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Children's Risky Play from an Evolutionary Perspective: The Anti-Phobic Effects of Thrilling Experiences

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Abstract: This theoretical article views children's risky play from an evolutionary perspective, addressing specific evolutionary functions and especially the anti-phobic effects of risky play. According to the non-associative theory, a contemporary approach to the etiology of anxiety, children develop fears of certain stimuli (e.g., heights and strangers) that protect them from situations they are not mature enough to cope with, naturally through infancy. Risky play is a set of motivated behaviors that both provide the child with an exhilarating positive emotion and expose the child to the stimuli they previously have feared. As the child's coping skills improve, these situations and stimuli may be mastered and no longer be feared. Thus fear caused by maturational and age relevant natural inhibition is reduced as the child experiences a motivating thrilling activation, while learning to master age adequate challenges. It is concluded that risky play may have evolved due to this anti-phobic effect in normal child development, and it is suggested that we may observe an increased neuroticism or psychopathology in society if children are hindered from partaking in age adequate risky play.

Keywords: anxiety, fear, development, risky play, etiology

Introduction

The purpose of this article is to explore and understand the functions of risky play from a modular evolutionary psychology perspective (Buss, 2004; Cosmides and Tooby, 1987, 1994; Kennair, 2002; Pinker, 1997). This modular perspective anticipates that

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different types of risky play might be due to specific adaptations or evolved mental mechanisms – and thereby have specific evolutionary functions. Individual differences in risk-taking among children (see, e.g., Morrongiello and Lasenby-Lessard, 2006; Morrongiello and Matheis, 2004, 2007; Morrongiello and Sedore, 2005) are not the issue of this article. Rather, this article focuses on human universals in children's way of exploring challenges in their play environment. Risky play will therefore be considered as part of children's normal development. This suggests that disturbances in the species' anticipated stimulation (i.e., the lack of risky play) may be part of the etiology of psychopathology. Specifically, fear of real dangers as an evolutionary adapted non-associative process (Poulton and Menzies, 2002b) will be suggested as part of normal development. Risky play, we will argue, is a part of the normal process that adapts the child to its current environment through first developing normal adaptive fear to initially protect the child against ecological risk factors, and thereafter risky play as a fear reducing behavior where the child naturally performs exposure behavior (Allen and Rapee, 2005). This may be framed more cognitively: The child is motivated to conduct behavioral experiments investigating their environment – with a reduction of safety behavior (Wells, 1997). Both of these formulations mirror effective modern anxiety treatment (Allen and Rapee, 2005; Wells, 1997). We will also address the evolutionary psychopathology perspective of mismatch (Nesse and Williams, 1995); i.e., where the modern environment does not adequately stimulate evolved mental mechanisms (e.g., Kennair, 2003, 2007, 2011). If the child does not receive the adequate stimulation by the environment through risky play, the fear will continue despite no longer being relevant (due to features of the ecology no longer constituting a risk, and the child's improved competencies due to physical and psychological maturation) and may turn into an anxiety disorder: fear responses toward imagined or exaggerated threats and dangers that reduce the individual's ability to function despite the individual having developed the abilities to handle these situations. This article dovetails with recent contributions to the field by Pellegrini, Dupuis and Smith (2007). While they consider safe skill acquisition while in an immature state in general, we consider specifically how anxiety demotivates children from partaking in too risky behaviors, while at the same time through thrilling play experiences motivates children to continuously challenge themselves and develop age relevant skill sets as they mature.

Children's Risky Play, Injuries and Hazards

Risky play is thrilling and exciting forms of play that involve a risk of physical injury. Risky play primarily takes place outdoors, often as challenging and adventurous physical activities, children attempting something they have never done before, skirting the borderline of the feeling of being out of control (often because of height or speed) and overcoming fear (Sandseter, 2009; Stephenson, 2003). Rather than the avoidance inducing emotion of fear, a more thrilling emotion is experienced. Most of the time risky play occurs in children's free play as opposed to play organized by adults (Sandseter, 2007a,c).

In modern western society there is a growing focus on the safety of children in all areas, including situations involving playing. An exaggerated safety focus of children's play is problematic because while on the one hand children should avoid injuries, on the

other hand they might need challenges and varied stimulation to develop normally, both physically and mentally (Ball, 1995, 2002, 2004; Chalmers, 2003; Freeman, 1995; Heseltine, 1995; Little, 2006; Satomi and Morris, 1996; Sawyers, 1994; Smith, 1998; Stephenson, 2003; Stutz, 1995). Children test possibilities and boundaries for action within their environment through play, most often without being aware that this is what they are doing. Apter (2007) outlines the importance in which this may aid survival when, later in life, watchful adults are no longer present. The rehearsal of handling real-life risky situations through risky play is thus an important issue. Paradoxically, we posit that our fear of children being harmed by mostly harmless injuries may result in more fearful children and increased levels of psychopathology.

Statistics of playground accidents from several countries show that most of the injuries related to children's play are species normal and less severe – injuries that children throughout evolutionary history have experienced without suffering any permanent harm, such as bruises, contusions, concussions and fractures – as results from falls or hits from swings, slides, climbing frames or other equipment (Ball, 2002; Bienefeld, Pickett, and Carr, 1996; Illingworth, Brennan, Jay, Al-Ravi, and Collick, 1975; Mack, Hudson, and Thompson, 1997; Phelan, Khoury, Kalkwarf, and Lamphear, 2001; Sawyers, 1994; Swartz, 1992), while the fatal playground injuries that result in death or severe invalidity are very rare (Ball, 2002; Bienefeld et al., 1996; Chalmers, 2003; Chalmers et al., 1996; Phelan et al., 2001). Thus the injuries themselves rarely constitute trauma that might influence normal development. While such may occur, and some children are more prone to such serious accidents and it is important to identify and prevent these children from harming themselves our focus in this article is, as mentioned, on normal children and development.

Further reviews on children's accidents on playgrounds have found that the most common risk factors are not the characteristics of the equipment, but rather the children's behavior and normal rashness, such as walking or turning summersaults on top of a climbing frame, standing (or even standing on the shoulder of others) on the swing, or pushing others off a slide or a swing (Ball, 2002; Coppens and Gentry, 1991; Illingworth et al., 1975; Ordoñana, Caspi, and Moffitt, 2008; Rosen and Peterson, 1990). No matter how safe the equipment, the children's need for excitement seems to make them use it dangerously.

