British Journal of Developmental Psychology (2002), 20, 479–494

www.bps.org.uk

Magical thinking in childhood and adolescence: Development and relation to obsessive compulsion

Derek Bolton[1]*, Pamela Dearsley[1], Richard Madronal-Luque[1] and Simon Baron-Cohen[2]

[1]Psychology Department, Institute of Psychiatry, Kings College London, UK
[2]Departments of Experimental Psychology and Psychiatry, University of Cambridge, UK

Magical thinking in childhood bears at least superficial similarities to obsessive compulsion, and recent cognitive models of obsessive compulsive disorder implicate forms of thinking akin to the magical. However, there has been little research on the relations between normal magical thinking in childhood and obsessive compulsion. The present study has two aims: to investigate magical thinking in young children and through to late adolescence, and to examine the relation between magical thinking and obsessive compulsion. It was found that children across the age range studied reported some magical thinking, and there was no general decline in the level of magical thinking with age. This overall pattern was complicated, however, by fluctuations in the level of magical thinking in later childhood and early adolescence, and by gender differences. There was a significant correlation between levels of magical thinking and obsessive compulsion. The results are discussed in the light of current theories.

Magical thinking typically involves attribution of causal effects on real events by either thought or an action that is physically unconnected to the events (Rothbaum & Weisz, 1988; Zusne & Jones, 1989). It is commonly supposed that children are particularly given to magical thinking, because of confusion or error about the distinction between mind and reality (Astington, 1993; Piaget, 1929). Piaget supposed that such beliefs are present through the concrete operations period, that is, until the age of 11 or 12. Rosengren and Hickling (2000) consider two possible time-courses consistent with this, one in which magical thinking declines with age from 0 to 12 years, the other in which it rises between 0 and 5 years and then declines. Most theory, however, has tended to

* Requests for reprints should be addressed to Derek Bolton, Dept of Psychology, Institute of Psychiatry, King's College London, De Crespigny Park, Denmark Hill, London SE5 8AF, UK.

focus on younger children, to age 5 or 6: Rothbaum and Weisz (1988, p. 20), for example, described a 'magical stage' between 2 and 6 years. Similarly, most experimental research in this area has involved children in this younger age group, and has demonstrated magical thinking in a variety of contexts (Harris, Brown, Marriot, Whittal, & Harmer, 1991; Vikan & Clausen, 1993; Woolley, Phelps, & Davis, 1995 (cited in Woolley, 1997); Woolley & Wellman, 1993), though with some conflicting findings (Golomb & Galasso, 1995; Woolley & Phelps, 1994). There has been relatively little research on older children and adolescents, and in her review of this literature Woolley (1997) recommended this as a direction for future research.

Woolley (1997) reviews two kinds of consideration that in fact weigh against a limited focus on younger children in relation to magical thinking. First, there has been an accumulation of evidence from experimental studies, including studies of magical thinking specifically, that younger children between the ages of 3 and 6 years are adept at making a variety of distinctions between fantasy and reality (Estes, Wellman, & Woolley, 1989; Flavell, Green, & Flavell, 1986; Wellman & Estes, 1986). Secondly, there is evidence documented in a wide and diverse literature that superstition, magical thinking and beliefs in the supernatural are common in adults (Woolley, 1997).

Recent research into magical thinking has highlighted the difficulties involved in defining 'magic' and the fact that the term probably covers a variety of related phenomena. There are various ways of contrasting magic with religion, science and metaphysics (Johnson, 2000; Nemeroff & Rozin, 2000; Thomas, 1971), and distinctions may be made between magical thinking, superstition and fantastical thinking (Boyer, 1997; Johnson, 1997) and between these phenomena in children and in adults (Chandler, 1997). Magical thinking was characterized above as typically involving attribution of causal effects on real events by either thought or an action that is physically unconnected to the events. This is a reasonable start at a working definition, but is not without difficulties and complications. One obvious point is that in a perfectly normal sense, thought and other mental processes can influence events in reality, as when a person wills her arm to pick up a cup. It seems essential, therefore, to the concept of magical action that it violates 'everyday' causal principles, a point emphasized by Harris (1994). This condition allows us to distinguish normal mental causation from cases such as thinking that harm will befall a person can cause the harm to happen. Much the same applies to the notion of unconnected physical events affecting one another. For example, modern mechanics needed the notion of action at a distance and the related notion of field, and these notions later re-appeared in electrodynamics. We need to distinguish these kinds of case from perceived magical effects (e.g. that walking under a ladder can cause the person to have an accident at some later time and place). Again, the idea that, in magic, 'everyday' causal principles are violated is useful.

Reliance of the definition of 'magic' as a belief in causal phenomena that contrast with everyday causal principles suggests that the status of a perceived causal connection as being magical will depend on the prevailing folk or scientific physics. Thus Newton's postulate of action at a distance was reasonably regarded as an appeal to the occult at the time, but over a period it became accepted by the scientific community and by the folk as belonging with everyday causality. Analogous points may apply in the case of mental causation. Bending a spoon by mental effort alone may be regarded as magic, but there could be a physical causal story, linking in some way the electrical activity of the brain, electromagnetic fields, and forces in the spoon, compatible in this way with accepted causal laws. Similarly, some magical or

superstitious practices might be thought to be effective because of familiar causal principles, for example believing that wearing a lucky mascot may increase confidence and raise the likelihood of winning according to self-regulatory psychological mechanisms (Nemeroff & Rozin, 2000).

Insofar as the attribution of magic depends on a contrast with everyday causal principles and hence is relative to the background psychology and physics, the implication is that in order to assess what is and what is not magical thinking in an individual or culture, one has to know the system of belief: consideration of beliefs in isolation runs the risk of making the judgment relative to the observer's distinctions rather the person or culture involved. That said, within a culture or subculture there is by definition a reasonably clear consensus on the background system of belief and within that the distinction between normal, everyday causal connections defined by folk physics and psychology, and extraordinary causal connections incompatible with folk physics and psychology, open to explanation by magic.

The distinction between everyday causal principles and magic is best regarded as being made within the person or culture that works with magic. There was a tendency in early anthropology to distinguish magical from scientific cultures, in which case the anthropologist as observer would describe the beliefs of the other culture as magical because they violated the home culture's view of scientific (everyday) causal principles. However, it was recognized that the so-called magical cultures use plenty of folk physics familiar to scientific cultures (Malinowski, 1955; Wittgenstein, 1967). For example, people who want to boil water for cooking place it over fire, even if they also use magic in other contexts: they do not just wish the water to boil, or draw a picture of boiling water. Developmental psychology has travelled a similar path, as noted above, from an early tendency to regard magical thinking in children as a stage that children pass through on their way to logical, scientific rationality, towards the view that from an early age children use both what they regard as everyday causal principles and 'magical principles' that violate those everyday ones.

