



## Risk-taking and inhibitory control in behaviourally inhibited and disinhibited preschool children



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### ABSTRACT

The temperament style Behavioural Inhibition (BI) has been implicated as a risk factor for the development of internalising disorders such as anxiety. Of interest is what factors influence the developmental trajectories of both inhibited and disinhibited children and the development of psychopathology. One such factor is risk-taking behaviour. Using the computer based Balloon Analogue Risk Task, we assessed risk taking behaviour in behaviourally inhibited ( $n = 27$ ) and behaviourally disinhibited ( $n = 43$ ) children. This is the first study to examine the relationship between BI, executive functioning and risk-taking. The results indicated Behavioural Inhibition was not related to risk-taking but that inhibitory control predicted reward focused results. These findings illustrate how inhibitory control affects risk-taking and risk avoidance in both inhibited and disinhibited children.

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### 1. Introduction

Behavioural Inhibition (BI) is a temperament style defined by withdrawal and restraint towards the unfamiliar (Garcia Coll, Kagan, & Reznick, 1984). Around 15% of typically developing children exhibit this temperament style and it is moderately stable across the lifespan (see Fox, Henderson, Marshall, Nichols, & Ghera, 2005 for a review) with children at the extremes showing the most stability across time (Kerr, Lambert, Stattin, & Klackenberg-Larsson, 1994). BI preschoolers take time to warm up to new children or adults and become quiet and socially restrained around unfamiliar people (Coplan, DeBow, Schneider, & Graham, 2009; Kagan, Reznick, Snidman, Gibbons, & Johnson, 1988).

BI has been identified as a risk factor for the development of internalising disorders, such as anxiety, while behavioural disinhibition (BUI) has been identified as a risk factor for externalising disorders, such as attention deficit/hyperactivity disorder (ADHD). For example, a recent longitudinal study by Hudson and Dodd (2012), demonstrated that BI in preschool children significantly predicted anxiety at age 9, over and above initial anxiety.

Conversely, early BUI has been associated with increased childhood disruptive behaviour, including ADHD (Hirshfeld-Becker et al., 2007). Early BUI has also been associated with increased aggressive behaviour in preschool children (Kimonis et al., 2006).

While BI has been clearly implicated in the development of psychopathology, not all BI or BUI children go on to develop mental health problems. Thus it is important to identify factors that may protect against or increase risk for psychopathology in BI and BUI children. One such factor implicated in the development and maintenance of anxiety is risk avoidance behaviour. Anxious individuals avoid specific fear-relevant threats. For example, individuals with social phobia avoid interactions with new people (Barlow, 2002). Also, behavioural avoidance in children (as reported by parents), has been demonstrated to predict changes in anxiety over time (Whiteside, Gryczkowski, Ale, Brown-Jacobsen, & McCarthy, 2013). In addition to specific avoidance, a more pervasive risk avoidance has also been associated with anxiety symptoms and disorder. For instance, individuals with high levels of trait anxiety reported less willingness to engage in risk-taking decisions (Maner & Schmidt, 2006). Furthermore, anxious individuals self-report substantially higher risk aversion when compared with other clinical patients and non-clinical controls (Maner et al., 2007). Risk-taking behaviour is also a factor identified as playing a possible role in the development and maintenance of externalising disorders such as ADHD (Humphreys & Lee, 2011). Children with ADHD are more likely to take risks and make poor decisions on a computer gambling task than healthy controls (DeVito et al., 2008).

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Risk-taking may play an important role in developmental pathways to psychopathology in BI and BUI children; the more a BI child avoids risk, the less their negative beliefs about potential threats, and their ability to cope with threats, are challenged. Such challenges, or exposures, are necessary learning experiences that enable children to overcome anxiety. By avoiding risk, a BI child's risk for an anxiety disorder may therefore increase. At the other end of the scale, the more a BUI child takes excessive risks, the higher the probability that the behaviour will be inadvertently reinforced (e.g., a reaction from a parent that signifies increased attention to the child), increasing the likelihood that the risky behaviour is repeated. This reinforcement of risk taking behaviour may potentially increase risk for externalising problems such as aggressive behaviour. Given the possible links between BI and BUI and later risks, we need to further investigate this relationship.

BI is not the only developmental factor associated with risk-taking behaviour. Executive functioning, such as the facet of inhibitory control, has also recently been implicated in the regulation of risk-taking behaviour (for a review see [Somerville & Casey, 2010](#)). [Rothbart, Ellis, Rueda, and Posner \(2003\)](#) define inhibitory control as the capability to repress an overriding response in order to perform a less dominant one. In particular, inhibitory control may be relevant for preventing excessive risk-taking behaviour by helping children to inhibit maladaptive responses in favour of a more balanced choice ([Lahat et al., 2012](#)).

Inhibitory control has also been implicated in the development of internalising and externalising problems. Low inhibitory control has been associated with higher levels of internalising and emotional symptoms in non-clinical children aged 8–10 years of age ([Vuontela et al., 2013](#)). However, in a clinical sample, depressed children and adolescents show a more conservative response style on neuropsychological tests related to inhibitory control ([Cataldo, Nobile, Lorusso, Battaglia, & Molteni, 2005](#)). Evidence in support of the relationship between inhibitory control and externalising symptoms is also mixed. Decreased inhibitory control has been shown to be correlated with increased ADHD symptoms in children ([Brocki, Nyberg, Thorell, & Bohlin, 2007](#)). Also, anger-prone infants displayed less inhibitory control than less anger-prone infants ([He et al., 2010](#)).