Research has indicated a relationship between a child's willingness to take risks and their injury proneness (Matheny, 1987; Morrongiello, Ondejko, and Littlejohn, 2004; Potts, Martinez, and Dedmon, 1995). Studies identify a certain group of children who are high risk takers (e.g., high on Extraversion and low on Inhibitory Control) and tend to overestimate their physical ability (Miller and Byrnes, 1997; Plumert, 1995; Plumert and Schwebel, 1997; Schwebel and Plumert, 1999), although the relationship between such overestimation and injury is somewhat inconsistent between studies (Plumert, 1995; Schwebel and Plumert, 1999). Studies have further found that a relatively small proportion of children tend to account for a large proportion of injuries, and that externalizing behavioral problems such as aggression, over-/hyperactivity (ADHD) and opposition towards parents seem to be important predictors for injuries in this group (Cataldo, Finney, Richman, and Riley, 1992; Jaquess and Finney, 1994; Jokela, Power, and Kivimaki, 2009; Ordoñana, Caspi, and Moffitt, 2008; Spinks, Nagle, Macpherson, Bain, and McClure,

2008; Wazana, 1997).

Research showing that overestimation of one's own ability is higher among 6 year olds than among 8 year olds who seem to have developed a better ability to make accurate judgments about risk situations. This suggests that children learn to judge risks through experience with risky situations and by developing the cognitive skills necessary to make more accurate judgments (Plumert, 1995; Plumert and Schwebel, 1997). Also, greater amounts of direct experience with a risky situation itself is found to be associated with lower risk appraisals in the situation (DiLillo, Potts, and Himes, 1998), probably partly because experience leads to the ability to manage the risk (Adams, 2001) and develop a more sound sense of the actual risk in the situation (Ball, 2002; Plumert, 1995). Other studies have found that younger children (2^{nd} graders) anticipated greater injury severity and more fear than older children (4^{th} graders and 6^{th} graders) in open-ended high-risk situations (Peterson, Gillies, Cook, Schick, and Little, 1994). Similar results were found among 6-10 year old children (Hillier and Morrongiello, 1998). Peterson et al. (1994) suggest that this may be explained by children becoming desensitized to the possibility of injuries by repeatedly experiencing near injury or minor injuries, while another explanation may be that they become better at both assessing and managing the risk (Adams, 2001; Ball, 2002; Plumert, 1995) – and, we claim, reduce their fear of these situations simultaneously. Investigating risk taking along the continuum from young child to adolescence, Boyers' (2006) extensive review of research on the development of risk taking showed that risk taking is likely to increase with age because of both child characteristics (e.g., cognitive development, emotional regulation and psychobiological development) and social characteristics (e.g., parents, peers, environment).

With age, play will change in quality – e.g., roughhousing turns more into real fights where the thrill of playing often will be replaced with more aggression and the activity seems to be more focused on establishing more adult-like hierarchies (Pellegrini and Long, 2003; Smith, 2005). Further, for adolescent and young adult males the Young Male Syndrome (Wilson and Daly, 1985) kicks in – and one assumes that, due to sexual selection (both intra-sexual selection, competing with other males, and inter-sexual selection, attempting to catch the attention of females), males of these ages take hazardous risks, resulting in hypophobia (Kennair, 2007; Marks and Nesse, 1994) and increased mortality (Kruger and Nesse, 2004).

Research on children's risk perception and injury proneness overall show that this is a complex issue where several factors (e.g., developmental, personality, emotional, social, environmental, parental) contribute to explain why childhood injuries occur (Cataldo et al., 1992; Dal Santo, Goodman, Glik, and Jackson, 2004; DiLillo et al., 1998; Morrongiello et al., 2004; Ordoñana et al., 2008; van Aken, Junger, Verhoeven, van Aken, and Deković, 2006; Wazana, 1997). It seems that both child characteristics and environmental characteristics must be considered when studying child injuries, and that one also has to take into consideration the child's age in terms of differences in parenting characteristics as the child grows older (e.g., child characteristics becoming more influential as the parents supervision eases off) (Matheny, 1987; Ordoñana et al., 2008; van Aken et al., 2006).

Still, most of the studies mentioned do not distinguish between minor and severe injuries but rather treat all injuries, mostly reported through parents' self-report measures,

as one. The most common way to distinguish minor and severe injuries in these studies (in the few cases this is done) is to categorize injuries that need medical treatment as severe/serious injuries, while home-treated injuries are minor injuries. Due to this a lot of non-severe injuries (even medically treated) that will heal well and have no further impact on the child's life are counted as severe. In this article, a starting point of our approach is that minor injuries are a natural part of children's activity and development and should therefore not be regulated out of children's everyday lives (Wyver et al., 2010). We believe that it is the severe and lethal accidents that should be avoided.

This leads to the important issue of distinguishing between risks and hazards when discussing risks that children can face through their activities (Little, 2010). The term risk-taking is usually interpreted negatively, seeing risk and hazard as synonymous (Lupton and Tulloch, 2002). For instance, within the developmental psychology literature, risk-taking is usually defined as the engagement in behaviors that are associated with some probability of negative outcomes (Boyer, 2006). However, most people meet situations that involve some element of risk throughout their everyday lives. We need, through experience and learning, to be prepared to meet these risks and to manage them. In this view, risk can be defined not necessarily as just negative, but as situations in which we are required to make choices among alternate courses of action where the outcome is unknown (Little, 2010). This means that risk is not necessarily a danger that needs to be avoided but rather something that needs to be managed (Ball, Gill, and Spiegal, 2008). Greenfield (2003) argues that a distinction should be drawn between hazard being something the child does not see, and risk being uncertainty of outcome and requiring a child's choice whether to take the risk or not. Adults should therefore try to eliminate hazards that children cannot see or manage without removing all risks, so that children are able to meet challenges and choose to take risks in relatively safe play settings. This means finding the balance between those risks that foster learning and the hazards that can result in serious injury (Little, 2010).

In this article the focus is, as mentioned, on normal children, and not on injury prone children or children with pathological proneness to injuries, nor the extremely shy and introverted children who actively avoid all risks, negative emotions, social situations and challenges. We also take a positive approach to risk, distinguishing between hazards as negative and risks as positive and thrilling challenges (Little, 2010) that will improve children's risk management and risk perception (Adams, 2001; Ball, 2002; Sandseter, 2010).

It seems that a large proportion of normal children have an urge to explore their environment and to engage in risky forms of play where they can rehearse fighting skills, and test their physical strength and courage, even though it involves the possibility of getting hurt for real (Ball, 2002; Buss, 1997; Pellegrini and Smith, 1998; Smith, 1998; Stephenson, 2003). Could this be due to our evolved psychology? And in that case what is the adaptive effect of seeking risky situations (albeit as noted, these situations are more thrilling than really dangerous)?

