust their information use when it had a cost. The structure of the game is such that it is always advisable to use information when about to go off course as once off-course one continues to lose points until one returns to the safe band. Consequently, risk takers, predicted to be the externalising pupils, should show least control of the spacecraft and internalizing pupils should show the best overall control.

The probability information is given implicitly in the rocket control task and in a visual representation of frequency, in the lottery choice task. Thus neither task should be subject to the artefacts Gigerenzer (1991) has reported.

Risk orientation has been shown to predict performance on risky dynamic control tasks (Pascoe & Pigeon; 1995). Risk orientation to potential losses, and locus of control measures, were therefore predicted to account for a significant proportion of the inter-

group variance on the effects predicted. The *Need for Closure Scale* (Webster & Kruglanski; 1994) was also administered. This was expected to provide a validity check on trends in information use. Externalizers were expected to have highest need for closure and Internalizers lowest need for closure. *Need for Closure* was expected to account for group differences in information use.

Chapter 2. Method

2.1 Participants

The experimental group was sampled from two state schools for adolescents with emotional and behavioural disturbance (SSchool1 and SSchool2). Controls were sampled from neighbouring state schools (School1, School2).

All pupils from each of years 8,9,10, and 11 attending the special schools were invited to participate (SSchool 1, N=17, 4 female and 13 male, SSchool 2, N=25, 24 male , 1 female). Twenty pupils (8 female and 12 male) from each of the four academic years, randomly selected from each of the two mainstream school's computerised roll were also invited. The special school population was overwhelmingly male, reflecting the elevated prevalence of school-related conduct problems amongst boys (Wallace, Crown, Cox & Berger; 1997).

Table 2.1 outlines the participation rate across the different schools. 65% of those invited participated. There was no significant difference in participation by site ($\chi^2(3) = 0.455$, $p>0.9$) or by sex (($\chi^2(1) = 0.2$, $p>0.5$). There was a significant difference in attrition amongst the sites ($\chi^2(3) = 9.7$, $p<0.02$). More than one third of those who completed consent forms dropped out in SSchool2 and this contributed 70% of the chi-squared statistic.

Table 2.1: Participation by site

Site	Invited (M/F)	Participated (M/F)	Dropped Out	Refused or did not return consent form
SSchool1	17 (13/4)	10 (7/3)	0	7
SSchool2	25 (24/1)	14 (14/0)	5	6
School1	80 (48/32)	51 (35/16)	2	27
School2	80 (48/32)	55 (32/23)	6	19

Table 2.2 Behavioural Rating by School Site

	Internalizing	Externalizing	Total
SSchool1	8	2	10
SSchool2	5	9	14
Total	13	11	24

Two teachers at each special school independently rated the pupils as internalizing or externalizing from a description of behaviours (see appendix) typically associated with each behavior pattern. Agreement was good (Cohen's $\kappa = .83$). There was disagreement about one pupil on each site. On the basis of their behaviour during the study, I allocated one to each of the internalizing and externalizing groups. The distribution of behavioural rating by school is presented in Table 2.2. There was a significant effect of school site on behavioural rating ($\chi^2(1) = 4.6$, $p<.05$). Internalizers were more likely to come from SSchool1 and Externalizers were more likely to come from SSchool2.

Using the norms in Raven et al (1996), the Raven's Matrices raw score was age scaled with mean, 100, standard deviation, 15. The details of the age and RPM scaled score are presented in Table 2.3. There was no significant difference in the age of mainstream and special needs pupils ($t(128) = 1.024$, $p=.3$). As expected the special needs pupils scored significantly lower on Raven's Matrices ($t(127) = 3.5$, $p<.001$.

For group comparisons, matches by age, gender and Raven's Matrice's score were selected for each of the special needs pupils. Where more than one match was possible, the one included was randomly selected. There was no main effect of group difference in the matched sample for age ($F(2,45)=.01$, $p>.9$) or RPM scaled score ($F(2,45)= .78$, $p>.4$) in a one way ANOVA . In a planned contrast it was found that there was no differences in age ($t(45)=.06$, $p>.9$) or RPM scaled score ($t(45)= .76$, $p>.4$)between the two special needs groups

Table 2.3 Age and Raven's Matrices Performance for Groups and Matched Sample

		Internalizing	Externalizing	Main	Main Matched
		N=13	N=11	N=106	N=24
AGE	Mean	14.1	14.2	14.4	14.2
	Std Deviation	(1.2)	(0.7)	(1.1)	(0.9)
Scaled RPM	Mean	86.6	90.2	99.8	91.6
	Std Deviation	(12.7)	(9.0)	(15.0)	(11.7)

RPM: Raven's Matrices Scaled Score Mean (SD) 100 (15)

2.2. Design

2.2.1 Measures

Raven's Matrices

Raven's Standard Progressive Matrices (Raven, Court & Raven;1996) provided a measure of ability. The extensive literature on its use attests to its reliability and validity in measuring fluid intelligence (Kline; 1993).

Locus of Control

Participants' Locus of Control was measured using the Connell Multidimensional Measure of Children's Perception of Control (MMCPC, Connell; 1985). This is a 48 item questionnaire with a choice of four responses from *not at all* to *very true*. The questions measure perceptions of *internal, powerful other* and *unknown* sources of control. Though the measure can differentiate amongst cognitive, social, physical and general domains, in this study the scores were aggregated over all domains yielding 16 questions per source of control belief. Connell (1985) has reported adequate internal consistency and good test-retest reliability. A copy of the questionnaire is appended.

Externalizing participants were expected to show lower external locus-of-control than internalizing participants. Both were expected to show higher external locus of control than the mainstream group.

Need For Closure

The tendency of participants to reach closure of a problem was measured using Kruglanski's *Need for Closure* questionnaire (Webster & Kruglanski; 1994). Need for closure is operationally defined as the tendency for a person to reach *any* answer to a problem, rather than endure confusion and anxiety. It is a unifactorial instrument made up of 42 items that address self-perceptions of preference for order, preference for predictability, decisiveness, discomfort with ambiguity, and closed mindedness. The questionnaire has not previously been used with adolescents and only minor alterations were made to the wording. Specifically, references to *work* were replaced with *school*. The version of the questionnaire used is appended.

Webster & Kruglanski (1994) report Cronbach α values of 0.85 and test-retest reliabilty of .86 over 12 weeks. They also report good discriminative validity with respect to measures of impulsivity and no significant correlation with group IQ measures.

Externalizing pupils at the special needs school were expected to show the highest *need for closure* and *Internalizing* were expected to show the lowest *need for closure*.

Lottery Task Program

The lottery choice task was a 2 (gain or loss choice) x 6 (lottery pairs) factorial design. The dependent measure was the lottery chosen. Lotteries were ordered by their expected value assuming value functions given by Prospect Theory (Kahneman and Tversky, 1979; Schneider & Lopes, 1986) . 0 coded for a sure thing (no risk, no variance in possible outcome). Successive values (1 - 3) coded for a decreasing value according to the prospect theory value function. Higher value choices indicate preference for riskier lotteries.

It was predicted that externalizing participants would tend to be potential seeking and internalizing participants would seek security. However in view of Schneider & Lopes' (1986) findings, all of the four possible patterns of risk orientation were expected amongst the control group.

The Computer Control Task

The control task was a 2 (cost of intervention) x 2 (cost of information) factorial design. The cost of intervention and the cost of information were repeated measures. Both took the values zero or five points.

This task was a modified version of a task developed by the author (Davies, 1996) in which the participants could fire a directional rocket to control the course of a spacecraft and seek information to help with the decision. The details reported here are adapted from source. There were three direct dependent measures: the number of times a subject requested information, the number of times a subject fired the rocket to control the spacecraft and the number of points accumulated by the subject. Points was a linear function of the number of times the subject strayed outside a target zone and, as such, is taken as a measure of the efficacy of control exhibited by subjects.

Hypotheses

1. Internalizers would use more, and externalizers less, information than the control group.
2. A main effect of information cost on information use was expected. When information acquisition carried a cost, less would be used. An interaction was expected between information cost and group. Externalizers would use proportionately less information when it had a cost than the control group. Internalizers would alter their information use least when it had a cost.
3. Externalizers would show least control and Internalizers would show most control in the simulation and the effect would be strongest when information had a cost.
4. A main effect of cost of intervention was expected with respect to the number of times the rocket was used. Adaptive changes in control usage were expected to be smaller than those for information use as task demands constrain intervention.

5. These effects would be mediated by risk orientation for potential losses but not gains. They would also be mediated by locus-of-control measures and need for closure.

2.3. Apparatus and Materials

The experimental task was programmed in Microsoft QBASIC (Microsoft Corporation 1987-1993) and run on standard IBM clone computers with 14" VGA colour monitors and a standard keyboard with 102 keys.

Lottery Task Program

The lottery choice tasks were adapted from Schneider & Lopes (1986). Figure 2.1 shows the lotteries used. Instructions (see appendix) were presented on the screen for as long as subjects wished. The potential loss choice lotteries were identical save that the values had minus signs before them. The lotteries were presented in pairs on the screen. Each pair remained on the screen until one was chosen. Depressing the <1> selected the left-hand lottery and the <2> selected the right hand lottery. All six possible pairs within both loss and gain conditions were presented. The order in which the twelve pairs were presented was randomised. Which lottery appeared on the left or the right of the screen was also randomised. All lotteries had the same expected outcome of 100 points for gain (or loss). The loss choice was introduced to subjects as analogous to choosing between

two insurance policies. The code for the lottery chosen and not chosen was recorded for each lottery pair and saved on a floppy disk. The computer randomly selected a lottery ticket for the subject from the chosen lottery and reported its value to the subject. This value was credited (debited) to the subjects lottery points score. The lottery points score was independent of the control task score. The value of the ticket drawn was shown to the subject between each trial. Subjects controlled when they proceeded to the next trial.