However, the younger the children, the less likely it is that the distinction between magic and everyday causality will be a sharp or even a useful one. This is because the young child is in the process of working out what can happen in the world, why things happen, the extent of his or her own power and related boundaries of the self. The young child also does not yet have an established working distinction between what is normally explicable in terms of everyday causal principles, and what is not (Meltzoff & Moore, 1998; Piaget, 1929; Woolley, 2000).

A related developmental issue is that crucial to the working out of the distinction between self and reality is differential attribution of causal efficacy to the self on the one hand and to independent reality on the other (Piaget, 1937/1954; Russell, 1995; Woolley, 2000). A very simple point can be made about this process. It has long been recognized that contiguity in space and/or time is a fundamental principle used in the attribution of causality (Hume, 1777/1902), and this is a point familiar in attribution theory (Heider, 1958) and developmental theory (Piaget, 1960). Use of this simple principle is liable to lead the young child to overestimate his or her control over events, to suppose for example that even the course of the sun is set by him or her (Piaget, 1960). This and related kinds of reasoning, (e.g. over-hasty attribution of causality based on a single salient case of association) may in some circumstances appear as instances of magical thinking in the child. But the characterization as magical may be unhelpful, in effect attributing to the child distinctions that so far he or she has not yet made. In line with the above considerations, they may be better regarded as primitive

attributions of causality in the familiar, mature sense, the basis of which is regular association or conjunction, not properly as examples of magical thinking. Alternatively such early judgments of causality may be regarded as instances of a distinct concept of causality based on perception of association or similarity in the absence of moderating theory, as in Subbotski's notion of 'phenomenalistic' causality (Subbotsky, 1997, 2000).

The recognition that (folk) scientific and magical thinking can coexist within a culture or individual raises the question of their relationship. One idea found in the literature is that they operate in different spheres, with different functions: magic but not science may rely, for example, on dramatic effect (Nemeroff & Rozin, 2000; Tambiah, 1990). This may be correct, but there is something crucial that scientific and magical thinking share, namely causal principles (Harris, 1997; Rosengren & Hickling, 2000). Magical beliefs refer to causal connections, albeit of extraordinary kinds, and magical practice is typically a way of making things happen in the world. A plausible hypothesis that is considered widely in the anthropological and psychological literatures in effect combines these two approaches: magical thinking is seen as achieving the appearance of control in the absence of real control.

The idea is that magic is invoked in salient situations where the folk science knows there is no normal means of securing the desired outcome, situations such as fertility, birth, rainfall, illness, battle, death (S. Freud, 1913/1966; Malinowski, 1955; Nemeroff & Rozin, 2000). The background psychological point is that it is critical to living beings to experience control over what matters to them, the alternative being anxiety and helplessness, with consequent giving up of action (Bandura, 1977; Bolton & Hill, 1996; Seligman, 1975). Magical thinking may interact powerfully with these fundamental problems by creating an 'illusion of control' where reason (the folk science) knows there is none. Both Freud and Piaget supposed that adults could regress to magical thinking in states of anxiety and fear (S. Freud, 1919/1955; Piaget 1929; see also Keinan, 1994; Werner, 1948). The possibility that magical thinking may be used as a resource for restoring a sense of control is consistent with the finding that adult magical thinking tends to occur where perception of control over highly salient events is otherwise lacking (Langer, 1975), such as winning in competitive sport (Neil, 1982), in games of chance (Weisz, 1981), illness (Taylor, 1983, Taylor, Lichtman, & Wood, 1984) and death (Persinger and Makarec, 1990).

The possible use of magical thinking to cope with anxiety is connected with another issue in the developmental literature: whether high levels of emotion interact with the ability to distinguish reality and fantasy. Samuels and Taylor (1994), for example, found that children deemed all scary events to be real. Some researchers have suggested that emotional charge disrupts the child's ability to distinguish fantasy and reality (Bretherton & Beeghly, 1982; Harris *et al.*, 1991), but it is also possible that in anxiety-provoking situations the judgment of fantasy serves as a coping strategy (Lillard, 1994). However, findings on the relation between affect and children's judgments of fantasy or reality have not been consistent, with negative findings in various contexts being reported by Golomb and Galasso (1995), Harris *et al.* (1991), and Anderson, & Hapkiewicz Prawat (1985).

The form of high anxiety and coping apparently most connected with magical thinking is obsessive-compulsion, and connection between magical thinking, anxiety-reduction and obsessive compulsive disorder (OCD) has been hypothesized frequently (A. Freud, 1966; S. Freud, 1913/1966; Pitman, 1987, 1993; Rachman & Hodgson 1980). It has also often been noted that obsessions and compulsions have some features in common with childhood superstitions and rituals (A. Freud, 1965; Leonard, 1989).

Notwithstanding evident differences (Leonard, Goldberger, Rapoport, Cheslow, & Swedo, 1990), the question arises whether cognitive processes in OCD are persistent expressions of developmentally normal magical thinking, but this question has so far hardly been explored (Bolton, 1996).

Recent cognitive models of OCD, based mainly on consideration of adults with the disorder (Rachman, 1993; Salkovskis, 1985), have implicated cognitive styles that may be linked to developmentally normal magical thinking. It has been proposed that individuals with OCD have a tendency to confuse the distinction between thinking about carrying out an action and carrying out the action in reality, and have the consequent tendency to feel as morally responsible for the thought as one would for action itself. These cognitive styles together have been called 'thought-action fusion' (Rachman, 1993, 1997).