The Etiology of Anxiety and Phobias

Until recently, most have believed that anxiety disorders were acquired due to

negative experiences with different stimuli (e.g., Rachman, 1977), i.e., combinations of classical and operant conditioning (as in Mowrer's two-factor theory) and social cognitive learning theory. This has been challenged by different studies by Poulton and colleagues. Poulton and Menzies (2002a, 2002b) suggest that anxiety appears as a normal part of the child's maturation, and that anxiety vanishes again due to a natural interaction with the anxious stimulus as part of normal development. They argue for a non-associative theory of phobias and fear acquisition, suggesting that liability to fears and phobias are innate and evolutionarily arisen, as opposed to the conditioning perspective of phobias being elicited by experience and learning. This theory has strong support in research of several fears and phobias (e.g., heights, water, separation; Poulton, Davies, Menzies, Langley, and Silva, 1998; Poulton, Menzies, Craske, Langley, and Silva, 1999; Poulton, Milne, Craske, and Menzies, 2001; Poulton, Waldie, Craske, Menzies, and McGee, 2000; Poulton, Waldie, Menzies, Craske, and Silva, 2001). Kendler, Myers and Prescott (2002) similarly found no support for the stress-diathesis model for phobias in a sample of twins. Rather, Kendler et al. interpret their findings as strong support of the non-associative theory of phobias and fear acquisition. Thus a contemporary approach to the etiology of anxiety disorders considers that they are due in large part to an interplay between genes and environment, and that they appear at a developmentally relevant age. Normal interaction with the relevant environment may thereafter reduce anxiety. We suggest that normal interaction to a large degree consists of risky play – which combines positive and activating emotions (e.g., thrilling sensations) with both a motivation to seek exposure and safety behavior reduction. Similarly, exposure therapy of anxiety patients attempts to create clinical settings that simulate this natural anti-phobic behavior in order to habituate, but more importantly provide the patient with a sense of coping. This also highlights what may be the result of not having the opportunity to engage in risky play: The child may not experience that he or she naturally can cope with the fear-inducing situations. And despite having matured mentally and physically enough to master the previously dangerous situations, one may continue to be anxious. Continued anxiety hijacks the adaptive function of fear and causes non-adaptive avoidance of situations that *were* but no longer *are* dangerous for the individual due to maturation and increased skills.

Children's Play in an Evolutionary Context

According to Pinker (1995) one of human children's evolved mental mechanisms is the module to face danger, "including the emotions of fear and caution, phobias for stimuli such as heights, confinement, risky social encounters, and venomous and predatory animals, and a motive to learn the circumstances in which each is harmless" (p. 420).

While evolutionists in general have been accused of being biased, from a developmental perspective, to focus on sexually reproductively mature adults – due to the ultimate importance of reproduction to the process of evolution – evolutionary developmental psychologists need to consider the age and context-specific evolutionary mechanisms behind development (Bjorklund and Ellis, 2005; Bjorklund and Pellegrini, 2000; Blasi and Bjorklund, 2003). Children need to survive in order to reproduce. They also have to develop to be able to reproduce. In order to do this they need to solve age

specific adaptive tasks. There are therefore predictable mental adaptations associated with childhood. These adaptations will increase the likelihood of solving survival tasks and tasks involving getting the necessary developmental stimulation, such as the sucking reflex in mammals (Bjorklund and Pellegrini, 2000), imitations and facial gestures by the infant as facilitating mother – infant social interaction and communication (Bjorklund, 1987; Bjorklund and Pellegrini, 2000), infants typical high pitched crying combined with gasping as an evolved mechanism to receive attention and care from their parents (Thompson, Dessureau, and Olson, 1998; Thompson, Olson, and Dessureau, 1996) and evolved psychological mechanisms that enable children to learn language (easier than in older age) in order to communicate effectively (Pinker, 1995).

Bekoff and Byers (1981) state that play in general would have been eliminated, or never would have evolved, unless it had beneficial results (functions) that outweighed its disadvantages (costs). The ontogenetic adaptive function of play is that children may learn skills that are important for adulthood (Bjorklund and Pellegrini, 2000, 2002; Pellegrini and Bjorklund, 2004; Pellegrini and Smith, 1998). Still, some of the presumably adaptive characteristics of infancy and childhood are not adaptations for later adulthood, but rather have been selected to adapt individuals to their current environment. Play might therefore be a specific adaptation relevant primarily to childhood (Pellegrini and Bjorklund, 2004; Pellegrini and Smith, 1998) with both deferred and immediate benefits (Bekoff and Byers, 1981; Pellegrini and Bjorklund, 2004; Pellegrini and Smith, 1998). According to Bjorklund and Pellegrini (2000), this view is consistent with the perspective that the functional pressure of natural selection also exists during childhood.

According to Bruner (1976), play provides a less risky situation than "real life," thus minimizing the consequences of one's actions. Aldis (1975) and Smith (2005) argue that play for practice initially evolved from immature agonistic behavior such as play fighting and pursuit-and-flight behavior, which had selective advantages for survival because individuals engaging in this play were more trained in survival behavior than were those without such practice. Similarly, Sutton-Smith (1997) discusses that play in an evolutionary selective model creates uncertainties and risks that children rehearse when managing both fictive and real play situations.

Risky Play and Hypophobia

Two opposing approaches to explaining risky play behavior would be a general immaturity in considering dangers, or that the risk-taking behavior itself is sought out especially and the risk is compensated by the stimulation it provides. The low level of actual harm – both in rough and tumble play and general risky play – suggests that the immaturity explanation is not convincing. Rather, risky play seems to involve a certain degree of *hypophobia* (Marks and Nesse, 1994) or a suspended fear of being hurt in potentially harmful situations. Many phenomena in the modern ecology are real hazards – the large amounts of sugar, fat and salt, driving, unprotected intercourse, guns, medication, razorblades, etc. are dangerous items that do not naturally elicit fear reactions; few people consider the risk of driving along the highway. On the other hand, the very common phobias include fear of heights, water, the dark, and animals such as spiders, snakes,

rodents and birds. This suggests that hypophobia may be due to a *mismatch* between our species' ancestral environment (i.e., the environment our species evolved to be adapted to) and the modern environment (Nesse and Williams, 1995). If one calculated the risk of the modern phenomena versus the more evolutionary relevant stimuli one will soon see that we are hypophobic of real risks, and hyperphobic of non-hazardous risks. Most cases of risky behavior would elicit fear, which would reduce risky behavior. Therefore, the lack of adaptive fear in risky play warrants an explanation – preferably an evolutionary explanation, as risky play provides an evolutionary paradox. Both the evolution and the development of fear and anxiety (Kennair, 2007; Marks and Nesse, 1994) may therefore be relevant to an understanding of risky play.