The Control Task

The program presented a cover story for the control task. This described the task as the earth based control of an interplanetary rocket with a damaged navigational system. The participant was to operate controls in an effort to keep the probe within a target zone as it flew to its destination. The rocket had been damaged so that it would change direction. Participants could intervene to change the rocket's direction. Participants were told that because the rocket was far away, signals from the rocket took a long time to travel across space. Thus, the information displayed on the screen was out of date. By the time any signal they sent to the rocket arrived there was the possibility that the rocket would have changed direction and their intervention might make the situation worse. To combat this, they could use a computer-generated prediction of the direction the rocket would be travelling when their intervention would be received. This allowed accurate control of the rocket. Participants were told that due to the earth's revolution and the need to relay signals the cost of signalling varied at different times of the day. Similarly, because of competition for computing resources, seeking information from the computer was more expensive at certain times of day. Participants were told that they would score points

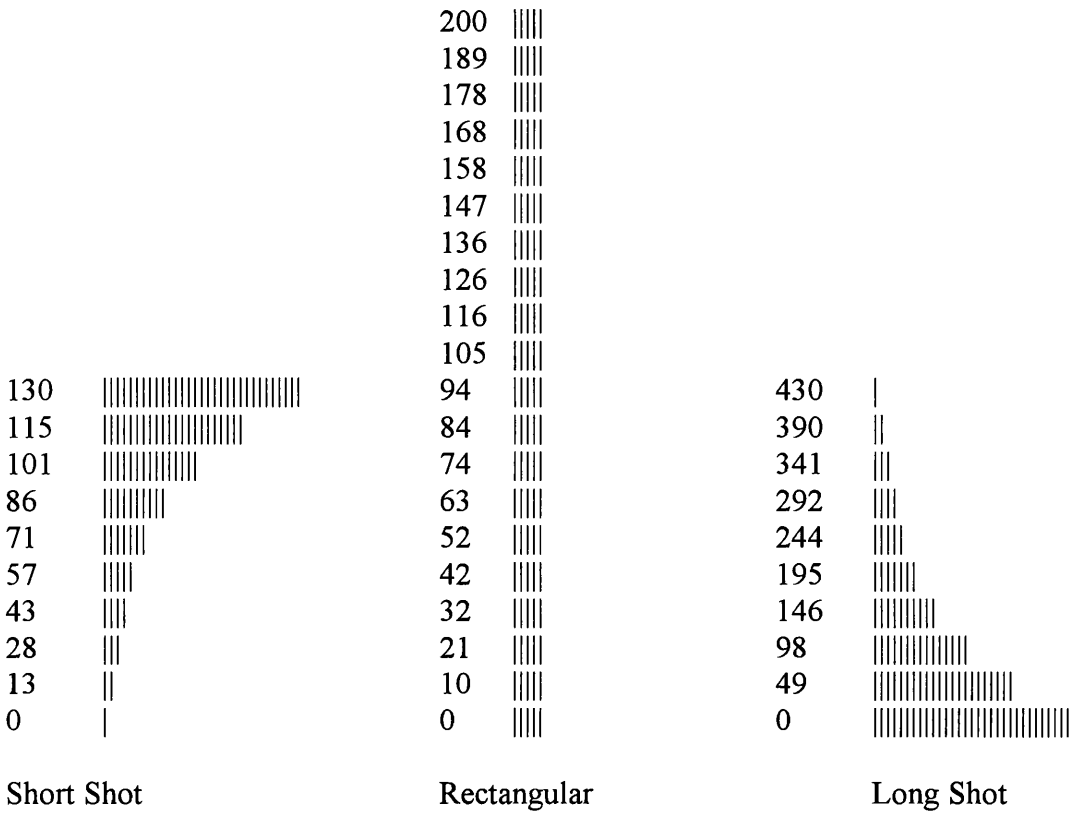


Figure 2.1. Lotteries from Schneider & Lopes (1986)

Both have expected outcome of 100. The loss version is identical with the addition of minus signs before the values in the first column

for keeping the rocket within the target zone and would lose points for straying outside. Following the cover story, participants read detailed instructions as to which keys performed which operations. Whilst reading the instructions, participants were shown the *help screen* which was always available to them if they pressed the **f-1** key. This provided a condensed version of the instructions. The instructions and the help screen are provided in the appendix. The detailed instructions were also read aloud and questions answered.

In each block of trials the computer generated two pairs of horizontal parallel lines spanning the width of the screen. One pair were red, separated by 10.5 cm with the lower line plotted 7.5 cm from the bottom of the screen. Within these were centred a blue pair separated by 3.5 cm. The blue lines represented the outer boundaries of the *target zone*. The computer generated a white trend line commencing on the left-hand side, centred in the target zone. This line turned red if the line went outside the target zone. The horizontal co-ordinate coded the trial number. Two hundred trials spanned the width of the screen (24 cm). On the bottom line of the screen three pieces of information were displayed permanently. On the left, the participant's score was printed. In the middle the current options for the participant were displayed. On the right was a reminder that pressing the **f-1** key would display a brief synopsis of the instructions.

There were two factors controlling the relationship between the vertical coordinate of a new point on the trend line. Firstly, there was a parameter setting the underlying slope of the trend. The vertical coordinate of the trend line was increased or decreased by 3.5

mm. depending on the value of the parameter. Initially the trend line went down the screen. In piloting work it was found that using a random time series with a probability of 0.25 that the direction would change provided a reasonable level of difficulty. However in generating the time series anew, for each participant, the score that would be obtained in the absence of any intervention varied greatly. Thus participants performance depended on the underlying time series generated. To control for this, five time series were generated which guaranteed participants would score 200 points on each and all of the blocks if they did not intervene in any way. All participants experienced the same time series controlling direction for the practice block. To ensure no confound of time series with performance in each of the cells of the design, the time series were randomly assigned to each of the possible levels of the cost of intervention and information.

The second factor controlling the change in the vertical coordinate was whether the participant intervened (fired the rocket). If the participant intervened by pressing the <y> key then the computer subtracted 7mm from the change in the vertical coordinate generated on the previous trial. Thus, if the trend was positive the computer subtracted 7mm and if the trend was negative the computer added 7mm. The underlying trend parameter was also altered by the participant's intervention. If the participant pressed the <return> key, i.e. chose to make no intervention, the algorithm generated the next point by adding or subtracting 3.5 m.m. to the vertical coordinate. Finally, if the new point was predicted to be at or outside the red boundaries the next point was plotted to be on the red line which would have been breached.

For the subject there was the added uncertainty due to the lag in the provision of information as to the direction the trendline had actually moved in the last trial. This uncertainty could be removed if the subject used the information key <i>. On pressing the information key the result of the last trial was displayed and the words *going up* or *going down* were displayed between the score and the list of current options. This was deleted at the end of the trial.

The net result of these procedures, in the absence of any subject intervention, was to plot on the screen a slowly and irregularly oscillating curve. Figure 2.2. presents one of the time series used in the experimental blocks. This assumes no subject intervention

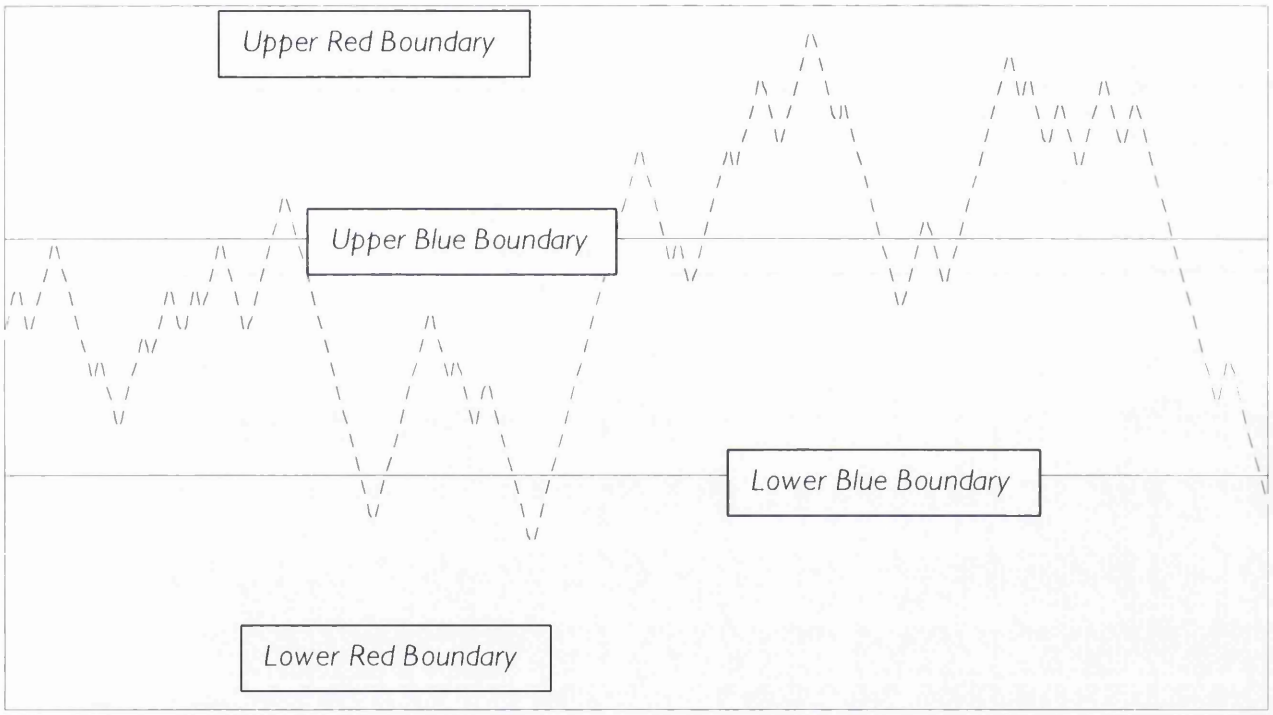


Figure 2.2. Computer Screen as seen in Control task. Dotted Line is trajectory of spacecraft.

During the practice block the use of information was free and the cost of intervention was set at one point. This was designed to encourage people to explore the use of information. In the experimental trials, use of information was either free or cost 5 points and intervention, also, was free or cost five points. Each block had a constant value for the costs of intervention and information. The four possible combinations of costs were presented in randomised order to control for learning effects.

A score was calculated for each trial. The cost of intervention and requests for information were debited when subjects used these facilities. Subjects were credited with five points when they remained within the target zone and debited with five points if they went outside the target zone. This component of the score was added (subtracted) when the result of the trial was displayed on the trend line either when the subject requested information or on the subsequent trial. This was to prevent subjects deriving information as to the effectiveness of their last choice from the change in score. The cumulative score was presented in the bottom left of the screen below the lower red line.

The aggregate score ignoring the costs incurred by use of information and intervention (i.e. the dependent variable points), the number of requests for information and the number of interventions for all the trials were recorded on floppy disk. The detailed behaviour of subjects and details of the position and direction of the trend line on each trial were also recorded.

2.4 Procedure

Participants completed the tasks in their year groups. These were smaller in the special schools (group size 2 - 5) than in the mainstream schools (group size 10 - 15). The complete procedure took ninety minutes. A short break was scheduled halfway through the session.

Participant Information

On first meeting, each participant completed two participant information sheets. One was kept by the researcher until all tasks had been completed in case the participants mislaid their copies, and was used to ensure feedback went to the correct participant. Participant's name, age and sex were collected. They were given a code of the form SIT0XX, where SIT coded for school and XX coded participant number. This information minus participant name was entered at the start of the computer task and on all of the questionnaires.

Raven's Progressive Matrices

Raven's Matrices was administered using the standard procedure for group testing (Raven, Court & Raven, 1996). Since there is no time limit, as each participant finished they were asked to hand in their answer sheet. After discussing it briefly with the

researcher, who checked it had been completed fully, they were given some puzzles to complete whilst they waited to proceed.

Questionnaires

The instructions were given verbally. Questions were invited and answered. The questionnaires were read aloud to ensure that those with poor literacy could complete them. In completing the *Need for Closure* words which were found difficult were defined as required.

Lottery Task

Participants sat in front of their computers and listened to and/or read the instructions. Questions were invited and answered. Participants pressed a key to start each trial. The two lotteries appeared on the screen and the computer requested a selection. Participants made a forced choice of one or other of the lotteries. The computer would not accept any key presses other than those indicating a selection. After each trial the value of the ticket they had drawn was presented to them. At the end of the task the total score was displayed on the screen.