Studies of the relation between obsessive compulsion and superstitiousness or magical thinking have had mixed results. A study of children with OCD found no more superstitousness than in non-clinically referred children (Leonard, *et al.*, 1990). A study of obsessive compulsive thinking and behaviours in a community adult sample did find some significant correlations with superstitiousness (Frost *et al.*, 1993). Regarding 'magical thinking' specifically, one measure has been used to investigate OCD, namely the Magical Ideation Scale (MIS), based on a definition of magical ideation as 'belief in forms of causation that by conventional standards are invalid', and originally developed to assess magical ideation in schizotypy (Eckblad & Chapman, 1983). The MIS was included in the Combined Schizotypal Traits Questionnaire (CSTQ; Bentall, Claridge, & Slade, 1989), which was found to differentiate between individuals with OCD and those with other anxiety disorders, although there have been mixed findings on the sensitivity of the MIS component within the CSTQ in discriminating between these two groups (Enright & Beech, 1990; Enright, Claridge, Beech, & Kemp-Wheler, 1993). Using a questionnaire measure of thought-action fusion, Muris, Meesters, Rassin, Merckelbacn, and Campbell (2001) found a significant correlation between this construct and obsessive compulsive symptomatology in a sample of non-clinically referred adolescents aged 13–16 years.

There is thus a range of outstanding issues concerning the development of magical thinking and its relation to anxiety in general and obsessive compulsion in particular. The present study was designed to address two of the preliminary issues by testing two hypotheses:

(1) that magical thinking declines in development between young childhood and late adolescence, and
(2) that there is an association between magical thinking and obsessive compulsive thoughts and behaviours.

Method

Participants

Participants were 127 children and adolescents, ranging in age between 5 and 17 years. They were assessed in six school-year age groups as follows: 5- to 6-year-olds ($N = 17$), 7- to 8-year-olds ($N = 21$), 9- to 10-year-olds ($N = 20$), 12- to 13-year-olds ($N = 28$), 14- to 15-year-olds ($N = 20$), and 16- to 17-year-olds ($N = 22$). Of the children, 61 were female and 66 were male. The children were recruited from an independent, fee-paying school

that on the basis of an entrance exam accepted children in the top half of the range of intellectual ability.

Measures

In the absence of an existing measure of magical thinking applicable through the age range from childhood to adolescence, the Magical Thinking Questionnaire (MTQ) was devised for the present study, and is given in the Appendix. It comprises 30 questions, each asking whether something is possible. There are two subscales, 'Thought' and 'Action'. In the MTQ thought subscale there are 10 questions that ask whether it is possible to make some event happen just by thinking about it (items 3, 6, 11, 13, 18, 19, 22, 25, 28 and 29). In the MTQ action subscale, there are 10 questions that ask whether it is possible by some action to make some event happen, the specified action being rationally or causally unrelated to the specified event (items 1, 4, 7, 8, 9, 14, 15, 20, 24 and 27). The remaining 10 questions of the MTQ assess bias for responding 'yes' (items 5, 12, 17, 21 and 26) or 'no' (items 2, 10, 16, 23 and 30); these questions relate to physical causal principles that children can reasonably be expected to know. Outcomes in the items on the two MTQ subscales were balanced between positive (4–10), negative (4–10) and neutral (2–10). (On the MTQ thinking subscale, the positive event items are 6, 11, 19 and 28; the negative event items are 3, 13, 25 and 29; and the neutral event items are 18 and 22. On the MTQ action subscale, the positive event items are 1, 7, 15 and 27; the negative event items are 4, 8, 9 and 20; and the neutral event items are 14 and 24.) Further, the MTQ action subscale was balanced between ritualistic (items 7, 8, 14, 20 and 27) and non-ritualistic (items 1, 4, 9, 15 and 24) actions. Responses are made on a 3-point scale, 'yes', 'no' or 'maybe', scored 2, 0 or 1, respectively. Scores on the 10 questions relating to thinking are summed to give the MTQ thought subscale score, and scores on the 10 questions relating to action are summed to give the MTQ action subscale score. These two subscale scores sum to the MTQ total score. Responses to the items controlling for response 'yes'–'no' biases are scored 1 for the incorrect answer, and 0 for the correct answer or 'maybe'. Scores are summed for use in estimating bias, but are not included in MTQ subscale scores or total score. The questionnaire was designed to be applicable across the age range. Earlier versions were piloted on children aged between 6 and 10 years, and items that were found to be confusing or ambiguous were modified or excluded from the final version.

In the present study, the MTQ was given to classes of children for self-completion, except in the case of the youngest class of 5- and 6-year-olds, in which case the investigator read out the questions to each child individually and recorded his or her response. To assess the reliability of the MTQ, a group of 17 participants were retested four weeks after the initial administration.

The Spence Children's Anxiety Scale (SCAS; Spence, 1998) was used as a measure of obsessive compulsion, and to provide comparison with other kinds of anxious thoughts and behaviours. The SCAS is a self-completed questionnaire with 38 items relating to anxiety and six filler items to reduce negative response bias. Of the 38 anxiety items, six reflect obsessive-compulsive symptomatology, six reflect separation anxiety, six reflect social phobia, six reflect panic and three reflect agoraphobia forming one factor, Panic-agoraphobia, six reflect generalized anxiety-overanxious disorder, and five reflect fears of physical injury. Validity of this six-factor structure has been confirmed on several cohorts by factor analyses, with high covariance between factors explained by a higher order model with a single 'anxiety' factor (Spence, 1997, 1998). Children are asked to

rate on a 4-point scale: 'never', 'sometimes', 'often' or 'always', scored 0–3, respectively.

In the present study the SCAS was given to classes of children for self-completion, except in the case of the youngest class, the 5- to 6-year-olds, where the investigator read out the questions to each child individually and recorded his or her response.

Results

Preliminary analyses of the MTQ data examined response biases, distributions and retest reliability. Answers to the questions assessing biases towards 'yes' or 'no' responding showed mode scores of either 0 or 1 out of a possible total of 3, with no significant differences between the age groups. No cases were excluded on the basis of responses to control questions. Distributions of MTQ total and subscale data were seen to approximate to normal in most age groups, but because of relatively low numbers non-parametric statistics were used for the main analyses. Test–retest correlation for MTQ total score was high ($N = 17$, Spearman rank order correlation .908, $p < .001$). Table 1 shows the medians, means and standard deviations for the MTQ total and subscales for each age group.

Table 1. Medians, means and SDs by age group for MTQ total and subscales, and significant between-groups differences

MTQ total and subscale scores	Age groups					
	5–6 years (N = 17)	7–8 years (N = 21)	9–10 years (N = 20)	12–13 years (N = 28)	14–15 years (N = 20)	16–17 years (N = 22)
Total*						
Median	5.00	11.00	13.00	2.00	6.50	7.00
Mean	6.76	8.86	12.15	5.44	7.60	8.59
SD	(6.42)	(5.40)	(6.63)	(7.25)	(5.79)	(7.93)
Thought						
Median	3.00	6.00	8.50	1.00	5.00	4.50
Mean	4.18	5.29	7.50	3.52	5.45	5.64
SD	(4.22)	(3.51)	(5.29)	(4.65)	(4.12)	(5.31)
Action*						
Median	2.00	3.00	4.50	0.00	1.00	2.00
Mean	2.76	3.52	4.65	1.85	2.15	2.86
SD	(2.70)	(2.44)	(2.78)	(3.01)	(2.48)	(2.68)

*$p < .05$. For *post hoc* analyses, see text.