Mental development might also influence the assessment of risk. Parenthood, or just being in a caretaker or caregiver role, may increase adaptive worry in order to keep children safe. Findings that, e.g., children are more at risk from injury through accidents when fathers rather than mothers are involved in taking care of them suggests that maybe mothers have specific care giving mechanisms involving adaptive worry (Schwebel and Brezausek, 2004). Regarding risk perception, it is also of interest to consider how more impulsive children with ADHD seem to be more hypophobic of dangerous situations than children in general (Barkley, 2001; DiScala, Lescohier, Barthel, and Li, 1998; Gayton, Bailey, Wagner, and Hardesty, 1986; Swensen et al., 2004), as well as the findings that children with a highly active and risk taking temperament engage in more risk taking behavior and thus experience more unintentional injuries (Matheny, 1987; Plumert and Schwebel, 1997; Potts, Martinez, and Dedmon, 1995; Schwebel, Brezausek, and Belsky, 2006; Schwebel and Plumert, 1999). However, one needs to differentiate between disturbed risk taking behavior and normal risky play.

It is therefore important to understand that our evolved psychology perceives risk differently than an objective assessment of statistical risk. What is perceived as risky might not necessarily be risky, while what actually is risky might not be perceived as risky. In normal, evolutionarily relevant situations one may expect that the real risk is relatively accurately calculated. Despite parents or younger children being anxious, the maturing child may alter their perception of the risk of specific stimuli. Thus the fact that children seem less fearful of typically fear-eliciting stimuli when engaged in risky play, and that the risk seems to be manageable for them (i.e., injuries are rarely serious), suggests that a fear modulating mechanism may be activated in this specific context. We believe this modulating mechanism provides the child with emotions that motivate approach and investigation, i.e., the thrilling emotions involved in risky play (rather than fear that motivates avoidance and safety behavior).

Possible Functions of Six Categories of Risky Play

Our hypothesis in this article is that the child, through play, reduces anxiety of situations that used to be dangerous when the child was younger.

A study aiming to categorize risky play through observations and interviews of children and staff in preschool suggested six categories of risky play (Sandseter, 2007a) that were recently confirmed by additional video observations and interviews (Sandseter,

2007b). The emerging categories are described in Table 1.

Table 1. Categories and subcategories of risky play (revised from Sandseter, 2007a, 2007b)

Categories	Risk	Sub-categories
Great heights	Danger of injury from falling	Climbing Jumping from still or flexible surfaces Balancing on high objects Hanging/swinging at great heights
High speed	Uncontrolled speed and pace that can lead to collision with something (or someone)	Swinging at high speed Sliding and sledging at high speed Running uncontrollably at high speed Bicycling at high speed Skating and skiing at high speed
Dangerous tools	Can lead to injuries and wounds	Cutting tools: Knives, saws, axes Strangling tools: Ropes, etc.
Dangerous elements	Where children can fall into or from something	Cliffs Deep water or icy water Fire pits
Rough-and-tumble	Where the children can harm each other	Wrestling Fencing with sticks, etc. Play fighting
Disappear/get lost	Where the children can disappear from the supervision of adults, get lost alone	Go exploring alone Playing alone in unfamiliar environments

These categories support previous research on children's play in general and risk-taking play in particular (Aldis, 1975; Blurton Jones, 1976; Humphreys and Smith, 1984; Kaarby, 2004; Smith, 1998; Stephenson, 2003).

Using a modular perspective based on Sandseter's (2007a, 2007b) six categories, each type of risky play will be considered separately. Sandseter's (2007a) interviews revealed that some of the categories were perceived risky by both children and staff (great heights, high speed and rough-and-tumble play), while others were unanimously perceived risky only by the staff (dangerous tools and dangerous elements), and still others were perceived risky only by the children (danger of disappearing/getting lost). This is in accord with the concepts of mismatch (Nesse and Williams, 1995) and hypophobia (Marks and Nesse, 1994) as previously mentioned. The relative stability of our evolved psychology and the rapid progress of socio-cultural development have led to the fact that not all dangerous items or situations elicit fear or anxiety reactions (Kennair, 2007). In addition the perception of what is risky or not may be due to individual genetic differences and environments (Kendler et al., 2002) as well as experience and habituation (Poulton and Menzies, 2002a, 2002b). In the following, the categories of risky play perceived as risky and thrilling by the children will be addressed first, followed by the categories perceived as

risky only by the staff (in this sense, caregivers). Each of the categories will be discussed in relation to *possible functions* and *anti-phobic effects.*

Play with great heights

The most frequent form of risky play in great heights is climbing. Children climb on all climbable features, such as trees, playground climbers, big rocks, steep slopes, hillsides, etc. Jumping down from high places, incidents of hanging or dangling from heights and balancing close to drops are also common kinds of play with great heights (Sandseter, 2007a, 2007b).

Possible functions. Benefits of this kind of play may be to get to know ones ecology, exploring the environment (Bjorklund and Pellegrini, 2002) and practicing and enhancing different motor/physical skills for developing muscle strength, endurance, skeletal quality, etc. (Bekoff and Byers, 1981; Bjorklund and Pellegrini, 2000; Byers and Walker, 1995; Humphreys and Smith, 1987; Pellegrini and Smith, 1998). All physical practice and training might be relevant for the developing child. Play in great heights also involves training on perceptual competencies such as depth-, form-, shape-, size-, and movement perception (Rakison, 2005), and general spatial-orientation abilities (Bjorklund and Pellegrini, 2002). These are important skills both for survival in childhood (i.e., immediate benefits) and for handling important adaptive tasks in adulthood (i.e., deferred benefits).

Although not describing in detail the behavior patterns of the play, many ethnographic studies provide evidence for locomotor play such as chasing, running, climbing, jumping down, sliding, swinging and different forms of acrobatics in a wide range of hunting-and-gathering and agricultural village cultures throughout the world (see, e.g., Gosso, Otta, Morais, Ribeiro, and Bussab, 2005; Power, 2000; Smith, 1982, 2005). Further strengthening the evolutionary explanation, locomotor play similar to human locomotor play is also found among non-human mammals (e.g., primates, carnivores) and some kinds of birds (Aldis, 1975; Power, 2000; Smith, 1982). Aldis (1975) also shows that an important aspect of this kind of play in both animal and human groups is seeking out thrills and slightly fearful situations related to height, speed, daring movements and unpredictable outcomes of the play.

