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| WATCHING FILMS WITH MAGICAL CONTENT FACILITATES CREATIVITY
IN CHILDREN¹²

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Summary.—Two experiments examined the possible link between magical thinking and creativity in preschool children. In Experiment 1, 4- and 6-yr.-old children were shown a film with either magical or non-magical theme. Results indicated that the mean scores of children shown the magical film were significantly higher than that of children watching the non-magical film on the majority of subsequent creativity tests, for both age groups. This trend was also found for 6-yr.-olds' drawings of impossible items. In Experiment 2, Experiment 1 was replicated successfully with 6- and 8-yr.-old children. Exposing children to a film with a magical theme did not affect their beliefs about magic. The results were interpreted to accentuate the role of magical thinking in children's cognitive development. Classroom implications of the results were also discussed.

Keywords: Magical thinking, cognitive development, children's creativity, media

Most researchers agree that magical thinking encompasses those ways of acting and reasoning about the physical world that violate known physical principles (Frazer, 1922; Woolley, 1997; Nemeroff & Rozin, 2000; Subbotsky, 2004, 2005). Contrary to scientific views, magical thinking embraces the idea that thoughts, words, and even wishes can produce direct physical effects on inanimate objects. Piaget (1929/1971) provided multiple examples of young children's behavior based on magical thinking (e.g., one boy believed that by saying the proper words he could cause gorgeous birds and butterflies in his father's illustrated manual "to come to life and fly out of the book, leaving holes behind them", p.135). Unlike *ordinary fantasy* (i.e., a child having an imaginary friend or dreaming that his or her mum buys a desired toy), *magical thinking* comprises supernatural events or operations (flying on a broomstick, a person turning into an animal, animals speaking human languages, etc.). As follows from the definition of magical thinking, the key feature of magical thinking is the ability to construct a world that is alternative to the real world. Magical thinking is unfolding whenever a person is involved in some kind of mental processing of supernatural events (i.e., through seeing magical events in a dream, reading a book, or watching a movie with magical content). Another distinction to be made is that between magical thinking and *magical beliefs*. Whereas magical thinking unfolds only in one's imagination (dreams, art, fantasies), the belief in magic implies that magic might have real world effects. In that regard, every person who is watching a movie with magical effects or is having a dream where magical things happen is involved in magical thinking, without necessarily having magical beliefs. The relationship between magical thinking and magical beliefs is therefore unidirectional: one has to be a magical thinker in order to be a believer in magic, but the opposite is not the case (see Subbotsky, 2010, Ch.1 for more on this).

Theoretically, it has been argued that fantasy and play have a major role in making children feel competent and effective and thus promote their cognitive development (White, 1959). By the age of six, most children have seen movies with magical themes and have had books about magical characters read to them. In most families, stories about Santa Claus, the Easter Bunny or the Tooth Fairy are part of normal family life (Prentice, Manosevitz, & Hubbs, 1978; Harris, Brown, Marriott, Whittal, & Harmer, 1991; Clark, 1995; Rosengren & Hickling, 1994; Woolley, 1997). Despite the pervasive nature of magical content, surprisingly little is known about the effects of this content on children's cognitive and social development. It is not known if involvement in magical thinking is a byproduct of cognitive development that occurs coincidentally, or whether it is a necessary stage of development and has to do with learning and communication.

Research on magical thinking has shown that most 4- to 6-yr.-olds entertain magical thinking and magical beliefs in both their actions and verbal judgments (Piaget, 1929/1971; Singer & Singer, 1990; Harris, *et al.*, 1991; Phelps & Woolley, 1994; Subbotsky, 2004, 2005). Thus, when Subbotsky (1985) told 4- to 6-yr.-old children a story involving a magical box that can turn pictures into real objects, the vast majority denied that this could happen in reality. However, when the experimenter left the children alone in the room, 90% used magical commands in an attempt to change the pictures into real objects and were disappointed when they could not make this happen. As this experiment demonstrated, children were trying to achieve a practical result (i.e., making a real golden ring out of the picture of the golden ring) in a novel and unusual way, by chanting a magic spell. This feature—employing novel and counterfactual ways of achieving one's goals—links magical thinking with another construct, *creativity*.