The first main analysis examined correlations between age and, separately, MTQ total score, MTQ thinking subscale score and MTQ action subscale score. These correlations were low (Spearman's $\rho = -.065$, .006 and $-.166$, respectively) and statistically non-significant. Subsequent analyses examined differences in MTQ total score and subscores by age groups, and significance levels of overall differences between groups are shown in Table 1. The one-way ANOVA on the MTQ total × age group was significant ($F(5,121) = 2.559$, $p = .034$). *Post hoc* comparisons using Bonferroni's statistic revealed significant difference between the 9–10 year age group

and the 12–13 year group ($p = .009$). For the MTQ thinking subscale there was no overall significant difference ($F(5,121) = 2.029, p = .079$). The one-way ANOVA on MTQ action subscale × age group revealed a significant main effect ($F(5,121) = 3.024$, $p = .013$). *Post hoc* analyses revealed a significant difference between the 9–10 year age group and the 12–13 year group ($p = .010$).

There were between 0 and 3 outliers in each age group, defined as cases with scores over 2 standard deviations above the mean. Exclusion of outliers had the effect of increasing the values of the overall F ANOVA statistic for between age-groups differences for MTQ total score and subscales scores.

In the group as a whole, scores on the two MTQ subscales were highly correlated (Spearman's $\rho = .736, p < .001$). This pattern was found within each age group, with Spearman rank order correlations ranging between .577 and .780, and significance levels between .008 and < .001, with the exception of the 5- to 6-year-old age group, where the correlation between the two MTQ subscales was lower and statistically non-significant (Spearman's $\rho = .412$, $p = .100$). In the group as a whole, MTQ thought subscale scores ($M = 5.20$, SD = 4.51) were significantly higher than the action subscale scores ($M = 2.91$, SD = 2.81) (paired t test $t(126) = 8.271, p < .001$), and this pattern was found within each age group except for the 5- to 6-year-olds, where no significant difference between scores on the two subscales was found.

Gender differences on the MTQ were explored in a two-way ANOVA with age group and gender as grouping variables. The overall model was significant ($F(11, 115) = 2.279$, $p = .015$), the main effect of age group was significant ($F(5, 121) = 2.576$, $p = .030$), and the age × gender interaction approached significance ($F(5, 121) = 2.140, p = .066$). Means of MTQ total scores × age groups for boys and for girls are shown in Fig. 1.

In the group as a whole, no gender differences in total or subscale scores were apparent. This negative finding was found within each age group except for the 12- to 13-year-olds. In this age group, comparison of the girls' ($N = 13$) and the boys' ($N = 15$) scores showed significant differences on MTQ total and both subscales. Mean MTQ total score for the girls was 10.07 (SD = 8.19) and for the boys was 1.87 (SD = 2.29); ($p = .001$); mean MTQ thinking subscale score for the girls was 6.64 (SD = 5.20), and for the boys 1.13 (SD = 1.55; $p = .001$); and mean MTQ action subscale score for the girls was 3.43 (SD = 3.57) and for the boys .60 (SD = 1.12; $p = .07$). Inspection of Table 1 shows that the 12- to 13-year-old group had the lowest mean scores compared with the other age groups, and the above marked gender difference in this age group suggests that this is because of the boys' low scores.

In view of the above gender effects, the main analysis of MTQ scores × age group was repeated separately for boys and girls. For the girls, none of the effects were significant. For the boys, however, all were significant. The one-way ANOVA on MTQ total × age group for the boys revealed a significant main effect ($F(3,62) = 4.119$, $p = .002$). *Post hoc* comparisons revealed a significant difference between the 9–10 year and 12–13 year age groups ($p = .001$). For the MTQ thought subscale, a significant main effect was found ($F(3,62) = 3.603, p = .006$). *Post hoc* analyses again revealed a significant difference between the 9–10 year and 12–13 year groups ($p = .003$). For the MTQ action subscale—again for the boys only—a significant main effect was also found ($F(3,62) = 4.229$, $p = .002$). *Post hoc* analyses again revealed significant differences between the 9–10 year and 12–13 year groups ($p = .001$), and also between the 7–8 year and 12–13 year groups ($p = .036$).