There is some indication that a child's temperament may influence the way inhibitory control is related to later problems. For example, in BUI children, greater inhibitory control has been linked to reduced externalising behaviour problems such as levels of hyperactivity ([Thorell, Bohlin, & Rydell, 2004](#)). The role inhibitory control plays in internalising problems for BI children is less clear, with studies demonstrating conflicting findings. For instance, [White, McDermott, Degnan, Henderson, and Fox \(2011\)](#) found that within children who had high levels of inhibitory control, high levels of BI predicted later anxiety. Conversely, BI was not associated with anxiety in children with low levels of inhibitory control ([White et al., 2011](#)). A similar study found that children with both higher levels of BI and high levels of inhibitory control were more likely to experience social anxiety than those with high levels of BI but low levels of inhibitory control ([Thorell et al., 2004](#)). However, a third study reported that increased inhibitory control was linked to less internalising and externalising problems in BI children ([Lengua, 2003](#)). It is possible that the increased conscious control of impulses in those with higher levels of inhibitory control, may help those children regulate their behaviour and feelings, but for others, such as BI children, it may increase their behavioural tendency to focus on more threatening stimuli ([Degnan & Fox, 2007](#)). Further work is needed to examine the differing impacts inhibitory control has on the developmental trajectories of BI and BUI children, and the implications for later internalising and externalising problems.

'Real life' risk-taking, or risk avoidance behaviour is difficult to replicate in a controlled laboratory setting. Participants may provide socially desirable responses and may potentially lack the

insight to provide a true report of their own risk-taking behaviour ([Ladouceur et al., 2000](#)). Behavioural measures of risk-taking have been developed, including the Balloon Analogue Risk Task or BART ([Lejuez et al., 2002](#)). In this task, participants inflate a balloon that can either grow larger or explode. A larger balloon is naturally associated with an increased probability of explosion. Unlike other behavioural risk-taking tasks in which the risk is arbitrarily controlled, the risk in the BART task is the probability that the balloon will explode. Participants choose whether to continue pumping up the balloon for a larger reward, and therefore have a choice in how much risk they take. The risk in the BART task was designed to model risk in the natural environment, with risk-taking up to a certain point leading to positive consequences (more points) and excessive risk-taking leading to negative consequences (loss of points). The BART correlates with risky behaviour such as substance abuse, both in adults and adolescents ([Aklin, Lejuez, Zvolensky, Kahler, & Gwadz, 2005](#); [Lejuez, Aklin, Bornovalova, & Moolchan, 2005](#)). A youth version has been created using a points system, with the points exchangeable for prizes at the end (BART-Y ([Lejuez et al., 2007](#))). Although the BART-Y has been shown to be a useful risk-taking measure for adolescents, only one study has examined task performance as well as temperament in preschool aged children thus far ([Lahat et al., 2012](#)).

In the present study, we evaluated the potential relationship between BI, inhibitory control and risk-taking as measured using the BART-Y. Based on previous research, it was hypothesised that: (1) BI children will take less risk on the BART-Y than BUI children; (2) high levels of inhibitory control will correlate with children taking less risk on the BART-Y; (3) temperament and inhibitory control will interact to predict risk-taking; BUI children with high inhibitory control will have less risk-taking than BUI children with low inhibitory control. As previous findings for how inhibitory control affects risk-taking in BI children have been inconsistent, this aspect of the study was exploratory.

## 2. Method

### 2.1. Participants

The sample comprised 60 BI and 86 BUI children, recruited when the children were approximately age 4 ( $M = 48$  months,  $SD = 4$ , 45% male) through local preschools and via an advertisement in a free parenting magazine. Advertisements specified that the families would participate in a research project on anxiety in preschool children, and that we were interested in shy and confident children. Due to the exclusion of participants who did not meet the BI/BUI cut off at the second screening (see Section 2.2), the final sample included 60 participants (35 male) aged between 3 years 5 months and 4 years 6 months ( $M = 48$  months,  $SD = 3.85$  months) when assessed, 27 BUI and 43 BI children. Of this final sample 61% described their ethnicity as Oceanic, with the majority of the remainder being Asian. There were no significant differences between those who were included in the final sample and those who were not on BI classification, maternal age, family income or number of siblings ( $p$ 's > .05). Significant differences were found for ethnicity,  $\chi^2(2) = 6.63$ ,  $p = .04$ , with greater numbers of children of Asian ethnicity included in the final sample.

### 2.2. Measures

#### 2.2.1. Maternal-report of BI

After completing a screening questionnaire when first calling about the study (Short Temperament Scale for Children, STSC; [Sanson, Smart, Prior, Oberklaid, & Pedlow, 1994](#)) children scoring one standard deviation above or below the normative mean on the Approach Scale were classified as BI or BUI, respectively

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