Creativity of realistic thinking is typically defined as the ability to generate “novel behavior that meets a standard of quality and or utility” (Eisenberger, Haskins, & Gambleton, 1999, p. 308). This ability is akin to *divergent thinking*, the ability to solve problems that do not have only one correct answer, but allow for a variety of alternative solutions. Divergent thinking is often seen as a manifestation of creativity (Russ, Robins, & Christiano, 1999; Mouchiroud & Lubart, 2001; Russ & Kaugars, 2001, Smith, 2005). Since the key feature of magical thinking is the ability to construct a world that is alternative to the real world, magical thinking can also be viewed as a simplistic type of divergent thinking. Whereas creativity in realistic thinking provides multiple realistic solutions to realistic problems (i.e., one can move from one place to another by using a car, a train, or a plain), magical thinking provides multiple unrealistic (supernatural) solutions to realistic problems (i.e., one can move from one place to another by using a broomstick, a magic carpet, or on a dragon). The common feature (divergent thinking) makes it possible to expect that engaging children in one of these activities—magical thinking—might enhance the other activity—creativity of realistic thinking, through priming or (and) association.

A common method of assessing creativity in realistic thinking is through divergent thinking measures. Torrance’s Thinking Creatively in Action and Movement Test (TCAM) was designed to measure 4- to 8-yr.-olds’ capacities to show fluency, originality, and imagination in action and thinking (Torrance, 1981). Significant correlations were found between preschool children’s scores on the Thinking Creatively in Action and Movement Test and a modified set of Piaget’s tests which had a variety of alternative solutions (divergent problem solving); however, correlations between Thinking Creatively in Action and Movement Test scores and traditional Piagetian measures, such as conservation of number and mass, which have

one correct answer (convergent problem solving) were not significant (Reisman, Pellegrini, Floyd, Paguio, & Torrance, 1980). Measures of divergent thinking also predicted creative achievements in subsequent years (Plucker, 1999). Creativity is also assessed in the area of imagination, by encouraging children to create nonexistent (impossible) items (Karmiloff-Smith, 1989; Scott & Baron-Cohen, 1996; Leavers & Harris, 1998; Craig & Baron-Cohen, 1999; Matuga, 2004). Make-believe drawing tasks challenge children to alter their familiar methods of drawing real objects and draw alternative versions of these objects. This can be seen as a form of divergent thinking. Such unrealistic alternatives to real objects require something like magical thinking.

Developmental research has shown that exposure to cinema and TV affects children's subsequent behavior (Huston & Wright, 1998; Singer & Singer, 2001). On this basis, it was hypothesized that showing children a film with highly magical content would facilitate the children's magical beliefs and their performance on cognitive tasks requiring creativity.

The aim of Experiment 1 of this study was to examine whether presenting children with a film with magical content will enhance their creativity in realistic thinking and in imagination, and encourage them to score higher on creativity tests than children who have been shown a film without any magical content. A second aim of Experiment 1 was to examine age differences in participants four or six years old. Older children were expected to perform better on creativity measures, based on data showing increased capacities of 5- and 6-yr.-olds to understand false belief and pretence in comparison with 4-year-olds (Lillard, 1998; German & Leslie, 2001). Those capacities are also positively related to divergent thinking (Suddendorf & Fletcher-Flinn, 1999).

The aim of Experiment 2 was to replicate the results of Experiment 1 with an older age range of participants. An additional aim of Experiment 2 was to examine whether exposing children to a film with magical theme, along with promoting their creativity, also affected their magical beliefs.

Experiment 1.