The second main analysis examined the relationship between MTQ scores and SCAS

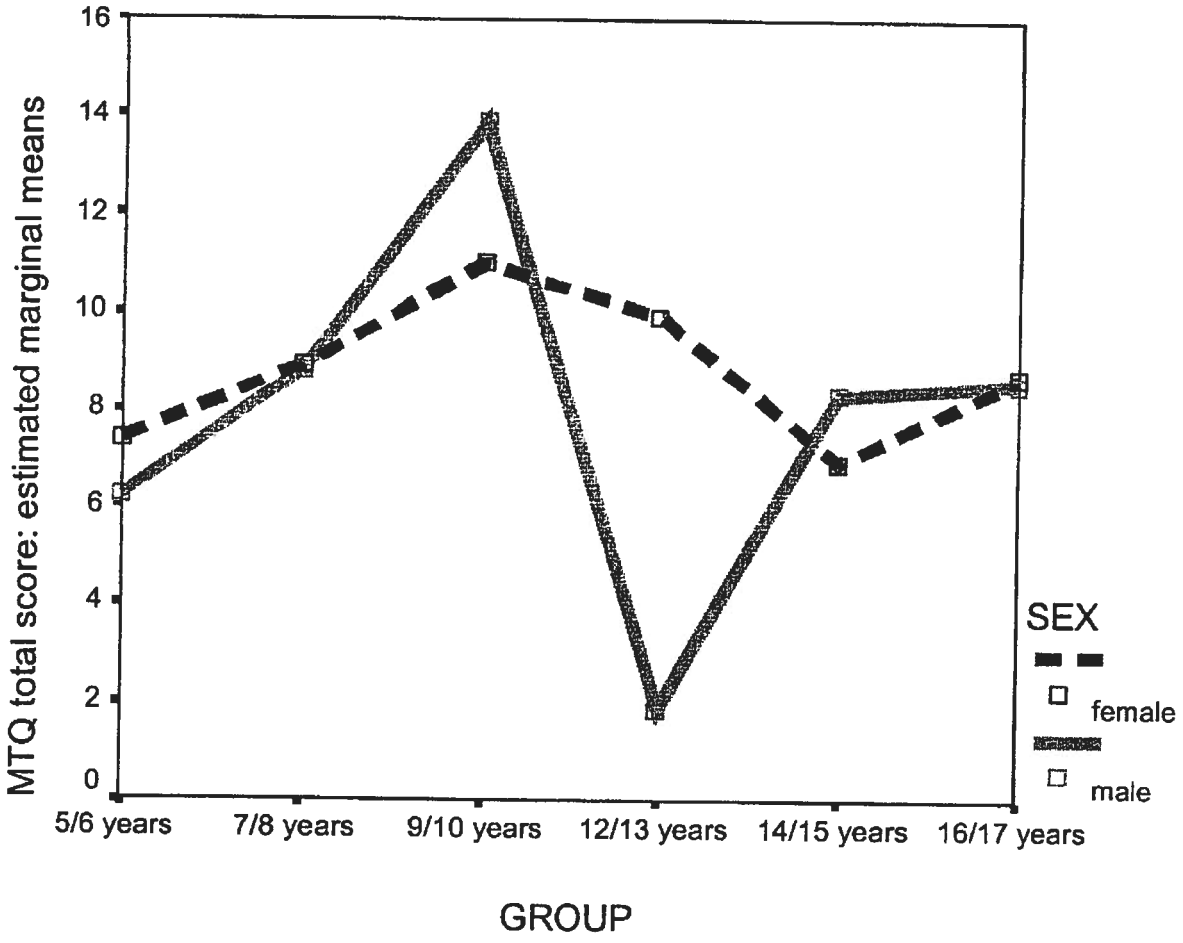

Figure 1. Estimated marginal means for MTQ total scores by age groups for males and females

scores. There were 3.7% (27/735) missing data in the SCAS. There were no cases with more than one missing datum point for any one subscale, and all missing values were replaced with the mean (for that child) on the same subscale. Table 2 shows the Spearman rank order correlations between MTQ total scores and subscales and SCAS total and subscale scores.

It can be seen in Table 2 that MTQ scores—total and both subscales—correlate most strongly with the obsessive compulsion subscale score of the SCAS, for the whole group and for girls and boys separately. However, there are also significant correlations for the whole group between MTQ scores and several other SCAS subscales: panic-agoraphobia, separation anxiety and generalized anxiety. However, these other significant correlations were found only among the boys. The boys (but not the girls) also showed a significant correlation between MTQ total/subscales scores and the fear of physical injury subscale of the SCAS. In general, the correlations between MTQ scores and SCAS scores were much stronger in the boys than in the girls, reflected in the highly significant correlations between MTQ total and subscales scores and SCAS total score for the boys, and lower and non-significant correlations for the girls.

Correlations between the MTQ and the SCAS subscale scores were also examined by age group. For MTQ total score, there were significant correlations with the SCAS obsessive compulsive subscale score in the 10–11, 12–13 and 14–15 year age groups. The correlation in the 12–13 year age group was notably high (Spearman's $\rho = .648$, $p < .001$), though in this age group there were significant correlations between MTQ

Table 2. Spearman rank order correlations between MTQ total scores and subscales and SCAS subscale and total scores: whole group and girls and boys separately, and significance levels

MTQ total and subscale scores	SCAS subscale and total scores						
	PA	SA	SocPh	PIF	OC	GA	Total
Total							
All	**.335*** **	**.233** **	**.076**	**.170**	**.415*** **	**.272** **	**.381*** **
Girls	.177	.013	.061	−.055	.352**	.175	.198
Boys	.397**	.329**	.052	.265*	.448***	.280*	.451***
Thought							
All	**.346*** **	**.218***	**.117**	**.146**	**.381*** **	**.304*** **	**.378*** **
Girls	.195	.033	.127	−.071	.277*	.214	.208
Boys	.387**	.284*	.050	.259*	.437***	.290*	.421***
Action							
All	**.259** **	**.225***	**−.012**	**.163**	**.422*** **	**.183***	**.326*** **
Girls	.053	.002	−.156	−.081	.406**	.060	.090
Boys	.390**	.358**	.092	.325**	.439***	.253*	.475***

*$p < .05$; **$p < .01$; ***$p < .001$.

Note: PA = panic-agoraphobid; SA = separation anxiety; SocPh = social phobia; PIF = physical injury fears; OC = obsessive-compulsion; GA = generalized anxiety.

total and all SCAS subscales except social phobia. A similar pattern of results was found for the MTQ thought and action subscale scores.

Discussion

This study was designed to test two hypotheses:

(1) that magical thinking declines in development between young childhood and late adolescence, and
(2) that magical thinking is associated with obsessive compulsive thoughts and behaviours.

The results did not confirm the first hypothesis. The findings did not support the common assumption that magical thinking declines with age from young childhood, but rather were consistent with the alternative view cited in the introductory text above, that younger children are in many contexts well able to distinguish imagination from reality, and that magical thinking is to be found among young children and adults alike.

However, the findings suggest that this overall picture may be complicated by fluctuations in the level of magical thinking in later childhood and early adolescence, and by gender differences. Magical thinking as measured by the MTQ was found not to decrease with age across the age range studied, but showed a fluctuating pattern, with increasing levels through the 5–6 and 9–10 year age groups, a trough in the 12–13 year age group, and higher levels in the 14–15 and 16–17 year age groups, similar to those found in the youngest age group.

This pattern was evident only in the boys, however; the girls showed approximately

the same levels of magical thinking throughout the age range studied. The present finding for the boys—that MTQ scores were relatively low at 12–13 years—is particularly striking. There were no apparent reasons for this finding in terms of special characteristics of this particular school year group, nor is there any obvious general explanation for relatively low magical thinking in boys of this age. The finding was not predicted, and requires replication.

So far as the authors are aware, there have been no previous reports of studies of magical thinking across the age range from young childhood to later adolescence, or of gender differences, and therefore the present findings generally stand in need of replication. Nevertheless, they do so far reinforce the recommendation in Woolley's (1997) review that research on magical thinking in childhood should not be restricted to younger children, but should focus also on older children and adolescents.