Computer Control Task

Participants sat in front of the computer and listened and/or read the scenario and instructions for the control task on the computer screen. Any questions the participants had concerning the operation of the equipment were answered by the experimenter. The

participant pressed a key to start the practice trials. Before each block the participants were presented with a screen showing them the cost of information and intervention for the next block. To ensure that participants were aware of the changing contingencies, before they could proceed to the next block they were required to type these values into the computer. This screen also reminded them of the potential gains and losses arising from their control of the rocket. The computer drew the starting position of the trend line. Each trial had the possibility of two decisions. Participants were permitted to take as long as they required to make all decisions. Firstly the computer asked the participants whether they wanted to intervene (depress the <y> key), seek information (depress the <i> key) or do nothing (depress the <return> key). If the participant chose to intervene or to do nothing the computer displayed the change resulting from the previous trial and moved to the next trial. If the participant chose to seek information, the last change in the trend line was plotted on the screen and participants made the second decision: to intervene, <y>, or to do nothing, <return>. The computer then moved on to the next trial. Updating of the score by virtue of the use of information and intervention was immediate. Updating of the score due to staying inside or going outside the target zone was delayed until the result of the action was displayed either by use of information or when the trial result was displayed one trial later. After each block of 200 trials the score for that block was displayed. When ready, participants proceeded to the experimental blocks. On completion of the four experimental blocks the total score for all five blocks was displayed.

Task Order

All participants completed Raven's Matrices first. Participants then completed a questionnaire, a computer task, the remaining questionnaire and the last computer task. The order of presentation of questionnaires and computer tasks was counter-balanced across schools separately. A set order was used in each school.

Participants were thanked and offered time to debrief immediately or at a later date if they preferred.

Chapter 3 Results

3.1 Missing Data and Preliminary Analysis

Only participants who completed both computer tasks were included in the analysis. One mainstream participant completed Raven's Matrices in a manner that was unscoreable and was omitted from the sample prior to matching. No participant omitted more than ten items on either questionnaire. Preliminary analyses indicated no patterns in the missing data. Missing items were replaced with the group mean. All variables were tested for normality where appropriate. Information use in the computer control task was highly skewed and was transformed to its logarithm.

3.2 Reliability of Questionnaires

Multidimensional Measure of Children's Perception of Control

(MMCPC, Connell; 1995)

Internal consistency was assessed using Cronbach's α. For the matched sample (N=48), the *Internal* subscale had α=0.82. The *Powerful Other* Subscale had α= 0.84. The *Unknown Other* had α=0.89.

Need for Closure (Webster & Kruglanski; 1994)

Cronbach's α for the Need for Closure Scale (NFC) was 0.6. Items 2, 12, 15, 18,21,22, 24, 27, 28, 34, 37, 38 and 42 were inconsistent with the other items. 12 of the 13 removed items were reverse scored and were designed to measure avoidance of closure. There were 16 such reverse scored items. Reverse scored items were significantly more likely to reduce internal consistency, $\chi^2(1)=23.5$, $p<.0001$.

To understand better the reasons for this inconsistency, separate scores were formed for the forward (NFC_{for}) and reverse (NFC_{rev}) scored items. For the forward scored items $\alpha=.86$. For the reverse scored items $\alpha=.64$. The two measures were negatively correlated, Pearson $r= -.606$, $p<0.001$.

3.3. Analysis of Questionnaire Data

Summary Statistics for the NFC and MMCPC are presented in Table 3.1. The MMCPC data are also presented graphically in Figure 3.1. Pupils at the Special Schools appear to score marginally lower on the reverse scored items of NFC_{rev}. The forward scored items of NFC_{for} showed no differences. In external measures of the MMCPC, Internalizing pupils score higher, and the Externalizing pupils score lower, than the mainstream

Figure 3.1 MMCPC Subscale Ratings by Group

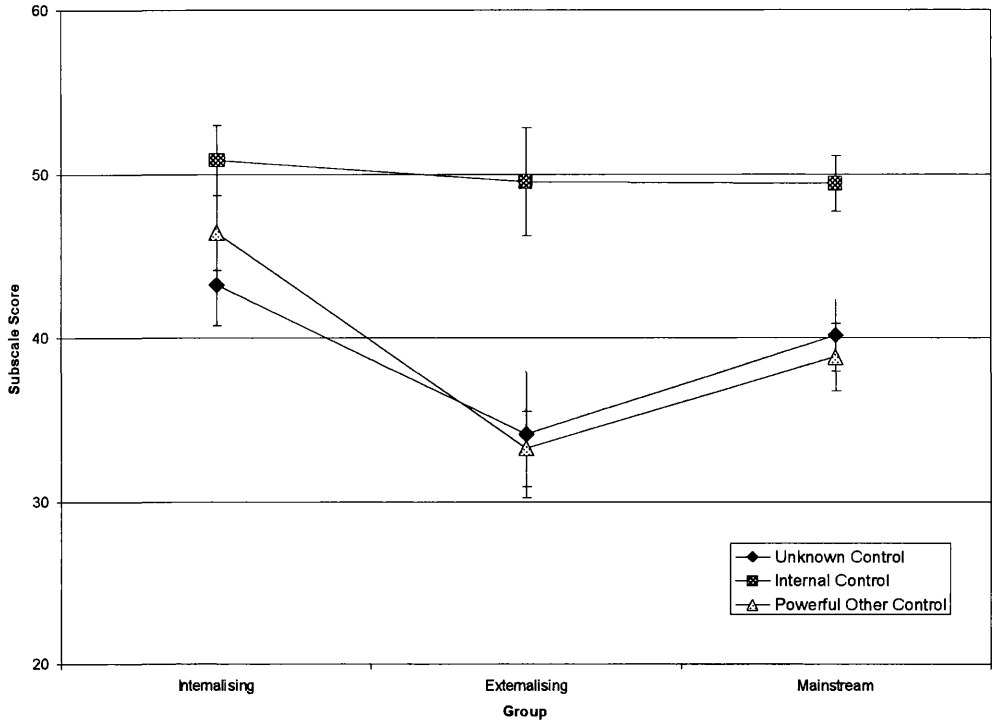


Table 3.1 Summary Statistics for Questionnaire Data by Group

		Internalizing (N=13)	Externalizing (N=11)	Main (N=24)
NFC_{for}	Mean	108.3	106.7	108.0
	SD	(20.1)	(22.3)	(15.7)
NFC_{rev}	Mean	49.6	47.7	52.4
	SD	(7.0)	(12.6)	(8.2)
Unknown Other	Mean	43.2	34.1	40.1
	SD	(8.8)	(12.7)	(8.1)
Internal	Mean	50.8	49.5	49.4
	SD	(7.8)	(11.0)	(6.4)
Powerful Other	Mean	46.4	33.2	38.8
	SD	(8.2)	(7.7)	(7.7)

Table 3.2 Intercorrelations within MMCPC Subscales (N=48)

	Unknown	Internal
Internal	.476**	
Powerful Other	.668**	.518**

** p= 0.01 level (2-tailed).

pupils. There were only small differences apparent in the internal locus of control measure. Higher scores indicate greater belief in that source of control.

Intercorrelations amongst the MMCPC subscales are presented in Table 3.2.

Because of the high intercorrelations the group differences in MMCPC were analyzed using a multivariate MANOVA. There was a main effect of group (Wilk's Λ= .648, exact $F(6,86) = 3.7$, $p<.004$). Examining the univariate statistics, the main effect of group was significant for Powerful Other control ($F(2,45)= 8.6$, $p<.001$). The main effect of Unknown control was not significant ($F(2,45) = 2.8$, $p=.07$, nor was the main effect of internal control ($F(2,45)=.15$, $p>.8$).

Planned contrasts comparing the two special school groups showed that pupils rated Internalizing scored more highly than those rated Externalizing on unknown ($t(45) = 2.32$, $p<.05$) and powerful other control ($t(45) = 4.1$, $p<.001$). There was no significant difference in internal control ($t(45)=0.4$, $p>.2$). There were no significant differences contrasting mainstream and special school pupils on ratings for unknown control ($t(45)=0.5$, $p>.5$), internal control ($t(45)=.33$, $p>.8$), or powerful other control ($t(45)=.46$, $p>.3$)

In order to further understand the group differences, pairwise comparisons were conducted using Tukey's test preserving the family-wise significance level at p= 0.05. (This practice was used throughout the analysis.) Internalizing pupils scored significantly

higher on powerful other control than mainstream pupils, Tukey's HSD = 7.6, $p<.02$. Externalizing pupils rated marginally lower than the mainstream on unknown control, Tukey's HSD, =5.5, p=.14.

There were no significant differences in a MANOVA with NFC_{rev} and NFC_{for} as dependent measures and group as an independent factor. The NFC was therefore dropped from all further analyses.

3.4 Analysis of the Lottery Selection Task

The number of risky choices in each of the lottery pairs as a function of group is presented in Table 3.3. For gain choices Internalizing pupils appear more likely to choose risky options and externalizing pupils appear more likely to choose less risky options than the mainstream group. The pattern is reversed for loss lottery choices, though in this instance, the difference between the internalizing group and the mainstream group appears to be marginal.

Following Schneider & Lopes (1986) the percentage of times each lottery was chosen in each loss or gain condition was plotted for each group. The data is presented in Figure 3.2. Note that each lottery appears in 50% of pairs so that the maximum possible percentage is 50%. In order to ascertain how the groups fitted within the Lopes two model factor model the data was analyzed in two repeated measures ANOVA separately for the loss and gain condition for each group. The repeated measure is lottery rank in each instance and the dependent variable was number of times the lottery was chosen.

Table 3.3 Number and percentage of higher risk choices by school and lottery pair

		Internalizing		Externalizing		Main	
		Count	% (N=13)	Count	% (N= 11)	Count	% (N=24)
Gain	0 v 1	8	61.5	2	18.2	13	54.2
	0 v 2	9	69.2	2	18.2	12	50
	0 v 3	11	84.6	2	18.2	11	45.8
	1 v 2	8	61.5	4	36.4	10	41.7
	1 v 3	7	53.8	4	36.4	11	45.8
	2 v 3	8	61.5	6	54.5	16	66.7
Mean		8.5	65.4	3.3	30.3	12.2	50.7
Loss	0 v 1	8	61.5	5	45.5	12	50
	0 v 2	6	46.2	8	72.7	12	50
	0 v 3	3	23.1	7	63.6	11	45.8
	1 v 2	7	53.8	5	45.5	9	37.5
	1 v 3	3	23.1	7	63.6	6	25
	2 v 3	3	23.1	9	81.8	7	29.2
Mean		5	38.5	6.8	62.1	9.5	39.6

Internalizers (Figure 3.2(a))

In the loss lotteries the internalizers showed a main effect of lottery rank, showing a preference for safer lotteries ($F(3,12) = 3.3$, $p<0.05$). However, only the quadratic component was significant ($F(1,12) = 8.3$, $p<.02$). The linear trend was marginal ($F(1,12) = 4.3$, $p=.06$). Post-hoc paired comparisons revealed that only differences between the long shot and the other choices were significant. Tukey's HSD= 1.0, $p<.04$ for the long shot and the sure thing. With the short shot Tukey's HSD= 1.15, $p<.02$, and with the rectangular lottery Tukey's HSD= 1.08, $p<.02$. This is comparable with Schneider & Lopes' (1986) result for pre-selected risk averse participants.

In the gain condition the internalizers showed a main effect ($F(3,12)=3.3$, $p<0.04$) preferring riskier lotteries. However, in this case only the linear trend was significant, ($F(1,12) = 5.8$, $p<0.04$). Only differences in rank greater than 2 were significant. Both the long shot (Tukey's HSD = 1.14, $p<0.04$) and the rectangular lottery (Tukey's HSD =0.85, $p<.02$) were preferred over the sure thing. The long shot was preferred over the short shot, (Tukey's HSD = 0.54, $p<.05$). This is as Schneider & Lopes (1986) found for risk seeking participants.