METHOD

Participants

Participants were 4-yr.-old children ($n=25$; $M=4$ yr. 9 mo., range = 4 yr. 0 mo. to 4 yr. 11 mo., $SD=2.6$ mo.) and 6-yr.-old children ($n=27$; $M=6$ yr. 4 mo., range = 5 yr. 11 mo. to 6 yr. 10 mo., $SD=3.1$ mo.). There were 15 boys and 10 girls in the 4-yr.-old group, and 12 boys and 15 girls in the 6-yr.-old group. In the 4-yr.-old group, 13 children saw magical and 12 saw non-magical movies (magical and non-magical conditions). In the 6-yr.-old group, 14 children were in the magical and 13 in the non-magical condition. The children were recruited from the greater London area. They were in the same class at school but came from a variety of ethnic backgrounds. Consent was obtained from parents prior to the experiment. Children themselves were also informed that they could opt-out if they wished to.

Materials

Film clips.— Materials included two 15-min. film clips comprising scenes from the film “Harry Potter and the Philosopher’s Stone,” deemed as having either “magical” or “nonmagical” content. The magical scenes included animals talking, and witches and wizards using wands, performing magic spells and flying on broomsticks. The non-magical film was made up of scenes with the same characters, but these

characters did not mention or display any non-standard behaviors or beliefs.³ Nine judges (scientists, attendants of a seminar of the Laboratory for Comparative Human Cognition at the University of California, San Diego) who were blind to the purpose of the study independently rated film clips on the following scales: magical content (1: Very nonmagical to 5: Very magical), emotional response (1: Neutral to 5: Very positive), pace (1: Very slow to 5: Very fast), and richness in action (1: Very poor to 5: Very rich).⁴ The scales of emotional response, pace and richness in action were chosen on the ground that they were deemed the most likely alternative aspects of the film clips that might affect the viewers' creativity (Filipowitch, 2006). The magical film clip scored significantly higher than the non-magical one on magical content (Wilcoxon $Z = -2.63$, $p < .01$). On the other three scales, the differences between the two films were not significant.

Creativity.—To assess participants' creativity, Torrance's (1981) Thinking Creatively in Action and Movement Test was used. The test, designed for 3- to 8-yr.-olds, is made up of four activities, two requiring plastic cups and a wastepaper bin. The experimenter, who had been trained to use the test, recorded all responses made by the children on a pre-set list of answers in a booklet provided with the test manual.

Children were also asked to complete six drawings of nonexistent objects, and

³ One might argue that using for the non-magical condition the neutral scenes from the Harry Potter film, and with the Harry Potter character in some of these scenes, may serve to prime children to think magically. However, even if simply seeing the known characters in the non-magical film triggered some magical thinking in the viewers, this effect should have happened to a significantly lesser extent than in the viewers who had watched the magical film, since the magical film has been rated by independent judges as significantly more "magical" than the non-magical film. In addition, using fragments from a different movie for the non-magical condition would create a possible confounding factor: the different attractiveness of characters taken from different movies.

⁴ Adults and not children were used as judges on the following grounds. First, a convincing argument has been made that adults are not fundamentally different from children in terms of magical thinking and magical beliefs (Woolley, 1997). Second, adults are a lot more sophisticated and accurate at rating, particularly on the scales such as pace or emotional attractiveness, than are children.

for these, grey and colored pencils were supplied. Children were first asked “Do you know what X (a fruit, a car, a house) is, how it looks?”, and then encouraged to draw a nonexistent X: “Now, I would like you to draw X for me, but not the way X is in reality, but how it would be in a fairy tale where things are funny, crazy, impossible and strange looking, X that could not exist in the real world”. After the drawings were produced, children were asked questions about their drawings (“Why do you think this X is impossible in the real world? How is this X different from other Xs?”), and the experimenter recorded the responses to these questions on pages added to the answer booklets.

Design

The between-subjects variables were Film (magical vs non-magical) and Age (4 and 6 yr.), and the within-subject variable was Time (before and after exposure to the film). The dependent variables were the measures of creativity, assessed using both the Thinking Creatively in Action and Movement Test (fluency, originality and imagination scores) and the children’s drawings and responses to questions about these drawings, rated on “originality” and “unreality” scales.