Anti-phobic effect. According to Poulton and Menzies (2002a, 2002b) one might expect the fear of heights to develop naturally. Contrary to earlier theories claiming that fear of heights was due to serious accidents, Poulton et al. (1998) found that children sustaining injury due to falls both before age 5 and between ages 5 and 9 did not have a greater frequency of fear of heights at age 11 and height fear and phobia at age 18. Interestingly, injurious falls from heights between ages 5 and 9 were associated with the absence of height fear at age 18, thus indicating an opposite direction than that predicted by conditioning, and providing strong support of a non-associative theory of fear acquisition in the development of a fear of heights (Poulton et al., 1998). Those who have fear of heights at low age usually avoid heights, while those who have a low level of fear of heights are more likely to engage in risky behavior near heights, thus experiencing more serious falls. Risky play with great heights will provide a desensitizing or habituating experience and maturationally adequate mastery providing cognitive restructuring. This will result in less

fear of heights later in life.

Play with high speed

Swinging with high speed, riding a bike at high speed, running at high and uncontrolled speed, or sliding down slides, hills, cliffs, etc. are common forms of this category of risky play. Sandseter (2007a, 2007b) discovered that children often increased the risk of swinging by standing on the swing, swinging several children together or in other challenging ways, or in sliding down snowy slopes by throwing themselves on their stomachs head first, backwards, or several children in a row, etc.

Possible functions. The most obvious evolutionary function of play in high speed is the enhancement of perception – particularly depth – and movement perception, but also the perception of size and shape (Rakison, 2005). Another obvious benefit of high speed activities such as swinging and sliding is training on spatial-orientation abilities (Bjorklund and Pellegrini, 2002). Also, the more general physical and motor stimulation of play where children move around running, bicycling, walking up and sliding down hills or slides, enhances their physical fitness and motor competence (Bekoff and Byers, 1981; Bjorklund and Pellegrini, 2000; Byers and Walker, 1995; Pellegrini and Smith, 1998).

The aforementioned documentation on locomotive play such as chasing, running, sliding and swinging found both in different human cultures across the world as well as in non-human mammals (see, e.g., Gosso et al., 2005; Power, 2000; Smith, 1982; Smith, 2005) applies to the evolutionary argument of the function of play with high speed.

Anti-phobic effect. This kind of play might be motivated by mechanisms that were necessary for our tree-dwelling ancestors to be motivated to swing from tree to tree. The result of this behavior may be a greater chance of falling and hurting oneself, but at the same time the behavior will decrease the chance of developing anxiety of heights and also fear of emotional activation in general.

High speed was not a typical part of our hominin ancestors' ecology. There are therefore no obvious hominin adaptations for high speed. Thus it seems more likely to be more archaic or due to by-products of perceptual systems. Still, the anti-phobic effects of feeling the thrill and excitement, as well as associating physiological activation with positive experiences and emotions, ought to be assessed in further research.

Rough-and-tumble play

Typical activities in this category of risky play are fighting, fencing with sticks/branches, play wrestling and chasing (Blurton Jones, 1976; Humphreys and Smith, 1984; Sandseter, 2007a, 2007b; Smith, 2005).

Possible functions. Rough-and-tumble play is the most common form of play in non-human mammals (Aldis, 1975; Bekoff and Byers, 1981; Fry, 2005; Power, 2000; Smith, 1982), and it is also found, not only in Western industrialized cultures, but in a wide range of other cultures such as hunting-and-gathering and agricultural village cultures all over the world (see, e.g., Fry, 2005; Gosso et al., 2005; Power, 2000; Smith, 2005). Research on rough-and-tumble play in both animals (e.g., primates, carnivores) and humans have also found that males engage more in play-fighting than females (Aldis, 1975; Bjorklund and Pellegrini, 2002; Power, 2000; Smith, 1982; Smith, 2005) and that the

roughness in the play seems to increase with age (Power, 2000). The findings that rough-and-tumble play such as play-fighting is common across cultures and animals similar to humans support the suggestion that this kind of play is a result of an evolutionary adaptive process.

Rough-and-tumble play involves great physical and motor stimulation, and the functions, both deferred and immediate, of physical training through play activities is addressed above. Another possible immediate function of rough-and-tumble play is to enhance complex social competences such as affiliation with peers, social signaling, good managing and dominance skills within the peer group, bargaining, manipulating and redefining situations (Flinn and Ward, 2005; Humphreys and Smith, 1987; Pellegrini and Smith, 1998; Smith, 1982). According to Bjorklund and Pellegrini (2000), rough-and-tumble play also serves deferred benefits by enhancing survival and reproduction, particularly for boys – who most often engage in this kind of play, of gaining competence in aggression, fighting, social competition and experience in dominant and subordinate roles. These are social competencies that are useful for adult life and evolved strategies for enhancing survival, as males have had to face competition, dangers and physical challenges as hunters (Jarvis, 2006). For kindergarten children there rarely is an aim to hurt the other and both parts partake in this as a playful activity (Humphreys and Smith, 1987). Still, research suggests that rough-and-tumble play in preschool- and primary school-aged children provides practice and hones skills for regulating aggressive behavior (Dodge, Coie, Pettit, and Price, 1990). Studies of peer perception found that non-aggressive cooperative children were liked by peers and that bullies were disliked by peers (Boulton and Smith, 1994, 1996; Dodge et al., 1990), and that physical aggressive behavior among boys may continue into adolescence (Broidy et al., 2003; Scholte, Engels, Overbeek, Kemp, and Haselager, 2007). Not being able to regulate aggression and real hostile behavior in rough play situations is therefore disadvantageous for the social development of a child.

It is worth noting that dominance in rough-and-tumble play becomes even more obvious as one enters adolescence (Humphreys and Smith, 1987; Smith, 1997). As the boys, as is most often the case, move toward puberty the roughhousing becomes more competitive and the weaker fighter will be dominated by the stronger fighter. The roughhousing thus changes character and function and becomes more a hierarchy building activity.

Rough-and-tumble play thus seems to have important functions, both immediate and deferred, for motor practice, social skills practice, aggression regulation and physical health.