Externalizers (figure 3.2(b))

In the loss lotteries the externalizers showed no main effect of lottery rank ($F(3,10) = 1.6$, $p=0.2$). The linear trend was marginal ($F(1,10) = 3.2$, $p=.1$) as a result of the higher frequency with which the long shot was chosen, suggesting risk seeking.

In the gain lotteries the externalizers showed a main effect, with safer lotteries preferred, ($F(3,10) = 5.2$, $p<0.005$). The linear trend was highly significant ($F(1,10)=11.8$, $p<.01$). No higher order components were significant. In post-hoc analysis only the differences between the sure thing and the risk lotteries were found to be significantly different. For the short shot Tukey's HSD was 1, $p<0.02$, for the rectangular lottery, Tukey's HSD = 1.45, $p<.01$, and for the long shot, Tukey's HSD = 1.36, $p< .01$. The pattern indicates risk aversion for gains.

Mainstream (Figure 3.2[c])

For the mainstream pupils, in loss choices, there was a main effect of lottery rank ($F(3,23) = 3.1$), $p<.04$). The quadratic component was significant ($F(1,23) = 4.8$, $p<.04$). The linear trend was marginal ($F(1,23)=3.99$, $p=.058$). In post-hoc testing it emerged that only the differences between the long shot and the two other risky lotteries were significant. For the difference with the short shot, Tukey's HSD was .88, $p<.01$. For the difference with the rectangular lottery Tukey's HSD was 0.58, $p<.04$. The less risky lotteries were preferred.

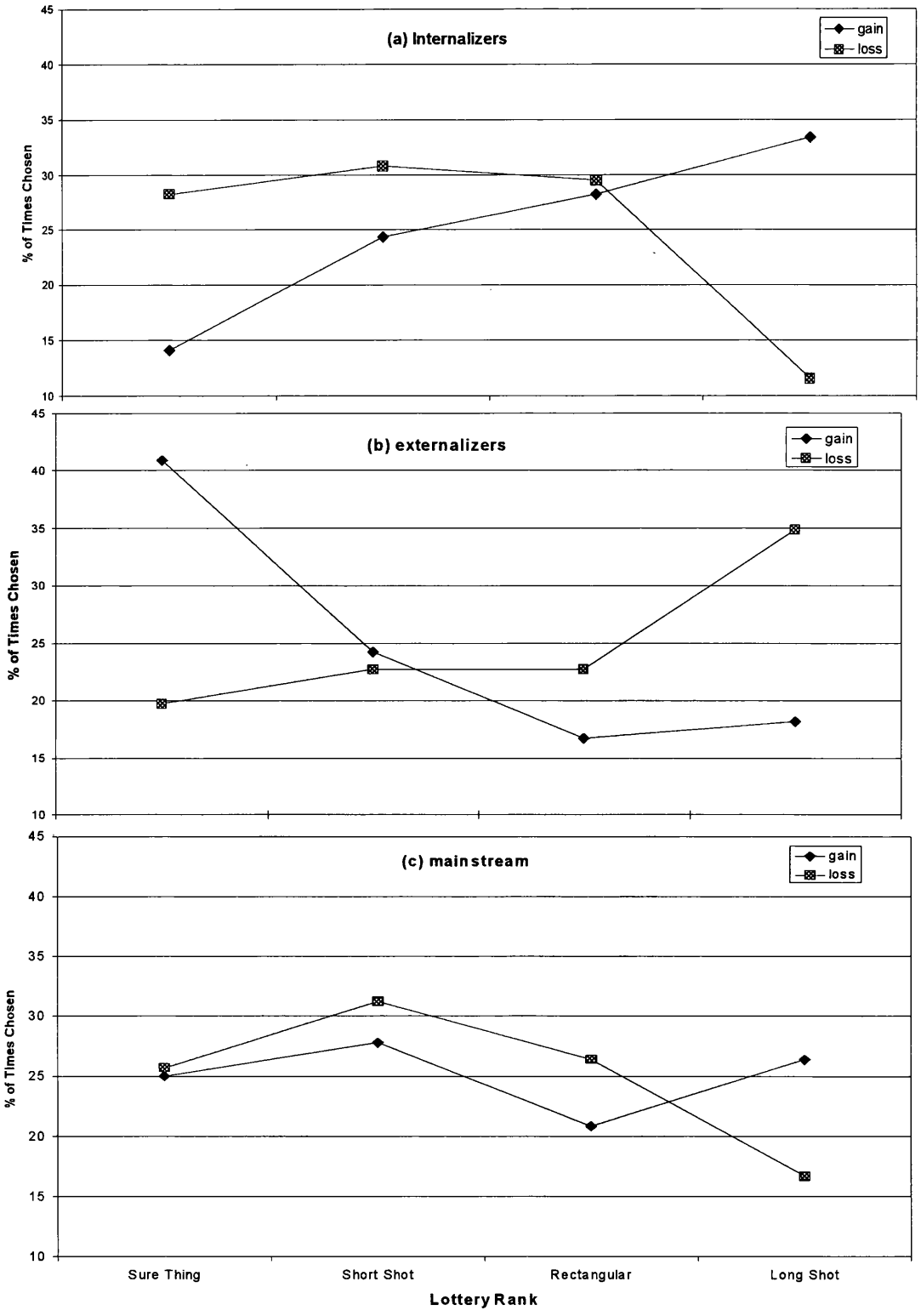


Figure 3.2 Percentage of times each Lottery was Chosen by each of the group Maximum Possible 50% (a) Internalizing, (b) Externalizing, (c) Mainstream .

There was no main effect for the gain lotteries ($F(3,23) = .817$, $p=0.5$).

No clear interpretation of this pattern is possible. It appears to be a mix of both risk-aversion and risk-seeking averaged over the group.

Data Reduction

In order to proceed with the analysis the six gain and the six loss lottery pair choices were separately reduced in two principal components factor analyses. Two factors were extracted and rotated using a promax rotation with $\kappa = 4$. Since the two factors extracted in each factor analysis were orthogonal, correlations less than .001, the Anderson-Rubin factor score for the factors was preferred. Some details of the factor analysis are presented in Table 3.4 . The loading for the first factor in the gain lotteries is largely due to choices between the sure thing (lottery 0) and the risky choices. In the loss lotteries the risky choices also load on the first factor.

The intercorrelations amongst the risk factors and the MMCPC measures are presented in Table 3.5. There were no significant correlations amongst the Lottery risk orientation factors and only the first gain factor correlated with the two external MMCPC subscales. There were no significant differences expected or found across groups for the second factors and these were discarded from the analyses.

Gain Lottery Factor Analysis			Loss Lottery Factor Analysis		
	Factor 1	Factor 2		Factor 1	Factor 2
% Variance Explained	27.3	22.8	% Variance Explained	26.4	19.8
Lottery Pair	Component Loading		Lottery Pair	Component Loading	
ST v. SS	.652	.133	ST v. SS	.257	.801
ST v Rect	.729	.314	ST v Rect	.521	.287
ST v LS	.727	-.472	ST v LS	.393	.107
SS v Rect		-.401	SS v Rect	.507	-.658
SS v LS		.755	SS v LS	.707	-.145
Rect v LS	.219	.638	Rect v LS	577	

Table 3.4. Structure Matrix showing variance for each factor and loading for each lottery pair for Loss and Gain Lotteries.

ST: Sure Thing, SS: Short Shot, Rect: Rectangular, LS: Long Shot.

Loadings below 0.1 have not been shown to aid clarity.

Table 3.5 Intercorrelations for Lottery Risk Orientation Factors and MMCPC subscales

Significance levels: p<.05* , p<.01**

	Powerful Others	Unknown Control	Internal Control	Loss Risk Factor 1	Gain Risk Factor 2	Loss Risk Factor 2
Gain Risk Factor 1	.490**	.314*	.214	-.045	.001	.014
Loss Risk Factor 1	-.194	-.112	.117		-.075	-.059
Gain Risk Factor 2	.065	-.025	.116			.268
Loss Risk Factor 2	.094	.103	.196			

Table 3.6 Risk Orientation with respect to Loss and Gain Lottery Choices

Positive values indicate risk seeking.

		Internalizing	Externalizing	Main
LOSS Orientation	Mean	-.3	.8	-.2
	SD	(1.1)	(.9)	(.8)
GAIN Orientation	Mean	.7	-.9	.0
	SD	(0.9)	(.6)	(.9)

Figure 3.3 Risk Orientation for Gain and Loss Lottery Choices
Mean with Standard Errors of factor Scores

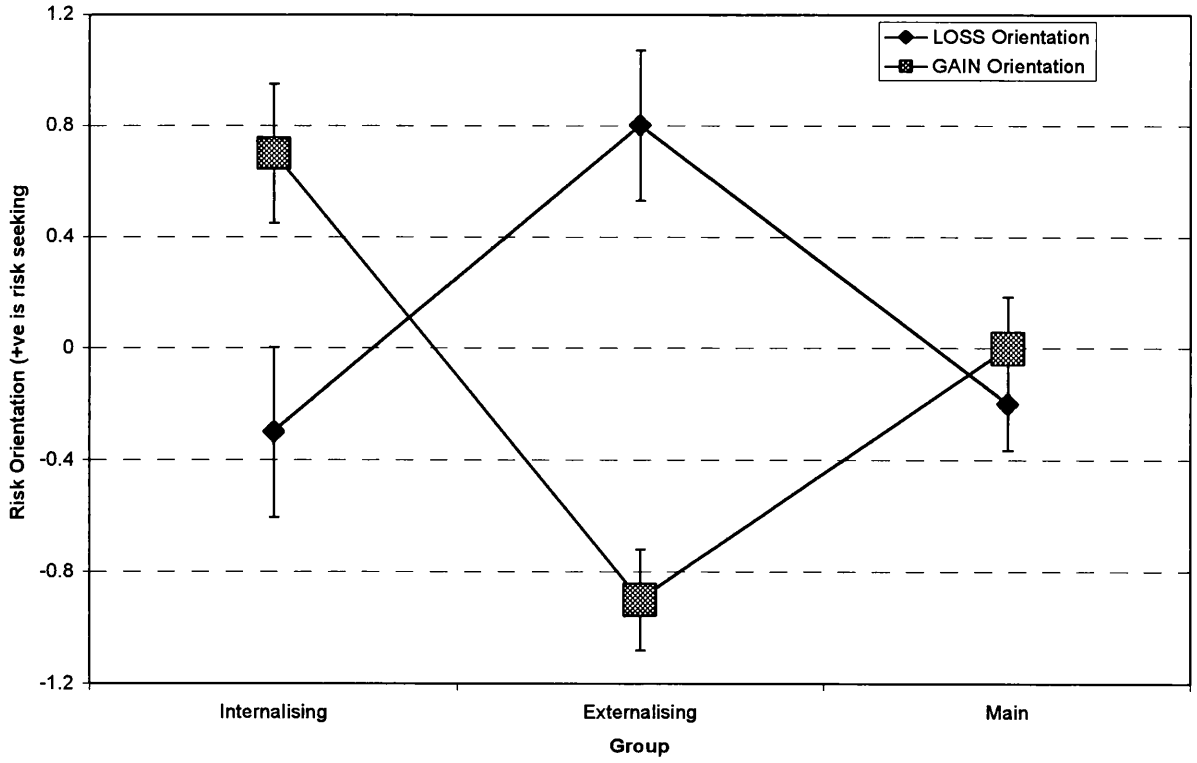


Table 3.6 presents summary statistics for the loss and gain risk orientation factor scores. The same information with standard error bars is presented in Fig 3.3.