Procedure

After being randomly assigned to conditions (magical vs non-magical film) and prior to watching the films, children completed pretests individually. The pretests included Activity 1 of the Thinking Creatively in Action and Movement Test, which involves moving across the room in as many different ways as possible. Six-yr.-olds also had to draw two pictures of nonexistent objects (toy and fruit) and answer questions about these prior to watching the films. Since 4-yr.-olds found it difficult to understand the task of drawing a nonexistent object, they were not asked to perform

this task.

After completing the pretests, participants watched the assigned films. After this, the remaining activities from the Thinking Creatively in Action and Movement Test were completed individually. Activity 2 required children to act out six different scenarios, for example, to pretend they were a rabbit or driving a car. Activity 3 involved thinking of different methods of putting plastic cups into a bin, such as balancing them on your head and dropping them in. Activity 4 again used cups, but in this task children were required to think of alternative uses for them, for instance pretending that the cup was a drum. Six-yr.-old children were then asked to draw and answer questions on four further non-existent objects (animal, car, house, and plant). The time between sessions for different children varied within the range of one to three days. Care was taken that in both magical and non-magical film groups equal numbers of children were tested on each of the subsequent days. The entire procedure, although it took place over a number of days, lasted approximately 45 minutes in total.

Scoring

The Thinking Creatively in Action and Movement Test scoring was performed as recommended in the manual. For Activities 1, 3 and 4, the experimenter scored children's responses for Fluency (which was a total number of alternative solutions reported) and Originality (on a scale of 0 to 3, according to the list provided in the manual). Since the weights for all possible responses were pre-set in the manual, the scoring procedure was straightforward: it involved just counting the total number of alternative solutions (Fluency), finding the child's responses in the available list of responses and taking the score weightings assigned to these responses from the list (Originality). This made the scoring reliability check of the aforementioned activities

unnecessary. For Activity 2, responses were scored in only one category, Imagination; the experimenter did the scoring on a scale of 1 to 5 while administering the test, with criteria for each score provided in the manual.⁷ In the pretest, raw scores on Activity 1 were used for the comparisons between baseline performances of children in the control and experimental conditions. Fluency and Originality scores for Activities 3 and 4 were summed. As long as the Thinking Creatively in Action and Movement Test is used for research purposes and not for clinical assessment, raw scores do not need to be converted into standard scores.

On the basis of a sample of items taken randomly from the pool of pictures that the children had produced, a scoring scheme was developed that assessed children's drawings and responses to questions in terms of their "originality" and "nonreality" on a scale between 0: Minimum originality or nonreality and 5: Maximum originality or nonreality. The experimenter and two scorers who were blind to the purpose of the experiment independently assessed children's drawings and responses to questions using the scoring scheme. This produced 36 scores for each child: three scores for Originality and Nonreality for six pictures. The scores were then divided into three categories—low (0 and 1), middle (2 and 3) and high (4 and 5), and the interrater agreements were assessed via Cohen's kappa for each pair of scorers. As long as all of the kappa values were over 0.70, the three scores for each item were averaged, leaving each child with 12 scores: six for Originality and six for Nonreality. The pretest scores for Originality and Nonreality were summed, and the same was done with the scores for the objects that children drew after they watched the films. This resulted in each child having four summary scores: two scores (for Originality and

⁷ Scoring Activity 2 contained the possibility of experimenter bias and should therefore be treated with caution in assessing the results.

Nonreality) assessing the child's performance before they watched the films and two scores (for Originality and Nonreality) assessing the children's performance after they watched the films.

Data Analysis

On those pretest measures' scores that were not normally distributed, the differences between conditions were assessed by nonparametric tests. Two-tailed assessment was used.

RESULTS

Means for summary scores on Thinking Creatively in Action and Movement Test measures taken before and after the children watched the films are shown in Table 1. As the Mann Whitney test indicated, before watching the films (Activity 1), for 4-yr.-olds there were no significant differences between mean scores in the magical and non-magical film conditions, both for the Fluency and for the Originality score. For 6-yr.-olds the differences were not significant either, for the Fluency or Originality scores, respectively. On the pretest scores for drawings, the independent samples *t* test indicated a significant difference between the Magical and Non-magical conditions on the summary Originality scores (Magical: $M = 5.3$, $SD = 2.5$, Non-magical: $M = 2.9$, $SD = 2.3$, $t_{25} = 2.6$, $p < .05$, $d = .9$), with children in the Magical condition having a higher mean score. The difference on the summary Non-reality scores was not significant (Magical: $M = 4.4$, $SD = 2.8$; Non-magical: $M = 2.3$, $SD = 2.8$; $t_{25} = 1.9$, $p = .07$, $d = .7$).