Anti-phobic effect. The anti-phobic effect of rough-and-tumble play is not very evident, and there is a lack of research looking into this issue. It might be that this is not a relevant function of this kind of play. Still, a couple of researchers have outlined the possibility that rough-and-tumble play, particularly the kinds where the participants aim to scare each other by taking the role as monsters or other scary creatures, the kinds where war-play is the essential focus, and the kinds including unpredictable and sudden movements and high sounds, can be a form of play-fear reinforcement that can reduce anxiety by habituation in a pretend situation (Aldis, 1975; Power, 2000). One might

speculate that social phobia and other forms of anxiety involving social hierarchy, physical closeness and social evaluation (i.e., fear of people) might be reduced due to a normalization of the intimacy and self-assertion involved in normal rough-and-tumble play. Organized rough and tumble play, such as Judo practice, has been researched and some findings suggest that children become less aggressive, less emotionally disturbed and less anxious through such practice (Gleser and Lison, 1992; Lamarre and Nosanchuck, 1999).

Play where the children can "disappear" / get lost

Both Sandseter (2007a) and Davidsson (2006) have found that children love to walk off alone and go exploring away from the eyes of adults. Children experience a feeling of risk and danger of getting lost on occasions where they are given the opportunity to "cruise" on their own exploring unknown areas; still, they have an urge to do it (Sandseter, 2007a).

Possible functions. The urge to walk off alone in new and undiscovered environments without supervision from adults is children's way of exploring their world and becoming at home in it (Bjorklund and Pellegrini, 2002; Smith, 1998). Research has shown that exploration is an important part of children's play (Davidsson, 2006; Kaarby, 2004; Sandseter, 2007a). According to Bjorklund and Pellegrini (2002), the fact that boys engage more than girls in exploration, and also explore larger areas than girls, is related to what Bowlby called the environment of evolutionary adaptedness (EEA) where males were hunters and had to be able to safely move around in diverse and large areas away from home. This is in accordance with the research of Silove, Manicavasagar, O'Connell and Morris-Yates (1995) arguing that a lower level of separation anxiety among boys than girls is due to the adaptive pressure for boys to learn hunting skills and the courage to venture far from the home, and opposite for girls to learn skills for nurturing and creating safe environments for child-rearing. Enhancing perceptual competencies such as depth-, form-, shape-, size-, and movement perception is also a natural function of children's exploration of their environment (Rakison, 2005).

Studying animal and human play, Aldis (1975) makes a distinction between serious exploration where the human/animal learns about their environment, and play which is just playful activity. Aldis describes serious exploration with the example of a young rhesus monkey that first independently leaves its mother to explore the immediate proximity, and at the first sign of danger will flee back to her. Then, over a period of time, the young rhesus monkey will gradually fan out from "home base" to explore more distant areas.
Aldis argues that through serious exploration, rather than play, animals learn what features of the environment lead to food, which lead to danger, and so on. Still, Aldis admits that it is difficult to differentiate between serious exploration and play, and that often a new and unknown environment or object is approached by serious exploration in the beginning and then gradually explored further through play. In our opinion exploration performed in a play "atmosphere," such as pretend play, is a kind of exploratory play, teaching the players about their environment though play situations.

Anti-phobic effect. The fear of separation from caretakers is common in humans (Buss, 2004) – particularly for the female part of the human population (Silove et al., 1995).The urge among children for going exploring on their own is puzzling in this view.

In our hominin ancestors' past, getting lost probably was a real danger, highlighting the adaptive function of initial separation anxiety in young children. Are these children less anxious than would have been adaptive for them in the past? In most western societies children sleep alone, which is both culturally and evolutionarily a novel situation. One might speculate that this may create a larger degree of individuality and also a hypophobia of being alone. In any case, as the child matures, independence and investigation of the surroundings is necessary – also in order to find food to feed themselves.

Is separation anxiety an evolved non-associative fear that can benefit from desensitization/habituating behavior? A study by Poulton et al. (2001) revealed that separation anxiety was largely independent of associative factors, strongly supporting a non-associative explanation. Interestingly the results showed that the amount of separation experiences before age nine correlated negatively with the separation anxiety symptoms at age 18, suggesting an "inoculation" effect of early separation events. The results also indicated that planned separations can help children to learn not to fear separations. These results support the assumption of children's voluntary separation from caretakers, by wandering off alone, as a mode of anti-phobic behavior. As in the case of anti-phobic effects of play in great heights (Poulton et al., 1998), one could expect that children with less fear of separation would be more willing to expose themselves to separation events than children with a high fear of separation. Even so, when having the opportunity to voluntarily plan and carry out a separation from their caretakers by exploring new and unknown areas, experiencing the thrill of the risk of being lost, children seem to "inoculate" themselves from the anxiety of separation.

Play with dangerous tools

Play with tools that are potentially dangerous included behaviors such as using a knife for whittling, a saw for cutting down branches, a hammer and nails for carpentering, and an axe for chopping wood (Sandseter, 2007a, 2007b). This is one of the categories that are risky from an adult point of view, while the children are more disposed to feel this is only an exciting activity (Sandseter, 2007a). It is also worth noting that this behavior was much more typical among children, and not considered risky by adults only one or two generations ago.

Possible functions. Play with dangerous tools can be regarded as a kind of object play. The central point of object play is manipulation of objects in different ways, such as hitting and throwing them (Bjorklund and Pellegrini, 2002; Pellegrini and Bjorklund, 2004). Pellegrini and Bjorklund (2004) argue that the large amount of time children spend in play and manipulation of objects is an indication of the importance and adaptive relevance this has for competencies both in childhood and later in life. Also supporting the adaptive function, play with objects has been described in a wide variety of human cultures throughout the world (Gosso et al., 2005; Smith, 2005). Object play is also observed in non-human mammals and great apes (Bruner, 1976; Pellegrini and Bjorklund, 2004; Power, 2000; Ramsey and McGrew, 2005; Smith, 1982). Aldis (1975) observed object play among some kinds of carnivores and to some extent among primates, although primates tend to be more engaged in serious exploration and manipulation of objects. Still, Aldis' results show that the serious exploration of objects often turned into play with objects when the primates

were more familiar with the new object.

Play with objects is beneficial for individuals to learn properties of objects and their functions, and seems to be valuable in emergent tool use (Bjorklund and Pellegrini, 2002). The fact that boys are more likely than girls to engage in object oriented play, and they do object play more vigorously and physically while girls seem to engage in more solitary manipulation of objects, suggests that this provides deferred benefits of important skill acquisition for the adult human where males would have to prepare for hunting and women for gathering (Bjorklund and Pellegrini, 2002; Pellegrini and Bjorklund, 2004).