Internalizing pupils are marginally more risk averse than mainstream pupils for losses. For these, Externalizing pupils are risk seeking. For gains, mainstream pupils were risk neutral, internalizing pupils were risk seeking and externalizing pupils were risk averse. The trends in the data were tested using a mixed plot ANCOVA across the groups, with the two risk orientation within-subjects measures and with the three MMCPC measures, age and RPM scaled score as covariates. There were no main effects of group or the covariates. Risk orientation difference for losses and gains interacted significantly with group ($F(2,40) = 8.6$, $p<.001$). The interaction between the difference in risk orientation to losses and gains and the powerful other subscale of the MMCPC was marginally significant ($F(1,40) = 3.9$, $p=.056$).

To test the contributions to the interaction the simple effects of risk orientation and group were examined. The simple effects of group were significant for both loss ($F(2,40) = 3.8$, $p<.05$) and gain lotteries ($F(2,40)=3.4$, $p<.05$). The simple effect of gain versus loss lottery choice was only significant for the externalizing group ($F(1,40)=14.093$, $p<.001$). For the internalizing group the simple effect was marginal ($F(1,40)=3.1$, $p=.088$).

A conservative, post-hoc analysis, within the ANCOVA showed that externalizers were significantly more risk seeking than mainstream students (Tukey's HSD = 1.01, $p<.01$) for losses but only marginally more so than internalizers (Tukey's HSD = .9, $p=.059$).

Externalizers were significantly more risk aversive for gains than both mainstream students (Tukey's HSD = -.68, $p<.05$) and internalizers (Tukey's HSD=-1.1, $p<.02$).

Since it is important when dealing with clinical samples to check for the consistency of the effect across participants, the sample was divided into those who became more risk seeking for gains relative to losses and those who showed the opposite pattern. Table 3.7 shows the contingency data. Group membership and the direction of risk shift were significantly related, ($\chi^2(2) = 11.7$, $p<.005$), with internalizers showing a shift from risk seeking for gains to risk aversion for losses and externalizers showing a shift from risk seeking for losses to risk aversion for gains. The mainstream group showed roughly equal numbers shifting in each direction.

Summary of Lottery Task Results

Mainstream pupils were on average risk neutral for both gain and loss lottery choices. Internalizing pupils showed a small risk aversion for losses and significant risk seeking for gains. Externalizers show the opposite pattern. They are risk seeking for choices between potential losses and risk averse to choices between potential losses. There is evidence that participants with a more external locus-of control tend to be more risk seeking for gains. The effect was stronger for the Powerful Other scale. No effect of locus-of control on risk orientation to loss was found. Raven's Matrices score accounted for no differences in risk orientation.

	Group			
	Internalizing	Externalizing	Mainstream	Total
More Risk Seeking for Gains	10	1	14	25
More Risk Seeking for Losses	3	10	10	23
Total	13	11	24	48

Table 3.7 Frequency of participants risk shifts between Loss and Gain Lotteries

3.5 Analysis of the Computer Control Task

Table 3.8 presents summary statistics for the computer control task by group, cost of intervention and cost of information.

Ability to Control

The mean total points score was 1370 and this was significantly greater than the 800 that would be obtained by merely pressing the return key ($t(47)=3.5$, $p<.001$). However the mainstream participants scored 1085, not significantly more than 800 points ($t(23) = 2.3$, $p>.2$). The internalizing group scored a mean of 1676, significantly more than 800 points ($t(12)= 3.0$, $p<.02$). The externalizing group scored 1628, significantly better than 800, ($t(10)=2.4$, $p<.04$). The variability in the data was large.

Internalizers score was relatively unresponsive to the cost structure of information and intervention. Externalizers did better when information was free and when intervention was free. Mainstream pupils repeated the externalizers pattern at a lower level of overall control efficacy.

A mixed plot ANCOVA between groups with cost of information and intervention as repeated measures and scaled RPM score, and age as covariates revealed only the information cost*group interaction was significant ($F(2,43)= 3.7$, $p<.05$).

Pair-wise comparisons showed a significant effect of information cost such that when information had no cost Tukey's HSD was 173 higher, $p<.001$. This effect was only significantly accounted for by the contribution from the Externalising group Tukey's HSD = 377, $p<<.001$, though the trends were the same for both other groups. The data relevant to this result are presented in Figure 3.4.

Information Use

Information use was generally low. This was particularly true where information had a cost and for the mainstream group. Externalizers tended to use more information than internalizers when it was free and less when it had a cost.

In the ANCOVA with factor and covariates as before only the interaction between Information cost and scaled RPM score was significant ($F(1,43)=7.3$, $p<.01$). The only significant relationship was between RPM scaled score and the use of information when both information and intervention were free. The regression coefficient, $b= .05$, was significantly different from 0, $t=2.3$, $p<.03$ and indicated that higher RPM score was associated with more information use.

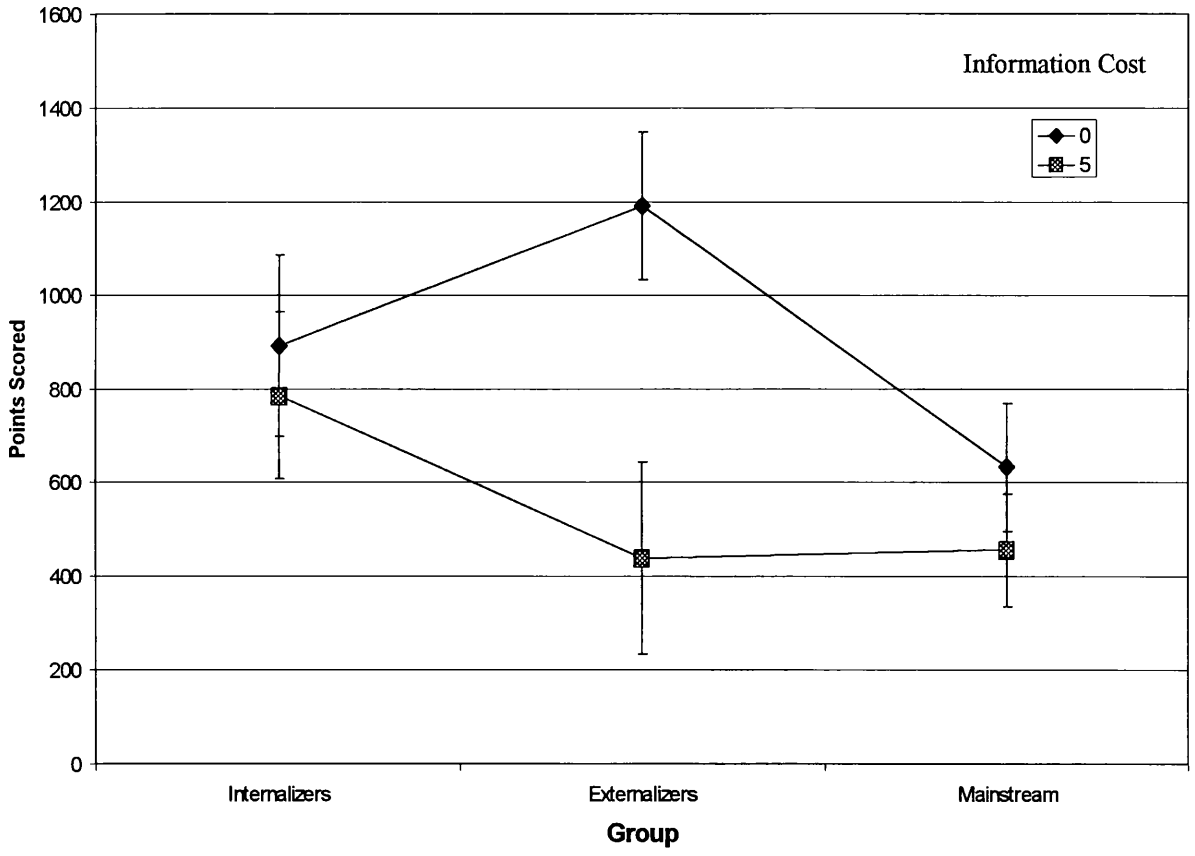
Table 3.8 Summary Statistics for the Computer Control Task by group, cost of intervention (cost), and cost of information (infocost).

			Information Cost			
			0		5	
Measure	Group	COST	Mean	SD	Mean	SD
NINFO	Externalizing	0	47.1	60.5	9.4	10.9
		5	37.7	50.2	14.1	13.4
	Internalizing	0	25.8	31.5	13.6	20.4
		5	33.7	50.0	26.2	46.5
	Mainstream	0	22.3	36.7	8.5	10.6
		5	16.0	36.8	8.5	13.4
Log_e (1+ NINFO)	Externalizing	0	2.72	0.52	1.65	0.42
		5	2.82	0.51	2.06	0.45
	Internalizing	0	2.29	0.49	1.67	0.40
		5	2.03	0.47	1.94	0.41
	Mainstream	0	1.9	0.36	1.53	0.31
		5	1.62	0.35	1.44	0.30
NINTS	Externalizing	0	60.2	18.7	59.6	19.7
		5	40	18.3	55.5	19.5
	Internalizing	0	79.4	17.2	100.2	18.2
		5	96.9	16.9	112.8	17.9
	Mainstream	0	87.3	12.6	74.1	13.4
		5	83.0	12.4	88.4	13.2
PTS	Externalizing	0	671.8	125.0	232.7	122.8
		5	519.1	128.6	204.5	139.0
	Internalizing	0	437.7	115.0	433.0	113.0
		5	453.8	118.2	352.3	127.9
	Mainstream	0	407.1	84.7	203.7	83.2
		5	224.2	87.0	250.8	94.1

Ninfo: log transform of number of information requests, Nints, number of control interventions, pts : degree of control effected.

N(externalizing) = 11, N(Internalizing) = 13, N(Mainstream)=24

Figure 3.4 Efficacy of Control of Groups by Information Cost



Control Interventions

Externalizers appear to use less control interventions than the other groups. The mainstream group appear to use the most control interventions. However in the ANCOVA there were no significant effects.

In the absence of clear effects in the ANCOVAs no attempt was made to address other hypotheses concerning risk orientation and performance in the control task.

Summary of Computer Control Task Results

Mainstream participants did not appear to exert control over the simulation. The cost of information had a significantly different affect in how participants of the different groups performed. Externalizers showed markedly less control when they had to pay for information. Overall information use was low and was correlated with Raven's Matrices score only when it was free. There was no evidence of differences in response to the changing cost of control interventions, that is, firing the rocket.

Chapter 4 Discussion

Before a discussion I present a brief summary of the salient results. After the discussion I will consider some implications within the wider research agenda in Clinical Psychology and for clinical practice.

4.1 Summary of Results

Locus of Control

External locus of control distinguished amongst the groups. Specifically, the internalizing group reported greater belief in external control than the externalizers on both *powerful other* and *unknown* control. There were no significant differences between the externalizers and the mainstream group on either measure, but the internalizers reported more perceptions of *powerful other* control than the mainstream group.