In order to assess the differences between means after watching the films, three two-way ANOVAs were performed for Film (2) x Age (2), with summarized Fluency, Originality and Imagination scores as dependent variables. There were

significant main effects of Film for Fluency ($F_{1,48} = 14.14, p < .001, \eta^2 = .2$), Originality ($F_{1,48} = 21.11, p < .001, \eta^2 = .3$), and Imagination ($F_{1,48} = 73.66, p < .001, \eta^2 = .6$). On all of the dependent variables, children in the Magical film condition had a higher mean score than those in the Non-magical film condition. For Fluency and Originality, there were significant main effects for age ($F_{1,48} = 11.70, p < .01, \eta^2 = .2$ and $F_{1,48} = 9.27, p < .01, \eta^2 = .2$, respectively, with 6-year-olds scoring higher than 4-year-olds). For Imagination, the effect of age was not significant. None of the interaction effects were significant.

The means for summarized scores on drawings after the intervention were compared by the independent samples *t* test. Children in the Magical condition had a significantly higher mean score than those in the Non-magical condition on Originality (Magical, $M = 13.13, SD = 4.9$ and Non-magical, $M = 3.6, SD = 3.5, t_{25} = 5.87, p < .001, d = 2.2$) and Non-reality (Magical, $M = 14.0, SD = 4.0$ and Non-magical, $M = 3.6, SD = 3.4, t_{25} = 7.19, p < .001, d = 2.8$).

DISCUSSION

Before the intervention, there were no significant differences between the Magical and Non-magical film conditions on Thinking Creatively in Action and Movement Test measures for both age groups and, for the 6-yr.-olds, Non-reality scores on the pictures. This suggests that the baseline capacity to perform on creativity tests was about the same in the two conditions. However, after the intervention the group in the Magical film condition performed significantly better on all three measures of Thinking Creatively in Action and Movement Test than the group in the Non-magical film condition. Similarly, after the intervention, the scores of 6-yr.-olds' drawings of nonexistent objects were significantly higher for the

Magical than for the Non-magical film condition. This supports the hypothesis that exposing children to a film with highly magical content would increase their creativity scores.

The expectation about the effect of the age was also supported. As predicted, 4-yr.-olds had significantly lower mean scores than 6-yr.-olds on Fluency and Originality measures of the Thinking Creatively in Action and Movement Test; however, on the Imagination measure they performed as well as the 6-yr.-old group. While the present results indicate the possibility of a magical film clip increasing subsequent creativity in realistic thinking and imagination, there may be alternative explanations. First, it is possible that children in the Magical film condition had been exposed, prior to the experiment, to films with magical content more often than had children in the Non-magical film condition. To some extent, this explanation is grounded in the pretest results: though all but one of the differences between the mean raw scores on the pretests were not significant, all means in the Non-magical film condition were slightly lower than those in the Magical film condition. However, watching the films markedly increased this difference. The most likely explanation of this fact is that exposing the group to the film clip with highly magical content enhanced scores on creativity measures to a significantly greater extent than did exposure to the film clip without magical content.

An alternative explanation may be that the higher post-test performance of the Magical film group is due to differences between the magical and nonmagical film clips other than magical content. For example, studies have indicated that positive emotion increases the number of creative responses (Filipowitch, 2006). Although these studies were only performed with adults and the results were contradictory (sometimes a negative effect of positive mood was observed on creativity), there is

still the possibility that a positive effect of the Magical film on children's creative behavior was achieved because of the greater emotional effect that the magical display had on participants compared with the Non-magical film. However, the experts' assessment of both films indicated that the films did not differ on emotion, pace, or richness in action. In addition, according to some data, showing children a film that is dense in action does not necessarily promote the children's imagination; Huston-Stein, Fox, Greer, Watkins, and Whitaker (1981) reported that showing preschoolers a high action-high violence film with increased visual and sound effects led to a decrease in imaginative fantasy play compared to a low action-low violence film. Thus, probably it was the Magical content of the film that led to the increase in creativity scores.