The assumptions behind the design of the MTQ should be emphasized. The common assumption is made that magical thinking may involve both mental and physical causation, reflected in the division between the thinking and action subscales. The questionnaire was designed specifically to assess beliefs in mental and physical cause–effect relationships that are generally regarded as magical or superstitious, as opposed to explicable by everyday causal principles. As noted in the introduction, this distinction turns on the background folk psychology and physics, and it would therefore be possible for high scores on the questionnaire to be obtained by someone not because of magical thinking, but because of sophisticated scientific speculation about, for example, neural electrodynamic fields or self-regulatory psychological mechanisms. In this sense, the questionnaire, like many others, is designed for the general population, not physicists or cognitive psychologists. It is assumed that positive responses to the items in the questionnaire generally reflect 'magical thinking'. However, as noted in the introduction, it is possible that the distinction on which this concept depends may not be firmly established in younger children, and that what would be appropriately described as 'magical thinking' in older age groups might be more appropriately described in younger children as examples of undeveloped causal thinking, or perhaps as a distinct form of causal thinking.

The second hypothesis under test—that magical thinking is associated with obsessive compulsive thoughts and behaviours—was supported. Magical thinking as measured by the MTQ was found to have strong and statistically significant correlations with obsessive compulsion as measured by the SCAS, in the group as a whole and in both genders.

Further, there were some unpredicted strong and statistically significant correlations between MTQ scores and other SCAS subscale scores, particularly panic-agoraphobia, separation anxiety and generalized anxiety. However, the correlations between MTQ scores and SCAS subscales other than the obsessive compulsive subscale were found for the boys only. The reason for this unpredicted gender difference is unclear. Gender differences in anxiety are well-established; for example, normative data on SCAS total and all subscales scores are higher for girls than for boys (Spence, 1998), and this was replicated in the present sample, with statistically significant differences in each case. Yet the authors are not aware of any published data on gender differences in correlations between anxiety and magical thinking. Such differences detected in the present study, if replicable, would merit further attention.

The present results are consistent with the findings by Muris *et al.* (2001) that scores on a questionnaire measure of thought-action fusion (TAF) were significantly correlated with the SCAS obsessive compulsive subscale and some other subscales, in a sample of

non-clinically referred adolescents aged 13–16 years. The present study differs from this previous one in that it covers a broader age range, specifically including younger children, and was focused on magical thinking, not TAF. The TAF construct in models of OCD comprises two distinguishable components: 'TAF-morality', which pertains to the belief that unacceptable thoughts are morally equivalent to overt actions; and 'TAF-likelihood', which refers to the belief that thinking of an unacceptable or disturbing event will increase the probability that it occurs (Muris *et al.*, 2001; Rachman, 1997; Shafran, Thordarson & Rachman, 1996). The MTQ relates more directly to magical thinking, specifically to beliefs that the occurrence of events in reality can be altered by thoughts and actions rationally or causally unconnected to them. The MTQ thought subscale corresponds quite closely to TAF-likelihood, though without the restriction to negative events.

As noted in the introduction, apparent similarities between magical thinking and OCD have often been remarked upon. The present study suggests that they are linked. However, the relation between obsessive compulsion in the general population as measured by the SCAS and OCD generally is unknown. Further research is needed to establish whether individuals whose thinking and behaviour warrants diagnosis of OCD have raised levels of magical thinking, as measured for example by the MTQ. The present results suggest that specificity should be assessed by the use of control groups of individuals with other anxiety disorders, including panic disorder-agoraphobia and generalized anxiety disorder.

To the extent that magical thinking is implicated in OCD, there would be at least two further issues for research. First, there is the set of questions raised in the introduction about whether magical thinking may constitute a resource for coping with high anxiety, and whether in this case OCD in particular represents a coping strategy intended to maintain control. Secondly, the bio-psychological regulators of onset of OCD in childhood and adolescence, most commonly at around 9 years or in early adolescence (Flament *et al.*, 1988; Rasmussen & Tsuang 1986) may involve fluctuating levels of magical thinking.

References

American Psychiatric Association (1994). *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.). Washington DC: American Psychiatric Association.

Astington, J. W. (1993). *The child's discovery of the mind.* Cambridge, MA: Harvard University Press.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*, 191–215.

Bentall, R. P., Claridge, G. S., & Slade, P. D. (1989). The multi-dimensional nature of schizotypal traits: A factor analytic study with normal subjects. *British Journal of Clinical Psychology, 28*, 363–375.

Bolton, D. (1996). Annotation: Developmental issues in obsessive compulsive disorder. *Journal of Child Psychology and Psychiatry, 37*, 131–137.

Bolton, D., & Hill, J. (1996). *Mind, meaning, and mental disorder: The nature of causality explanation in psychology and psychiatry.* Oxford University Press.

Boyer, P. (1997), Further distinctions between magic, reality, religion, and fiction. *Child Development, 68*, 1012–1014.

Bretherton, J., & Beeghly, M. (1982). Talking about internal states: The acquisition of an explicit theory of mind. *Developmental Psychology, 18*, 906–921.

Chandler, M. (1997). Rescuing magical thinking from the jaws of social determinism. *Child Development, 68*, 1021–1023.

Eckblad, M., & Chapman, L. J. (1983). Magical ideation as an indicator of schizotypy. *Journal of Consulting and Clinical Psychology, 51*, 215–225.

Enright, S., & Beech, A. R. (1990). Obsessional states: Anxiety disorders or schizotypes? An information processing and personality assessment. *Psychological Medicine, 20*, 621–627.

Enright, S., Claridge, G. S., Beech, A. R., & Kemp-Wheler, S. M. (1993). A questionnaire study of schizotypy in obsessional states and the other anxiety disorders. *Personality and Individual Differences, 16*, 191–194.

Estes, D., Wellman, H. M., & Woolley, J. D. (1989). Children's understanding of mental phenomena. In H. Reese (Ed.), *Advances in child development and behavior* (pp. 41–86). New York: Academic Press.

Flament, M. F., Whitaker, A., Rapoport, J. L., Davies, M., Berg, C. Z., Kalikow, K., Sceery, W., & Shaffer, D. (1988). Obsessive compulsive disorder in adolescence: An epidemiological study. *Journal of the American Academy of Child and Adolescent Psychiatry, 27*, 764–771.

Flavell, J. H., Green, F. L., & Flavell, E. R. (1986). Development of knowledge about the appearance–reality distinction. *Monographs of the Society for Research in Child Development, 51*(1), Serial No. 212.