The Lottery Task

The mainstream group was, on average, risk neutral for gains and slightly risk-averse for losses. The internalizers showed strong risk seeking for lotteries with gains and weak risk aversion for lotteries with losses. The externalizers showed strong risk seeking for the loss lotteries and strong risk aversion for gain lotteries. Analysis of the risk-shift between choices for losses and gains confirmed that the patterns for the externalizers and internalizers were found in all but four of the participants. Mainstream participants showed a split with roughly half shifting in each direction.

Belief in *powerful other* control accounted for a significant proportion of this effect. External control beliefs were correlated only with risk-orientation for gain choices.

Computer Control Task

There was some evidence suggesting that higher ability predicted information use. This was only the case when information was free. Externalizers showed a significant decline in their ability to keep control of the spacecraft when information became costly. The mainstream group did not demonstrate an ability to exert control over the spacecraft in the simulation.

4.2. The Study in Context

Locus of Control

It was expected that both clinical groups would rate themselves more highly on the external measures of locus-of-control than the mainstream group. Whilst this was true for the internalizing group it was not found to be the case for the externalizing group. Indeed, there was a trend for the externalizing group to rate less highly on the external source of control scales. Most previous reports in which the MMCPC was administered do not report the absolute values found. They show only correlations with other measures. However, Roberts , Zachorchemny & Cohen (1992) give MMCPC scores for a sample of 56 in-patients before and after a stay at an adolescent psychiatric unit. They divide their sample using an under-restrained versus over-restrained dichotomy which is similar to the division used in this study. They do not report scores for the sub-groups but the total sample of 48 under-restrained and 8 over-restrained participants had mean scores of 39 on both the external *powerful other* and *unknown* scales and 51 on the internal scale before treatment. After treatment the ratings were 36 for *powerful other* control, 33 for *unknown* control, and 53 for *internal* control. A weighted mean of the results found here, using the proportions found in their sample, gives 35 on each of the external scales and 50 on the internal scale. This indicated that the two studies have comparable results for the clinical samples. Despite the limited sample size in this study there is a clearly significant difference between the internalizing and externalizing groups and a non-significant trend for the externalizers to have a less external locus of control than the mainstream group. One is led to question whether the relationship between

locus of control and measures of delinquency (Kelley; 1996) only holds within pre-selected at-risk groups of externalizers. Given that an adolescent has an externalizing problem, Kelley (1996) shows they are more seriously at risk if they also have highly external perceptions of control. It is open to question, though, whether external locus of control is necessarily associated with externalizing behaviour within the wider population.

The observed pattern of results conforms to Halloran et al's (1999) observation that external belief in control is negatively correlated with aggressive behaviour. Halloran et al (1999) used a non-clinical sample. Therefore it is possible that the adolescents in this study were not extremes on the externalizing scale. However, this seems an unlikely explanation for their low ratings of external locus of control. Rather, my experience with the externalizing participants was of adolescents who overtly prided themselves on their ability to act autonomously of adult control. The possibility that this is a defended position, covering covert externality remains (Furnham & Steele; 1993). This points to the difficulty of relying on self-reports, explicitly elicited. Bentall (1996) describes studies in which people diagnosed to have persecutory delusions blame other people when bad things happen. In the language of attribution theory: they make extreme, external, personal attributions for negative outcomes when the attributions are elicited explicitly. However, when the attributions are elicited implicitly they are more likely to blame themselves; they make more internal attributions for negative outcomes, as depressed people do. Bentall (1996) argues this pattern indicates defended depression.

In this study there were no differences in internal perceptions of control. This was also surprising, but again, maybe a problem with power in the analysis, or alternatively, a ceiling effect. All participants rate themselves highly, the average response being between agree and strongly agree. This raises the question as to whether the answers given reflect the perceived social desirability of autonomy beliefs (Furnham & Steele; 1993).

In summary the validity of expressed locus of control by adolescents in self-report measures is open to question. However the differences between the clinical groups were as expected.

Need for Closure

No results of interest were found in this study from the *Need for Closure Scale* (Kruglanski, Webster & Klem; 1993). However, the poor internal consistency and the clear negative correlation between positively and negatively scored items are worthy of some discussion. The scale has not previously been used with adolescents and it is possible that comprehension difficulties have made the results invalid. However, an examination of the items does not suggest any systematic variation in comprehension difficulty or in use of positive or negative frames for the items scored forward or reverse.

Neuberg, Judice & West (1997) have produced data which puts into question the reported univariate structure of the *need for closure* scale. They suggest that it has five factors

which are correlated in adults. These are, *preference for order, preference for predictability, decisiveness, discomfort with ambiguity* and *close-mindedness.* Kruglanski, Atash, De Grado, Mannetti, Pierro & Webster(1997) have attempted to refute this criticism, but have not produced new data. Rather, they argue that the construct is theoretically justified and has proved fruitful in generating testable hypotheses. However, it may be that in adolescence, and particularly with clinical samples, the factor structure of the scale is more evident. For instance it might be conceivable that internalizing adolescents score higher on discomfort with ambiguity and lower on decisiveness, whereas externalizing adolescents show the reverse pattern. Further work is needed to establish whether the *need for closure* is a valid construct for adolescents.

The Lottery Task

The results in the lottery task are both clear and to some extent counter-intuitive. When gains are at stake those considered least risk seeking, the internalizers, choose the riskier options and those considered the most risk seeking, the externalizers, choose the least risky options. The converse is true when choices between losses were offered. These risk-orientation shifts accurately reflect the distinction between externalizing and internalizing behaviour but they are not what would be expected on a simple reading of what is meant by risk-seeking and risk-aversion. I will start by discussing them in terms of Lopes' model (e.g. Lopes; 1993).

Let us first consider the pattern of results shown by the internalizers in terms of Lopes' two-factor model (e.g. Lopes, 1993). Were they to fit into the standard pattern for security minded individuals, they should show a quadratic trend with increasing rank of the lotteries and a linear decreasing trend for the gain lotteries. They show the expected pattern for the losses. For the gains they show a linear increasing trend rather than the expected linear decreasing trend.

In the loss choices, they select in a way that is consistent with balancing security and aspiration. On the one hand they focus on the possibility of losing seriously, which increases from the *sure thing* to the *long shot*, as this would threaten their security. At the same time the cumulative probability of avoiding loss increases in the same direction. The aspiration to minimise the potential loss would be more likely met by the riskier lotteries. When the maximum potential loss is marginally more than the *sure thing* they find it worth the risk, but for the *long shot* the maximum possible loss is too large and the gamble is refused. This fits the Lopes' explanation for security-minded risk-aversive response when faced with potential loss. The consideration of aspiration also serves to mute their overall risk-aversion to potential losses and is responsible for the weakness in the observed level of risk aversion in the reduced data.

In the gain lotteries, however, internalizers show a clear linear trend in preference for the higher rank lotteries. Since the cumulative probability of reaching the aspiration level decreases with rank from *sure thing to long shot* this means that they are not using this dimension as the basis for their selection. Rather they appear to focus on the potential for

the biggest possible gain. This is a risk-seeking strategy where aspirational considerations do not serve to mute the tendency to take risks within the range offered in this experiment.

In summary, internalizers appear to make sophisticated trade-offs between their desire for security and their aspirations when considering potential losses but adopt a simple risk-taking strategy, determined by the maximum possible potential gain, when selecting amongst potential gains. Thus only half of the pattern Schneider & Lopes (1986) found for risk-averse subjects has been found. Internalizers are not simply security minded.

Externalizers show an extreme version of the pattern modal amongst adults. They are risk seeking for losses and risk averse for gains.

When presented with a choice between losses, perhaps because of the relatively small sample size, when the raw data was analysed, there was a non-significant linear trend for externalizers to choose the riskier lottery. After data reduction this was found to be significant. This is consistent with potential seeking, as both aspiration and the probability of avoiding loss increase with lottery rank. Nonetheless it does not demonstrate that externalizers use both dimensions in making their choices. Use of either one would be predicted to lead to the same result. Only the presence of higher order polynomial trends clearly shows both dimensions are in use.

When the choice is amongst gains, externalizers show a clear trend preferring the less risky option. Since most of the variance is provided by the choices relative to the *sure thing*, this may just be a *certainty effect*. Potential increases across the lottery series but aspiration, the cumulative probability of exceeding the threshold, decreases. Therefore, one explanation is that externalizers have to trade-off these two properties and when presented with two gambles may choose either, depending on the particular level to which they aspire. When the *sure thing* is one of the options it provides least conflict since it will meet any level of aspiration that is not greater than the expected outcome of the lotteries and provides a reasonable and certain potential. However, in this context, this is risk aversion.

Another possible explanation of their behaviour when choosing between lotteries for gain is that they are being security minded. The level of security in a gain choice is the likelihood of avoiding getting nothing. This is highest for the *sure thing* and lowest for the *long shot*. Remembering that aspiration decreases in the same direction for gain choices, one expects security minded individuals to show a decreasing trend of lottery choice as the rank increases from *sure thing* to *long shot*. Again, this explanation only requires that the externalizers use at least one of these dimensions in making their decision.

In summary, externalizers show risk-seeking for loss choices because potential to avoid loss and aspiration increase together across the lotteries.. When faced with potential for gains, they behave in a way that has two possible explanations. Firstly, they are potential

minded, but the conflict between aspiration and potential encourages them to prefer *certainty*, in the guise of the *sure thing* and so they appear risk aversive. Alternatively they are security minded and the sure thing or the lower ranked lottery is usually preferred. Either way, the observed behaviour in the gain lotteries is indicative of risk aversion. It is noteworthy that most of the contribution to the gain risk-orientation factor came from the pairs that included the *sure thing*. In order to test which explanation is correct the experiment would need to be repeated with more pairs of pure gambles offering a wider range of aspiration and potential. This would differentiate between certainty effects and the trade-offs presumed for potential-minded people in the gain lotteries, within Lopes' model.

Mainstream pupils show a pattern of risk-orientation reversal that is an average of the behaviour of the two clinical groups. However, the modal pattern is for greater risk seeking for gains rather than for losses. This suggests that adolescents are more potential minded, and therefore more risk seeking, than adults for whom the modal pattern would be expected to be the reverse. The effect is weak, and at the group level adolescents appear to be risk neutral for gains and risk aversive for losses. It should also be remembered that this result is true for this non-random sample, selected on the basis of ability, age and gender, to match the clinical sample.

The Lopes model better accounts for the data than Prospect Theory, as the pattern of risk seeking for losses and risk aversion for gains is far from universal. Theoretically, these results are of interest because they strongly suggest that there is a psychological

difference for the clinical sample between decisions in the face of loss or gain. Their decisions are not simply the result of their disposition with respect to Lopes' posited security-potential continuum combined with the aspiration constructed in the situation. There appears to be a qualitative difference in their orientation to risks depending on whether losses or gains are at stake. There is little justification from this study for the belief that the wider adolescent population tends to be risk seeking, either when faced with potential gains or losses. Rather these results suggest that at the group level they are risk neutrl. Clearly, a more differentiated account of risk-orientation is required.

The results also show that external locus of control, particularly, a belief in *powerful others* as being in control, is associated with more risk-taking behaviour for gains, in agreement with Liverant & Scodel (1960). This is not true for risk-taking with respect to potential losses. The internalizing group were both more risk seeking for gains and had a higher self-rating for *powerful other* control. One possibility is that a sense of personal powerlessness predisposes people to trust to chance. This would conflict with Benthin et al's (1993) observation that a sense of personal control of the risk is a predictor of engagement in a risky behaviour. However, in this task participants clearly had no control over the outcome of the lottery draw beyond the choice of lottery so this may have been less relevant to the decisions participants made.