However, it was not clear from Experiment 1 whether engaging children in magical thinking using a movie with magical content directly affected children's creativity in realistic thinking and imagination or did so indirectly by increasing children's magical beliefs. Since by definition magical thinking is necessary to magical beliefs, showing children a film with magical content may also have affected magical beliefs. In that case, then the relationship between viewing a magical film and creativity could be more complex than an effect of one cognitive process (watching a magical film) on another cognitive process (producing creative responses). There could be a mediating role of increased magical beliefs. In support of this alternative, Principe and Smith (2008) reported that 5- and 6-yr.-olds who strongly believed in the Tooth Fairy gave more complex, creative, and voluminous memory reports of their tooth losses than non-believers, and they also recollected more supernatural occurrences, including actually hearing or seeing the Tooth Fairy. This suggests that increased magical beliefs might facilitate children's creativity. Experiment 2 was

designed to address this possibility and to replicate Experiment 1 in older children.

Experiment 2

METHOD

Participants

Participants were 6-yr.-old children ($n=32$; $M = 6$ yr. 8 mo., range = 6 yr. 0 mo. to 6 yr. 10 mo., $SD = 2.1$ mo.), and 8-yr.-old children ($n=32$; $M = 8$ yr. 7 mo., range = 8 yr. 2 mo. to 8 yr. 11 mo., $SD = 2.6$ mo.). There were 14 boys and 18 girls in the 6-yr.-old group, and 22 boys and 10 girls in the 8-yr.-old group. For both ages, 16 children were in the Magical and 16 children in the Non-magical film condition. The children represented a variety of ethnic backgrounds and came from primary schools in Shropshire, England.

Materials and Measures

Materials were the same as in Experiment 1, with the addition of the Magical Thinking Questionnaire by Bolton, Dearsley, Madronal-Luque, and Baron-Cohen, (2002). The questionnaire comprises 30 items asking whether certain events are possible. Of the 30 items, 10 addressed knowledge of ordinary causal principles and assessed bias for responding “yes;” answers to these questions were not included in the Total score. The other questions addressed the possibility for various magical effects to happen. Responses were rated on a 3- point scale, as suggested by Bolton, et al. (2002), with “yes,” “no,” or “maybe” scored as 2, 0 or 1, respectively.

The Thinking Creatively in Action and Movement Test and pictures were scored as in Experiment 1.

Design

The design was as in Experiment 1. The between-subjects variables were film type and age, and the within-subject variable was time (before and after exposure to

the film). The dependent variables were the measures of creativity, the Thinking Creatively in Action and Movement Test (Fluency, Originality and Imagination scores) and the children's drawings and responses to questions about these drawings, rated on "Originality" and "Non-reality" scales. An additional dependent variable was the Total score on the Magical Thinking Questionnaire.

Procedure

The procedure was as in Experiment 1, except that after participants completed the creativity tests, they were asked to complete the Magical Thinking Questionnaire. As in Experiment 1, in this experiment children in the Magical condition were expected to have significantly higher mean creativity scores than children in the Non-magical condition after the exposure to the film, but not before. Similarly, as in Experiment 1, in this experiment, 8-yr.-olds were expected to generally outperform 6-yr.-olds on the Torrance creativity test.

No specific hypothesis about the effect of the film with magical content on children's magical beliefs was proposed, since some research suggests that children's beliefs in magic can be affected by watching magical effects that children are unable to explain (Chandler & Lalonde, 1994; Subbotsky 2004). On the other hand, unlike magical thinking, which is rooted in children's imaginations, magical beliefs are based on more stable psychological grounds, such as parental attitudes, education, and children's own experience with physical events (see Rosengren & Hickling, 1994; Subbotsky, 2004). It was thought unlikely, therefore, that exposing children to a single film with magical content would affect children's magical beliefs. In contrast to experiments that presented children with "real" magical effects (Chandler & Lalonde, 1994; Subbotsky 2004), in this experiment children were presented with a movie.