Freud, A. (1937). *The ego and the mechanisms of defence*. London: Hogarth Press.

Freud, A. (1965). *Normality and pathology in childhood: Assessments of developments*. New York: International Universities Press; London: Tavistock Press.

Freud, A. (1966). Obsessional neurosis: A summary of psychoanalytic views as presented at the Congress. *International Journal of Psychoanalysis, 47*, 116–122.

Freud, S. (1913/1966). Totem and taboo. In J. Strachey (Ed.), *Standard edition of the complete psychological works of Sigmund Freud* (Vol. 13, pp. 1–62). London: Hogarth Press.

Freud, S. (1919/1955). The 'uncanny'. In J. Strachey (Ed.), *Standard edition of the complete psychological works of Sigmund Freud* (Vol. 17, pp. 217–25. London: Hogarth Press/Institute of Psychoanalysis.

Frost, R. O., Krause, M. S., McMahon, M. J., Peppe, J., Evans, M., McPhee, A. E., & Holden, M. (1993). Compulsivity and superstitiousness. *Behaviour Research and Therapy, 31*, 423–425.

Golomb, C., & Galasso, L. (1995). Make believe and reality: Explorations of the imaginary realm. *Developmental Psychology, 31*, 800–810.

Harris, P. L. (1994). Unexpected, impossible and magical events: Children's reactions to causal violations. *British Journal of Developmental Psychology, 12*, 1–7.

Harris, P. L. (1997). The last of the magicians? Children, scientists, and the invocation of hidden causal powers. *Child Development, 68*, 1018–1020.

Harris, P. L., Brown, E., Marriot, C., Whittal, S., & Harmer, S. (1991). Monsters, ghosts, and witches: Testing the limits of the fantasy–reality distinction in young children. *British Journal of Developmental Psychology, 9*, 105–123.

Heider, F. (1958). *The psychology of interpersonal relations*. New York: Wiley.

Hume, D. (1777/1902). *An enquiry concerning human understanding*. L. A. Selby-Bigge (Ed.), 2nd ed. Oxford: Oxford University Press.

Johnson, C. N. (1997). Crazy children, fantastical theories, and the many uses of metaphysics. *Child Development, 68*, 1024–1026.

Johnson, C. N. (2000). Putting different things together: The development of metaphysical thinking. In K. S. Rosengren, C. N. Johnson, & P. L. Harris (Eds.), *Imagining the impossible: Magical, scientific, and religious thinking in children* (pp. 179–211). Cambridge: Cambridge University Press.

Keinan, G. (1994). Effects of stress and tolerance of ambiguity on magical thinking. *Journal of Personality and Social Psychology, 67*, 48–55.

Langer, E. J. (1975). The illusion of control. *Journal of Personality and Social Psychology, 32*, 311–328.

Leonard, H. L. (1989). Childhood rituals and superstitions: Developmental and cultural perspective. In J. L. Rapoport (Ed.), *Obsessive-compulsive disorder in children and adolescents* (pp. 289–309). Washington, DC: American Psychiatric Press.

Leonard, H. L., Goldberger, E. L., Rapoport, J. L., Cheslow, D. L., & Swedo, S. E. (1990). Childhood ruituals: Normal development of obsessive-compulsive symptoms. *Journal of the American Academy of Child and Adolescent Psychiatry, 29*, 17–23

Lillard, A. (1994). Making sense of pretense. In C. Lewis & P. Mitchell (Eds.), *Children's early understanding of mind: Origins and development* (pp. 211–234). Hove: Earlbaum

Malinowski, B. (1955). *Magic, science, and religion.* New York: Doubleday.

Meltzoff, A. N., and Moore, M. K. (1998). Infants' understanding of people and things: From body imitation to folk psychology. In J. L. Bermddez, A. J. Marcel, & N. Eilan (Eds.), *The body and the self* (pp. 43–69). Cambridge, MA: MIT Press.

Muris, P., Meesters, C., Rassin, E., Merckelbach, H., & Campbell, J. (2001). Thought-action fusion and anxiety disorders symptoms in normal adolescents. *Behaviour Research and Therapy, 39*(7), 843–852.

Neil, G. I. (1982). Demystifying sport superstition. *International Review of Sport Sociology, 17*, 99–124.

Nemeroff, C., & Rozin, P. (2000). The makings of the magical mind: the nature and function of sympathetic magical thinking. In K. S. Rosengren, C. N. Johnson, & P. L. Harris (Eds.), *Imagining the impossible: Magical, scientific, and religious thinking in children* (pp. 1–34). Cambridge: Cambridge University Press.

Persinger, M. A., & Makarec, K. (1990). Exotic beliefs may be substitutes for religious beliefs. *Perceptual and Motor Skills, 71*, 16–18.

Piaget, J. P. (1929). *The child's conception of the world.* London: Routledge & Kegan Paul.

Piaget, J. (1937/1954). *The construction of reality in the child.* (Trans. M. Cook.) New York: Basic Books.

Piaget, J. (1960). *The child's conception of physical causality.* London: Routledge & Kegan Paul.

Pitman, R. K. (1987). A cybernetic model of obsessive-compulsive psychopathology. *Comprehensive Psychiatry, 28*, 334–343.

Pitman, R. K. (1993). Post-traumatic obsessive-compulsive disorder: A case study. *Comprehensive Psychiatry, 34*, 102–107.

Prawat, R. S., Anderson, A. H., & Hapkiewicz, W. (1985). Is the scariest monster also the least real? An examination of children's reality justifications. *Journal of Genetic Psychology, 146*, 7–12.

Rachman, S. (1993). Obsessions, responsibility, and guilt. *Behaviour Research and Therapy, 31*, 149–54.

Rachman, S. (1997). A cognitive theory of obsessions. *Behaviour Research and Therapy, 35*, 793–802.

Rachman, S., & Hodgson, R. (1980). *Obsessions and compulsions.* Englewood Cliffs NJ: Prentice Hall.

Rasmussen, S. A., & Tsuang, M. T. (1986). DSM-III obsessive-compulsive disorder: Clinical characteristics and family history. *American Journal of Psychiatry, 143*, 317–322.

Rosengren, K. S., & Hickling, A. K. (2000). Metamorphosis and magic: The development of children's thinking about possible events and plausible mechanisms. In K. S. Rosengren, C. N. Johnson, & P. L. Harris (Eds.), *Imagining the impossible: Magical, scientific, and religious thinking in children* (pp. 75–98). Cambridge: Cambridge University Press.