It is interesting to consider these results in the light of Lavery et al's (1993) observations. Conduct disordered adolescents' engagement in risky behaviour was associated with their perception of the greater potential benefit likely to result from involvement. At face

value, the utility of risky behaviour is greater for them and so they get involved. For the remainder of their sample lower levels of perceived potential loss predicted involvement. Seeing greater benefit or less loss, makes risk taking more likely in either a gain or a loss frame of reference. Normatively, this cannot explain the self-reported levels of involvement since it is the absolute utility for the individual that determines which option is chosen.. I would argue that the difference in involvement is conditional on the observed difference in self-reported perceptions of potential loss. If it is this difference that sets the frame for the decision then the result is understandable in terms of the risk-orientations to loss seen in this study. A further problem with Lavery et al's study (1993) is that they have not explicitly separated out considerations of outcome should the decision be not to engage in the risky behaviour. This may bias the frame of reference that participants used when assessing the level of risk.

These results may also help to explain some of the other findings presented earlier. Beyth-Marom et al (1993) found that adolescents were more likely to frame decisions from a future reference point. Benefits that would be foregone if they did not take a risk were salient. For example, if an adolescent were to refuse to smoke marijuana peer opprobrium was mentioned as a sure loss. This frame is explicitly one in which not taking the risk leads to certain loss with respect to the potential, but not certain, losses of taking the risk. In this frame the relevant risk-orientation is the one for loss situations. With the results of this study one would predict that externalizing adolescents would be more likely to take such risks. They avoid the certain loss of peer opprobrium by taking

the gamble that the bad consequences of smoking marijuana will not happen. In contrast internalizing adolescents would be more likely to take the sure loss.

There are clear limitations to the results of this study. It is not clear how robust risk-orientation reversal is. In all the lotteries the expected outcome was the same, 100 points. It is open to empirical demonstration how many points should be offered , either more or less as appropriate, to alter the observed preferences. The issue of incentives is also important. This experiment did not offer any tangible reward linked to performance, or participation, and there is evidence that payment can significantly alter performance on tasks such as the lottery choice task (Lopes; 1994). It would also be important to look at risk-orientation where both losses and gains were simultaneously considered.

Representations of probability are implicit in the Schneider & Lopes (1986) visual stimuli. The adolescents who participated in this study clearly responded differentially to the lotteries and in a systematic interpretable way. Clearly, they have used the frequency information. Baron et al (1993) would, therefore, appear to have found poor use of probability, because of the disguised manner in which they elicited the use of probability information.

It is possible that the observed trends in this study are the result of systematic biases across groups in their derivation of relative frequencies from the representations. Behaviourally, this is of limited importance, since whatever the interpretation of the results internalising and externalizing adolescents show biases in risk-orientation

compared to what is average for their cohort. However, this remains an important area for future research towards developing adequate preventative strategies for at-risk groups.

The Computer Control Simulation

Generally the results from this task were disappointing. The original development work with this task was completed with high ability pupils in a school in an affluent suburb of a city in a different country (Davies, 1996). Though the task had been simplified after this study, it was clear that the mainstream group had not fully understood the task and did not demonstrate adequate control. Participants in the mainstream group completed this task in groups of approximately 15 and therefore may not have had adequate time from the researcher to comprehend what is a complicated cover story and set of instructions. The pupils at the special schools completed the task in groups of between 2 and 5. Consequently they had more opportunity to have their questions answered. The small sample size also mitigated against clear results but cannot explain the low levels of control exerted by the mainstream students.

Nonetheless, there is some convergent data available. The externalizing group was less in control of the spacecraft when information had a cost. This suggests that they rather gamble in the hope that the rocket would change direction, or perhaps fire the rocket

without information, rather than take the sure loss of paying to find the information which would help make the correct decision. This is consistent with the view that externalizers are risk seeking in potential loss situations. There was also some indication that cognitive ability predicts information usage when it is free even though the sample had a curtailed range of ability after matching. However, when information had a cost this effect was not maintained. Since the general level of information use was low it is difficult to draw any wider conclusions concerning at-risk groups adaptive decision making from this result. A simpler task is required in order to address the hypotheses formulated. In particular, the cover story would benefit from simplification.

4.3. Implications for Research and Clinical Practice

The primary implication for clinical practice is the result that risk-orientation can be reversed when a risk is reframed from a choice between potential losses to a choice between potential gains or vice versa. The best choice of frame for the reduction of risky behaviour depends on the personal characteristics of the individual concerned. Thus a risk framed as a potential loss is more likely to be refused by an internalizing adolescent whereas a risk framed as a gain is more likely to be refused by an externalizing adolescent. Sometimes it is advisable to experiment with new things in adolescence. For such a risk to be taken, the reverse frame is more useful.

Internalizing adolescents may be content with chronic but small losses rather than take a risk, which they perceive may lead to a major loss. School-refusal in the context of

bullying would be one such situation. Indeed, the transaction between bully and victim is a clear example of this process. For the bully, the choice is between extorting a small pleasure with perceived certainty now and the risky choice that a more productive longer-term relationship can be established. The choice is between gains, and the externalizing bully would choose the certainty according to this thesis. For the victim the choice is between losses: to take the sure loss now, pay up, and discount future pain, or risk that if the bully is refused far worse might happen now. The internalizing victim, risk-averse for losses, chooses the *sure thing*.

If this insight is to be useful it is important to understand the way clients frame risky decisions in order to facilitate effective and safe decision-making. From a health psychology perspective it also becomes crucial to understand how different populations frame risky decisions and how they are likely to be oriented to risk for gains and losses. This is not to underrate the importance of understanding the actual utility structure of the decision itself. Clearly, part of risky behaviour prevention must include accurate information about options and the likely outcomes.

There remains a dearth of research into adolescent decision making. Nonetheless, these are important issues when thinking about the psychological processes which lead to risky behaviour. Preventative interventions would benefit from careful consideration of what is known in the adult decision making literature. Clearly, it would be advisable to use visual or other implicit representations of probabilty. I would suggest that the evidence presented by Klayman (1985) and Byrnes & McLenny (1994), and reviewed previously,

begin to show how it is that cognitive abilities specifically act as protective factors against engagement in risky behaviour.

Reframing effects are hardly a new phenomena within clinical psychology. They are explicit in many well established therapeutic models and arguably therapeutic change requires at least some reframing of the presenting problem. Cognitive restructuring within cognitive behaviour therapy can be seen in this light (Hawton, Salkovskis, Kirk & Clark; 1989).

De Shazer's (1985) model of *Solution Focussed Therapy* within the field of Strategic Family Therapy gives primary place to reframing, to the extent of discouraging "problem talk". Conversations are encouraged which encourage attention to positive change within a frame of potential gains. One wonders if there is a differential efficacy with internalizing problems when such a model is used. The current study suggests that this would be the case.

The decision-making perspective has much to offer clinical psychologists in thinking about managing professional risk, such as the discharge of potentially violent patients. This is an area, though of considerable topical interest, which is beyond the scope of this thesis. The decision-making perspective also, I argue, offers an alternative and complimentary frame for thinking about those who come to see us in the various settings in which we work. It has clear implications for both clinical practice and population wide

risk-reduction interventions. The results are not intuitively obvious, and provide further fruitful hypotheses worthy of exploration.

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Appendices

Need For Closure Questionnaire.

Multidimensional Measure of Children's Perception of Control.

Descriptions of Internalizing and Externalizing in Teacher Rating.

Scenario & Instructions for Computer Control Task.

Instructions for Lottery Task.

Agreement of Ethical Committee for this Study.

The Need For Closure Scale

Read each statement and decide the extent with which you agree or disagree. Tick one of the agree/disagree comments. Do this for all of the statements on all the three pages.
For example: if you agree to this question put an x as shown

		Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
1	I think that young people deserve the respect of their elders.....	☐	☐	☐	☐	☒	☐

Now begin here.

		Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
1	I think that having clear rules and order at work (school) is essential for success.....	☐	☐	☐	☐	☐	☐
2	Even after I've made up my mind about something, I am always eager to consider a different opinion.....	☐	☐	☐	☐	☐	☐
3	I don't like situations that are uncertain.....	☐	☐	☐	☐	☐	☐
4	I dislike questions that could be answered in many different ways.....	☐	☐	☐	☐	☐	☐
5	I like to have friends who are unpredictable.....	☐	☐	☐	☐	☐	☐
6	I find that a well ordered life with regular hours suits my temperament.....	☐	☐	☐	☐	☐	☐
7	When dining out, I like to go to places where I have been before so that I know what to expect.....	☐	☐	☐	☐	☐	☐
8	I feel uncomfortable when I don't understand the reason why an event occurred in my life.....	☐	☐	☐	☐	☐	☐
9	I feel irritated when one person disagrees with what everyone else in a group believes.....	☐	☐	☐	☐	☐	☐

		Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
10	I hate to change my plans at the last minute.....	☐	☐	☐	☐	☐	☐
11	I don't like to go into a situation without knowing what I can expect from it.....	☐	☐	☐	☐	☐	☐
12	When I go shopping, I have difficulty deciding exactly what it is that I want.....	☐	☐	☐	☐	☐	☐
13	When faced with a problem I usually see the one best solution very quickly.....	☐	☐	☐	☐	☐	☐
14	When I am confused about an issue, I feel very upset.....	☐	☐	☐	☐	☐	☐
15	I tend to put off making important decisions until the last possible moment.....	☐	☐	☐	☐	☐	☐
16	I usually make important decisions quickly and confidently.....	☐	☐	☐	☐	☐	☐
17	I would describe myself as indecisive.....	☐	☐	☐	☐	☐	☐
18	I think it is fun to change my plans at the last moment.....	☐	☐	☐	☐	☐	☐
19	I enjoy the uncertainty of going into a new situation without knowing what might happen.....	☐	☐	☐	☐	☐	☐
20	My personal space is usually messy and disorganised.....	☐	☐	☐	☐	☐	☐
21	In most social conflicts, I can easily see which side is right and which is wrong.....	☐	☐	☐	☐	☐	☐
22	I tend to struggle with most decisions.....	☐	☐	☐	☐	☐	☐
23	I believe that orderliness and organisation are among the most important characteristics of a good student.....	☐	☐	☐	☐	☐	☐
24	When considering most conflict situations, I can usually see how both sides could be right.....	☐	☐	☐	☐	☐	☐
25	I don't like to be with people who are capable of unexpected actions.....	☐	☐	☐	☐	☐	☐
26	I prefer to socialise with familiar friends because I know what to expect from them....	☐	☐	☐	☐	☐	☐

		Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
27	I think that I would learn best in a class that lacks clearly stated objectives and requirements.....	☐	☐	☐	☐	☐	☐
28	When thinking about a problem, I consider as many different opinions on the issue as possible.....	☐	☐	☐	☐	☐	☐
29	I like to know what people are thinking all the time.....	☐	☐	☐	☐	☐	☐
30	I dislike it when a person's statement could mean many different things.....	☐	☐	☐	☐	☐	☐
31	It's annoying to listen to someone who cannot seem to make up his or her mind.....	☐	☐	☐	☐	☐	☐
32	I find that establishing a consistent routine enables me to enjoy life more.....	☐	☐	☐	☐	☐	☐
33	I enjoy having a clear and structured mode of life.....	☐	☐	☐	☐	☐	☐
34	I prefer interacting with people whose opinions are very different from my own.....	☐	☐	☐	☐	☐	☐
35	I like to have a place for everything and everything in its place.....	☐	☐	☐	☐	☐	☐
36	I feel uncomfortable when someone's meaning or intention is unclear to me.....	☐	☐	☐	☐	☐	☐
37	When trying to solve a problem I often see so many possible options that it is confusing.....	☐	☐	☐	☐	☐	☐
38	I always see many possible solutions to problems I face.....	☐	☐	☐	☐	☐	☐
39	I'd rather know bad news than stay in a state of uncertainty.....	☐	☐	☐	☐	☐	☐
40	I do not usually consult many different opinions before forming my own view.....	☐	☐	☐	☐	☐	☐
41	I dislike unpredictable situations.....	☐	☐	☐	☐	☐	☐
42	I dislike the routine aspects of my work (studies).....	☐	☐	☐	☐	☐	☐

Confidential

Connell Locus of Control Scale

Read each statement and decide the extent with which you think the statement is true of you. Put an X in the box under the degree of truth you think is right for you. Do this for all of the statements on all the three pages.
For example:

		Very True	Sort of True	Not very True	Not at all True
1	If I want to do well in school it's up to me.....	☐	☒	☐	☐

Now begin

		Very True	Sort of True	Not very True	Not at all True
1	When I win at a sport, a lot of times I can't figure out why I won.....	☐	☐	☐	☐
2	When I am unsuccessful, it is usually my own fault.....	☐	☐	☐	☐
3	The best way for me to get good grades is to get the teacher to like me.....	☐	☐	☐	☐
4	If somebody doesn't like me, I usually can't figure why.....	☐	☐	☐	☐
5	I can be good at any sport if I try hard enough.....	☐	☐	☐	☐
6	If an adult doesn't want me to do something I want to do, I probably won't be able to do it.....	☐	☐	☐	☐
7	When I do well at school, I usually can't figure out why.....	☐	☐	☐	☐
8	If somebody doesn't like me, it's usually because of something I did.....	☐	☐	☐	☐
9	When I win at a sport, it's usually because the person I was playing against played badly.....	☐	☐	☐	☐
10	When something goes wrong for me, I usually can't figure out why it happened.....	☐	☐	☐	☐
11	If I want to do well in school, it's up to me to do it.....	☐	☐	☐	☐
12	If my teacher doesn't like me, I probably won't be very popular with my classmates.....	☐	☐	☐	☐

		Very True	Sort of True	Not very True	Not at all True
13	Many times I can't figure out why good things happen to me.....	☐	☐	☐	☐
14	If I don't do well in school, it's my own fault.....	☐	☐	☐	☐
15	If I want to be an important member of my class, I have to get the popular kids to like me.....	☐	☐	☐	☐
16	Most of the time when I lose at a game in athletics, I can't figure out why I lost.....	☐	☐	☐	☐
17	I can pretty much control what will happen in my life.....	☐	☐	☐	☐
18	If I have a bad teacher, I won't do well at school.....	☐	☐	☐	☐
19	A lot of times I don't know why people like me.....	☐	☐	☐	☐
20	If I try to catch a ball and I don't, it's usually because I didn't try hard enough.....	☐	☐	☐	☐
21	If there is something that I want to get, I usually have to please the people in charge to get it.....	☐	☐	☐	☐
22	If I get a bad grade at school, I usually don't understand why I got it.....	☐	☐	☐	☐
23	If somebody likes me, it is usually because of the way I treat them.....	☐	☐	☐	☐
24	When I lose at an outdoor game, it is usually because the kid I played against was much better at that game to begin with.....	☐	☐	☐	☐
25	When I win at an outdoor game, a lot of times I don't know why I won.....	☐	☐	☐	☐
26	When I don't do well at something, it is usually my own fault.....	☐	☐	☐	☐
27	When I do well in school, it's because the teacher likes me.....	☐	☐	☐	☐
28	When another kid doesn't like me, I usually don't know why.....	☐	☐	☐	☐
29	I can be good at any sport if I work on it hard enough.....	☐	☐	☐	☐
30	I don't have much chance of doing what I want if adults don't want me to do it.....	☐	☐	☐	☐
31	When I get a good grade in school I usually don't know why I did so well.....	☐	☐	☐	☐
32	If somebody is mean to me, it's usually because of something I did.....	☐	☐	☐	☐

		Very True	Sort of True	Not very True	Not at all True
33	When I play an outdoor game against another kid, and I win, it's probably because the other kid didn't play well.....	☐	☐	☐	☐
34	A lot of times I don't know why something goes wrong for me.....	☐	☐	☐	☐
35	If I want to get good grades in school, it's up to me to do it.....	☐	☐	☐	☐
36	If the teacher doesn't like me, I probably won't have many friends in that class.....	☐	☐	☐	☐
37	When good things happen to me, many times there doesn't seem to be any reason why.....	☐	☐	☐	☐
38	If I get bad grades, it's my own fault.....	☐	☐	☐	☐
39	If I want my classmates to think I am important person, I have to be friends with the really popular kids.....	☐	☐	☐	☐
40	When I don't win at an outdoor game, most of the time I can't figure out why.....	☐	☐	☐	☐
41	I can pretty much decide what will happen in my life.....	☐	☐	☐	☐
42	If I don't have a good teacher, I won't do well in school.....	☐	☐	☐	☐
43	A lot of times there doesn't seem to be any reason why somebody likes me.....	☐	☐	☐	☐
44	If I try to catch a ball and I miss it, it's usually because I didn't try hard enough.....	☐	☐	☐	☐
45	To get what I want, I have to please the people in charge.....	☐	☐	☐	☐
46	When I don't do well in school, I usually can't figure out why.....	☐	☐	☐	☐
47	If somebody is my friend, It is usually because of the way that I treat him/her.....	☐	☐	☐	☐
48	When I don't win at an outdoor game, the person I was playing against was probably a lot better than I was	☐	☐	☐	☐

Criteria for Internalizing and Externalizing Behaviour

Internalizing Behaviour

Internalizing adolescents are more likely to

1. show anxiety and worry
2. withdraw from company
3. be bullied

Externalizing Behaviour

Externalizing adolescents are more likely to

1. be aggressive
2. be disobedient
3. be bullies

Instructions for the computer control game.

(presented on screen)

1. Cover Story

NASA, the American space exploration agency have a problem. They've launched a space-probe to explore the outer planets of the solar system. Unfortunately the engineers made a serious mistake in programming the navigational system. The result is that the probe starts to move off course if left to its own devices.

It is possible to send commands to the space-probe from earth and to receive information sent from the space-probe showing the direction in which it is moving. Because the space-probe is beyond Jupiter these messages take more than five minutes to arrive at their destination.

The only action which the earth based engineers can take is to fire the directional rockets. This can be used to correct the path of the probe.

press any key to continue

Because of the delay in signalling, by the time the command signal arrives the probe may already have changed direction.

The staff at NASA knew that later in the mission the delay would be potentially disastrous, as the probe might get caught in the gravitational pull of one of the planets. To solve the problem they wrote a computer program to predict the direction the probe would be going in when it next received any signal from earth. The program needed to provide the answer very quickly for it to be of any use to the engineers who were attempting to control the probe. This meant that
it had to be run on a very expensive computer.

At certain times of the day the charge for using the computer are very high. At night time it is free.

As the earth revolves the probe spends time on the other side of the earth from NASA's main control station. When this happens the signals to and from the space-probe have to be relayed via Australia. When this happens the signals cost money. If the probe can be signalled directly from NASA then signals are free.

press any key to continue

In this simulation you decide whether to correct the path of the space-probe. You have five goes to guide the probe to its destination. In each case the cost of finding out which direction the space-ship is going and of altering its course are different.

Because NASA has had its funding cut severely you are under instructions to ensure that you spend as little money on controlling the ship as possible. Your boss gives you five points for every time the space ship stays within two blue lines drawn on the screen. If the space-probe goes outside the blue lines you lose five points. The cost of sending control signals and running the computer program to

predict the space-probe's movements are subtracted from your score. Your annual salary depends on your score.

press any key to continue

The space-probe's onboard computer will stabilise the space-probe if it goes too far off course. This point is shown on the screen by two red lines outside the blue lines. However, if the probe flies along this path it will miss its target and is in danger of getting stuck in orbit around Saturn.

Before each go the cost of information and control will be shown to you.
*

2. Control Instructions

You will see two blue lines running across the screen.
Outside these blue lines are a pair of red lines.

The path of the space-probe will be drawn on the screen using a white line (this turns red if you go outside the blue lines).

If you do not take any action then the probe will move either one unit up or down the screen each time.

press any key to continue

The probe starts on the left hand side of the screen, midway between the two blue lines. The computer will display the probe's path based on the latest signal from the probe. You can choose to pay to see the computer prediction of where the probe will next move.

To see this information press the <i> on the keyboard.

press any key to continue

Whether or not you choose to pay to get this information you can signal the probe to change direction.

To do this press the <y> key on the keyboard.

Sending the change direction signal will push the probe two units in the opposite direction to which it is travelling.

press any key to continue

If you wish to take no action press the <return> key.

*

lottery instructions

You will be presented with pairs of lotteries. Each lottery has 100 tickets.
You must choose to enter one of the lotteries. Show which you prefer by
typing 1 or 2 followed by the return key.

Half of the choices are between lotteries where you will lose points and half
are between lotteries where you will gain points. When you have chosen a
lottery the computer will randomly select a ticket for you. You will get
(or lose) the number of points the chosen ticket is worth. Losses are indicated
by a minus sign before the number of points.

It may seem odd to enter a lottery where you are guaranteed to lose points.
Think of it as a decision to spend money repairing something in order that
it does not break down costing more to fix later.

Press any key to see an example lottery.

Each ticket is represented by a vertical line '|'. Both lotteries in the pair
are displayed on the screen. Tickets with the same value are grouped in a
line beside the amount of points they are worth.

The lotteries look something like this:

```
         1                          2
pts pts
100   |||||||||||||              200   |||||
90    ||||||||||||               180   |||||
80    ||||||||||                 160   |||||
70    ||||||||||                 140   |||||
60    |||||||||                  120   |||||
50    |||||||||                  100   |||||
40    |||||||||                  80    |||||
30    ||||||||                   60    ||||||||
20    |||||||                    40    ||||||||||
10    ||||||                     20    ||||||||||||||||||
0     |||||                      0     |||||||||||||||||||||||
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The University College London Hospitals

The Joint UCL/UCLH Committees on the Ethics of Human Research

Committee Alpha Chairman: Professor André McLean

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Dr N Harvey
Reader in Psychology
Department of Psychology
UCL
Gower Street

February 4, 1999

Dear Dr Harvey

Study No: **99/0018** *(Please quote in all correspondence)*
Title: **Understanding factors that influence the collection and use of information in young people's decision making.**

Thank you for letting me see the above application which has been agreed by Chairman's Action. You may go ahead with your study. However, if I may comment it does look as if the computer game is likely to interest boys far more than girls. Will that cause problems? I know there are computer games which are less 'space' orientated and designed to be of equal interest to girls.

Please note that it is important that you notify the Committee of any adverse events or changes (name of investigator etc) relating to this project. You should also notify the Committee on completion of the project, or indeed if the project is abandoned. **Please remember to quote the above number in any correspondence.**

Yours sincerely

Professor André McLean, BM BCL PhD FRC Path
Chairman