Since children are taught to perceive the Harry Potter movie as a fantasy, it is less likely that they would start to believe in magical events after watching the movie.

RESULTS

According to the Mann Whitney test, before the intervention, for the 6-yr.-olds, there were no significant differences between children's performances on Activity 1 in the Magical and Non-magical film conditions (see Table 2). The differences were not significant in the 8-yr.-old group either. On the pretest scores for drawings, for 6 yr.-olds, the independent samples *t* test indicated no significant difference between mean scores of the groups viewing Magical and Non-magical films (see Table 3). In the 8-yr.-old group, in 3 of 4 comparisons the Magical film group scored significantly lower than the Non-magical film group (Table 3).

Three two-way ANOVAs were performed for Film (2) \times Age (2) with summary Fluency, Originality and Imagination scores after watching the film as dependent variables. The analyses indicated significant main effects of film for Fluency ($F_{1,60} = 15.68, p < .001, \eta^2 = .21$), Originality ($F_{1,60} = 22.11, p < .001, \eta^2 = .27$), and Imagination ($F_{1,60} = 21.82, p < .001, \eta^2 = .27$). On all of the dependent variables, the group of children in the Magical film condition had a higher mean score than those in the Non-magical film condition. There was no significant effect for age, nor was there a significant interaction between the age and film.

The means for summary scores on drawings children produced after watching the films were compared by an independent samples *t* test (see Table 4). Six-year-olds in the Magical film condition had a significantly higher mean score than those in the Non-magical film condition on both measures, but there were no significant differences between the Magical and Non-magical film conditions for 8-yr.-olds.

Finally, an independent samples *t* test compared magical beliefs scores (see Table 4). No significant main or interaction effects were found.

DISCUSSION

The results of Experiment 2 supported the results of Experiment 1. As predicted, exposing children to a film with magical content increased their performance on the Torrance creativity test to a significantly larger extent than exposing children to a film with no magical content. This effect was observed in both 6- and 8-year-old children.

A similar facilitative effect of the magical content on children's creativity was seen on the drawings test. In 6-yr.-olds, the Magical and Non-magical film groups scored equally on both the Originality and Non-reality measures before they watched the film; after they watched the film, the Magical film group scored significantly higher than the Non-magical film group on both measures. In 8-yr.-olds, before the exposure to the film, the Non-magical film group scored significantly higher than the Magical film group on three out of four measures of drawing creativity; after watching the film, the group that saw magical film scored similarly to the group that saw a film with non-magical content, eliminating the significant differences in creativity scores of drawings.

Exposing children to the film with magical content did not, however, affect their magical beliefs scores. This supports the assumption that magical beliefs are distinct from magical thinking: whereas magical thinking is a phenomenon of children's imagination, magical beliefs are embedded in their education and personal experience with physical reality. It is, therefore, possible to affect creativity of realistic thinking and imagination by showing children a movie with magical content, but their magical beliefs were not affected. The results therefore support the hypothesis that exposure to

the film with magical content affected children's creative performance directly, without the mediating link of altering magical beliefs.

GENERAL DISCUSSION

Altogether, the findings of Experiments 1 and 2 provided support for the main hypothesis of this study that showing children a magical display promotes divergent thinking and subsequently increases creativity. This places magical thinking in the broader context of children's cognitive development, linking it with the development of creative thinking and imagination. Rather than being a mere byproduct of cognitive development that accompanies "mainstream" development and can occasionally be used for entertainment, magical thinking can be viewed as an additional source of development of imagination and divergent thinking in children. Along with other domains that promote the development of children's imagination—play and symbolic function (Piaget, 1937/1962; Vygotsky, 1999)—magical thinking enables children to create fantastic imaginary worlds, and in this way enhances children's capacity to view the world and act upon it from multiple perspectives (Woolley, 1997; Harris, 2000; Subbotsky, 2010).