Rothbaum, F., & Weisz, J. R. (1988). *Child psychopathology and the quest for control.* New York: Sage.

Russell, J. (1995). At two with nature: Agency and the development of self-world dualism. In J. L. Bermddez, A. J. Marcel, & N. Eilan, (Eds.), *The body and the self* (pp. 127–151). Cambridge, MA: MIT Press.

Salkovskis, P. M. (1985). Obsessive-compulsive problems: A cognitive-behavioural analysis. *Behaviour Research and Therapy, 23*, 571–583.

Samuels, A., & Taylor, M. (1994). Children's ability to distinguish fantasy events from real-life events. *British Journal of Developmental Psychology, 12*, 417–427.

Seligman, M. (1975). *Helplessness: On depression, development, and death*. San Francisco: Freeman.

Shafran, R., Thordarson, D. A., & Rachman, S. (1996). Thought-action fusion in obsessive compulsive disorder. *Journal of Anxiety Disorders, 10*, 379–391.

Spence, S. (1997). Structure of anxiety symptoms among children: a confirmatory factor-analytic study. *Journal of Abnormal Psychology, 106*, 280–297.

Spence, S. (1998). A measure of anxiety symptoms among children. *Behaviour Research and Therapy, 36*, 545–566.

Subbotsky, E. (1997). Explanations of unusual events: Phenomenalistic causal judgements in children and adults. *British Journal of Developmental Psychology, 15*, 13–36.

Subbotsky, E. (2000). Phenomenalistic perception and rational understanding in the mind of an individual: This fight for dominance. In K. S. Rosengren, C. N. Johnson, & P. L. Harris (Eds.), *Imagining the impossible: Magical, scientific, and religious thinking in children* (pp. 35–74). Cambridge: Cambridge University Press.

Tambiah, S. J. (1990). *Magic, science, religion, and the scope of rationality*. Cambridge: Cambridge University Press.

Taylor, S. E. (1983). Adjustment to threatening events. *American Psychologist, 38*, 1161–1173.

Taylor, S. E., Lichtman, R. R., & Wood, J. V. (1984). Attributions, beliefs about control, and adjustment to breast cancer. *Journal of Personality and Social Psychology, 46*, 489–502.

Thomas, K. (1971). *Religion and the decline of magic*. New York: Charles Scribner's Sons.

Vikan, A., & Clausen, S. E. (1993). Freud, Piaget, or neither? Beliefs in controlling others by wishful thinking and magical behavior in young children. *Journal of Genetic Psychology, 154*(3), 297–314.

Weisz, J. R. (1981). Illusory contingency in children at the State Fair. *Developmental Psychology, 17*, 481–489.

Wellman, H. M., & Estes, D. (1986). Early understanding of mental entities: A re-examination of childhood realism. *Child Development, 57*, 910–923.

Werner, H. (1948). *Comparative psychology of mental development*. New York: International Universities Press.

Wittgenstein, L. (1967). *Bemerkungen uber Frazer's* Golden Bough [*Remarks on Frazer's* Golden Bough]. *Synthese, 17*, 233–253.

Woolley, J. D. (1997). Thinking about fantasy: Are children fundamentally different thinkers and believers from adults? *Child Development, 68*, 991–1011.

Woolley, J. D. (2000). The development of beliefs about direct mental-physical causality in imagination, magic, and religion. In K. S. Rosengren, C. N. Johnson, & P. L. Harris (Eds.), *Imagining the impossible: Magical, scientific, and religious thinking in children* (pp. 99–129). Cambridge: Cambridge University Press.

Woolley, J. D., & Phelps, K. E. (1994). Young children's practical reasoning about imagination. *British Journal of Developmental Psychology, 12*, 53–67.

Woolley, J. D., Phelps, K. E., & Davis, D. L. (1995). *Children's beliefs about wishing as a mental and magical process*. Unpublished manuscript, University of Texas.

Woolley, J. D., & Wellman, H. M. (1993). Origin and truth: Young children's understanding of imaginary mental representations. *Child Development, 64*, 1–17.

Zusne, L., & Jones, W. H. (1989). *Anomalistic psychology: A study of magical thinking*. Hillsdale, NJ: Erlbaum.

Received 13 March 2001; revised version received 20 December 2001

Appendix
Magical thinking questionnaire (MTQ)

Please read each question carefully and answer each question as it applies to you by circling 'yes', 'no' or 'maybe'. Please complete all the questions.

1. Is it possible to make tomorrow a sunny day by drawing a picture of the sun?
2. Is it possible for dogs to fly?
3. Is it possible that you could cause a car crash *just* by thinking about it?
4. Is it possible that a friend could get the flu *just because* you argued with them?
5. Is it possible to crash your bicycle by going too fast?
6. Is it possible to make something good happen to you or someone else *just by* thinking about it?
7. Is it possible to do really well at a test at school *just by* crossing your fingers?
8. Is it possible to lose a race just because you lost your lucky mascot or lucky charm?
9. Is it possible for you to get flu *just because* you were rude to your parents?
10. Is it possible for stones to float in water?
11. It is possible that if mummy or daddy is quite ill, you could make them better by thinking or wishing it?
12. Is it possible for snow to melt?
13. Is it possible for a friend to get into trouble with a teacher at school *just because* you were thinking about it?
14. Is it possible to make a rainbow disappear by clicking your fingers?
15. Is it possible to make a bully leave your school *just by* always avoiding walking past their house?
16. Is it possible to burn yourself with cold water?
17. Is it possible to show you are happy by smiling?
18. Is it possible to move an object across a room *just by* thinking about it?
19. Is it possible that you could win a bike in a raffle *just by* thinking really hard of your ticket?
20. Is it possible to make something bad happen by standing on cracks in the pavement?
21. Is it possible to think of a balloon floating in the sky?
22. Is it possible for your mummy or daddy to change their job *just by* you thinking or wishing about it?
23. Is it possible to ride a bicycle with no wheels?
24. Is it possible to make a train run on time *just by* walking up and down the station platform?
25. Is it possible to cause something bad to happen *just by* thinking about it?
26. Is it possible for glass to break?
27. Is it possible to prevent a plane crash *just by* touching wood?
28. Is it possible to prevent an accident *just by* thinking or wishing it?
29. Is it possible to cause an argument between mummy and daddy *just by* thinking about it?
30. Is it possible for you to lift an elephant?