Anti-phobic effect. Some forms of hypophobia (Marks and Nesse, 1994) will be due to a mismatch between our ancestors' environment that we are adapted to (Nesse and Williams, 1995; Tooby and Cosmides, 1990) and the current environment. Many dangerous tools never existed in the past and we did not evolve natural fears of them. Even though tools such as knives and axes existed in earlier phases of human evolution (although less sharp), object play (including playing with dangerous tools) more likely is motivated by an interest in tools and acquisition of tool handling skills than by anti-phobic effects. Future research into the differences between play involving modern tools and role-playing adult skill behavior might shed light into the different motivational mechanisms.

Play near dangerous elements

Play near dangerous elements in Sandseter's (2007a, 2007b) study included play on top of high and steep cliffs, play near deep water by the seaside and tumultuous play near a burning fire pit. Like in the case of play with dangerous tools, this is a category that primarily is regarded risky from an adult point of view, while some of the children thought this was scary and others did not (Sandseter, 2007a).

Possible functions. Similar to some of the other categories of risky play, one can assume that this kind of play serves a function of exploring the environment and becoming familiar with its possibilities and constraints. Still, research shows that some of the children are not very attentive to the fact that they are playing near a dangerous element, but rather are preoccupied in their activity, such as role play, play chasing and the like (Sandseter, 2007b). The potential hazard is thus not always perceived by the children (Sandseter, 2007a). The function of playing near dangerous elements may therefore be an indirect function, the dangerous element not being the essential part of the play itself, still having an effect on how children learn to handle different environmental features and elements such as water, steep and high cliffs, and fire. Children have been playing close to dangerous ecological features throughout our species' evolutionary history – so one would assume that there has been selection to improve children's ability to be aware of real risks.

Anti-phobic effect. If one assumes that fear of potentially dangerous elements, similar to fear of height (Poulton et al., 1998), are non-associative evolutionarily-relevant fears that arise naturally in young humans, the hypothesis of habituation through exposure to the stimuli and the falsification of exaggerated belief of hazards through behavioral experiments would be reasonable also for fear of high and steep cliffs, water and fire. It is possible that the children who were not afraid of dangerous elements in Sandseter's (2007a, 2007b) studies have had more anxiety reducing experiences than the ones that thought that playing near dangerous elements was scary. We addressed the anti-phobic effect of

experiencing injurious falls through exposing oneself to great heights above (Poulton et al., 1998). A study carried through by Poulton et al. (1999) found similar results on fear of water. This study concluded that there was no relationship between water confidence and experiencing water trauma before age nine and the symptoms of water fear at age 18. The authors conclude (see also Poulton and Menzies, 2002a; Poulton and Menzies, 2002b) that their studies support a non-associative perspective arguing that the fear of water arises due to innate reasons. Thus, anxiety is due to maturation, rather than associative learning of anxiety (Rachman, 1977). Further, Poulton et al. (1999) conclude that anxiety is reduced over time with repeated exposure to the stimuli. Thus, play behavior near dangerous elements such as high cliffs, water and fire may be natural, anti-phobic behavior, while preventing this behavior may increase the risk of phobias and a lack of normal coping behavior in heights, water or close to fire.

Survival Tasks, Functions and Sex-Differences

One would assume that all children would gain from enhancing physical, social and perceptual skills and being familiar and comfortable in their surrounding environment, as well as acquiring good risk management skills and anti-phobic effects of stimulation. Still, research concludes on boys being far more represented than girls in the willingness to take risks and engage in risky play (Cairns and Cairns, 1994; Ginsburg and Miller, 1982; MacDonald, 1995; Morrongiello and Rennie, 1998; Smith, 1998), intense challenging physical play and rough-and-tumble play (Blurton Jones, 1976; DiPietro, 1981; Eaton and Enns, 1986; Eaton and Yu, 1989; Humphreys and Smith, 1984, 1987; MacDonald, 1998; Pellegrini and Smith, 1998; Power, 2000; Smith, 1997, 2005). Research findings also indicate that boys have a higher injury liability than girls (Boles, Roberts, Brown, and Mayes, 2005; Coppens and Gentry, 1991; Matheny, 1987; Morrongiello and Rennie, 1998; Ordoñana et al., 2008; Rosen and Peterson, 1990; Schwebel, Brezausek, and Belsky, 2006). Can this sex-difference be accounted for in an evolutionary perspective? Several authors (see, e.g., Bjorklund and Pellegrini, 2000, 2002; Ellis and Bjorklund, 2005; Jarvis, 2006; Pellegrini and Bjorklund, 2004; Smith, 1982) state that the documented sex-differences in play styles is consistent with the adaptive problems males and females have had to encounter. Men have had to prove themselves as a strong, safe, protective and worthy partner for the females with whom he wanted to produce offspring (Ellis, 1992). This would, in the past, imply the willingness to take great risks (Kruger and Nesse, 2004; Wilson and Daly, 1985). This includes both travelling away from the home base for hunting and fighting wild animals, and protecting the partner and offspring from enemies and other "hostile forces of nature." Women, on the other hand, would have to be more cautious to survive and secure reproductive success, and then serve as the primary caregivers for their children staying at the home base performing gathering tasks. Sex-differences in the urge for risky play could possibly be viewed as an adaptation to enhance competencies important for survival in the history of evolution. Differences in fearfulness or anxiety, and the need to reduce both fear and anxiety more in males, may be part of this (Kruger and Nesse, 2004; Wilson and Daly, 1985).

General Discussion

Anxiety etiology has been based on, e.g., Mowrer's two-factor theory – including both classical and operant conditioning (see also Rachman, 1977, for a conditioning approach). This is no longer considered a likely explanation. At least the associative pathways might need to be expanded with non-associative models (Poulton and Menzies, 2002a). The isomorphic principle of how pathogenesis and cure need to be similar processes has been typical within much psychotherapeutic theory – since the effective treatment of anxiety has been learning theory-based, many have expected conditioning to be the etiology of anxiety. At the same time researchers such as Poulton and Menzies (2002a, 2002b), and Kendler, Myers and Prescott (2002) provide strong evidence that suggests that anxiety appears through largely maturational or dispositional mechanisms. On the other hand, anxiety reduction seems to be due to coping and interaction with the naturally fear-generating stimulus. The naturally developed fear seems to be alleviated through normal habituation or coping experiences, somehow. We suggest that risky play provides the exact conditions that will be most curative of any anxiety, the exaggerated fear reactions to stimulus or situations that the child in reality is able to master. These are: the motivation to seek out the stimulus (exposure/experience) and to learn how to master the stimuli while being motivated by a positive (thrilling) rather than aversive emotion resulting in coping/mastery experiences. Note that thrill reduction occurs after a period of careful but thrill motivated negotiation of the threatening condition and the learning and mastery of the necessary skills involved. In other words, the child starts off with a natural inhibition toward situations that the child developmentally is not mature enough to cope with, but this fear is reduced as the child develops mental and physical skills and exposes itself to the stimulus motivated by thrilling emotions, while learning how to master these challenges.

Children do not consciously consider the immediate or deferred benefits of their play while playing or while deciding what to play. Enjoyment or thrill of play is basically the motivational basis for play among children (Smith, 1982), and children engage in risky play because they enjoy doing it (Sandseter, 2007c, 2009). Sutton-Smith (1997) states that there is no contradiction between assuming that a child's personal reason for play is an intrinsic motivation to experience positive emotional stages such as arousal, excitement, fun, merriment, joy, ecstatic feelings, mastery and competence, and assuming that the effects of such play are useful for other kinds of adaptations such as enhancing survival and the child's fitness. This corresponds to hominins procreating through history, not primarily due to the conscious desire to have offspring, but due to sexual drives and the pleasures of sex.

Still, several important questions remain unanswered: It is important not to prematurely conclude that risky play is due to specific adaptations or plays an adaptive role in normal development. Other explanations are possible: Are the motivational and perceptual mental systems that make children experience this form of stimulation activating and thrilling by-products (Gould and Lewontin, 1979; see also Buss, Haselton, Shackelford, Bleske, and Wakefield, 1998; Kennair, 2002) of our mental mechanisms? Or might they be remnants of systems that, e.g., made our tree dwelling ancestors feel

motivated to climb and jump from branch to branch? Would this have consequences? And is it still a system that needs stimulating in order to ensure normal development?

Few deprivation studies have been conducted to try to reveal the developmental importance of different kinds of play. This has been more common in animal play literature (Bjorklund and Pellegrini, 2002). Still, some studies of the effects of depriving children of locomotor play have occurred. The results from these studies were consistent in showing that deprivation led to increased levels of locomotor play when the opportunities for this kind of play were re-established (Byers and Walker, 1995; Pellegrini and Davis, 1993; Pellegrini, Huberty, and Jones, 1995). Further research would be necessary to consider the effects of preventing risky play. If this indeed resulted in an increased tendency toward fearfulness or neuroticism this would provide further evidence of the fear reducing effect of risky play.

We have been informed by a modular approach, and posited specific mechanisms for specific types of risky play. One might object that a more domain general approach might also be possible to explain such behavior. We do believe that heights, speed and play near dangerous elements probably use many of the same mechanisms, and although there probably are different mechanisms involved in rough and tumble play, probably there also are common processes such as the thrilling emotion. We do posit at that level that this process is rather general. Also there may be evolved individual differences (see Buss and Hawley, 2011) that regulate this process at a general level, such as poor self-regulation and inhibitory abilities that both reflect general universal development of the prefrontal cortex as well as individual differences, as well as meta-cognitive processes involved in the overestimation of abilities to manage risky situations.

Conclusions

This article suggests that one of the most important aspects of risky play may be the anti-phobic effect of exposure to typical fear eliciting stimuli and contexts, in the combination of positive emotion and relative safety and with autonomous coping behavior. As such risky play mirrors effective cognitive behavioral therapy of anxiety (Allen and Rapee, 2005). Current research on the etiology of anxiety suggests that anxieties develop due to both genetic and environmental factors (Allen and Rapee, 2005). The specific genes have not been identified, but neither are we aware of what environmental factors cause anxiety disorders (e.g. Kendler et al., 2002). It seems that the genetic factors cause individual differences, and apart from the phobias most anxiety disorders do not seem functional from an evolutionary perspective (Kennair, 2007). The evidence that phobias seem to develop rather independently of learning experiences (these have at least been difficult to document to date), does not mean that learning may not be a way of reducing or even curing anxiety. Actually graded exposure and learning to think less negative and more mastery oriented thoughts about the anxiety producing stimuli have shown to be the most effective treatment of child anxieties (Allen and Rapee, 2005). It is possible that risky play is a natural way of reducing many phobic reactions that are functional when the child has a low level of mastery of the fear provoking conditions. Thus adaptive *fear*, necessary to keep the child safe and alert and careful when learning to cope with potentially dangerous

situations for young children, is countered by the positive emotions that are typical of the adaptively thrilling experience involved in moving the boundaries of what is safe and what is dangerous. Research has shown that anxious children may elicit overprotective behavior from others, such as parents and caretakers, and that this reinforces the child's perception of threat and decreases their perception of controlling the danger (Allen and Rapee, 2005). Overprotection might thus result in exaggerated levels of anxiety. Overprotection through governmental control of playgrounds and exaggerated fear of playground accidents might thus result in an increase of anxiety in society. We might need to provide more stimulating environments for children, rather than hamper their development.

This means that some forms of risky play may be developmentally adequate species-specific and universal anti-phobic processes. For other types of risky play, the motivational systems may be more archaic systems or they may be due to by-products of our perceptual systems that provide a mixed activation that the children perceive as thrilling and hedonic. The different analyses of function give different testable hypotheses of the psychological mechanisms and motivational systems involved in the different types of play. From a modular approach one would not expect to find the same mechanisms involved in all different types of behavior.

If these ideas are correct, this might not only be about prevention or increasing anxiety at the population level, but also relevant for the improvement of treatment of young children with anxiety. Treatment might profit from having more than merely a habituation perspective; relaxation (e.g., Öst, 1987) may counter anxiety, but it may be more important – at least for many young patients – to experience more thrilling and coping emotions. A treatment program for young patients that uses thrilling emotions to cure anxiety and compares it to current best practice cognitive behavioral treatment protocols would test this directly.

Further research into risky play is necessary. Risky behavior is a potential health hazard. At the same time, an understanding of why and when children will engage in risky behavior is important – not least if such behavior in the long run is beneficial to their normal development. It seems that risky behavior is maintained despite adults' attempts at making children's environments safer. From both a safety perspective as well as from a normal psychological developmental perspective an understanding of the function of risky play and the different psychological mechanisms and motivational systems involved are important to understand. This will be essential in the world wide discussion on demands for children's play safety, by a growing number of researchers regarded as drawing near overprotection, and the balance between such safety requirements and children's needs for opportunities to play freely in challenging, stimulating and developing environments. Even though highly active and risk taking children experience more (albeit minor) injuries, this article suggests that these children will benefit psychologically from natural adaptive fear alleviation and the anti-phobic effect of risky play.

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