The findings of this experiment modify some aspects of our understanding of children's cognitive development and could have educational implications. Teachers sometimes use magical content in the classroom to enhance interest and increase engagement in the material. The research reported in this paper was the first attempt to systematically study whether there are educational benefits of exposing children to magical content. The results suggested that books and videos about magic might serve to expand children's imagination and help them to think more creatively, at least in children of younger ages and as far as divergent thinking tasks are concerned.

REFERENCES

- Bolton, D., Dearsley, P., Madronal-Luque, R., & Baron-Cohen, S. (2002). Magical thinking in childhood and adolescence: Development and relation to obsessive compulsion. *British Journal of Developmental Psychology*, 20, 479–494.
- Clark, C. D. (1995). *Flights of fancy, leaps of faith: children's myths in contemporary America*. Chicago: Univ. of Chicago Press.
- Craig, J., & Baron-Cohen, S. (1999). Creativity and imagination in autism and Asperger's syndrome. *Journal of Autism and Developmental Disorders*, 29, 319-326.
- Eisenberger, R., Haskins, F., & Gambleton, P. (1999). Promised reward and creativity: effects of prior experience. *Journal of Experimental Social Psychology*, 35, 308–325.
- Filipowitch, A. (2006). From positive affect to creativity: the surprising role of surprise. *Creativity Research Journal*, 18, 141-152.
- Frazer, J. G., Sir. (1922). *The golden bough*. New York: Macmillan.
- German, T. P., & Leslie, A. M. (2001). Children's inferences from 'knowing' to 'pretending' and 'believing' *British Journal of Developmental Psychology*, 19, 59–83.
- Harris, P. L. (2000). *The work of the imagination*. Malde, Massachusetts: Blachwell.
- Harris, P. L., Brown, E., Marriott, 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.
- Huston, A. C., & Wright, J. C. (1988). Mass media and children's development. In W. Damon (Gen. Ed.), I. E. Sigel, & K. A. Reninger (Vol. Eds.), *Handbook of*

- child psychology: Vol.4. Child psychology in practice.* New York: Wiley. Pp. 999-1058.
- Huston-Stein, A., Fox, S., Greer, D., Watkins, B.A., & Whitaker, J. (1981). The effects of TV action and violence on children's social behaviour. *The Journal of Genetic Psychology*, 138, 183-191.
- Karmiloff-Smith, A. (1989). Constraints on representational change: evidence from children's drawing. *Cognition*, 34, 57-83.
- Leevers, H. J., & Harris, P. L. (1998). Drawing impossible entities: a measure of the imagination in children with autism, children with learning disabilities, and normal 4-year-olds. *Journal of Child Psychology and Psychiatry*, 39, 399-410.
- Lillard, A. S. (1998). Wanting to be it: children's understanding of intentions underlying pretence. *Child Development*, 69, 981-993.
- Matuga, J. M. (2004). Situated creative activity: the drawings and private speech of young children. *Creativity Research Journal*, 16, 267-281.
- Mouchiroud, C., & Lubart, T. (2001). Children's original thinking: an empirical examination of alternative measures derived from divergent thinking tasks. *The Journal of Genetic Psychology*, 162, 382-401.
- Nemeroff, C. & Rozin, P. (2000). The making 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*. Cambridge, UK: Cambridge Univer. Press. Pp.1-34.
- Phelps, K. E., & Woolley, J. D. (1994). Young children's practical reasoning about imagination. *British Journal of Developmental Psychology*, 12, 53-67.
- Piaget, J. (1937/1962). *Play, dreams, and imitation in childhood*. (C. Gattegno and F. M. Hodgson, Transl.), New York: Norton.

- Piaget, J. (1929/1971). *The child's conception of the world*. London: Routledge & Kegan Paul.
- Plucker, J. A. (1999). Is the proof in the pudding? Reanalyses of Torrance's (1958 to present) longitudinal data. *Creativity Research Journal*, 12, 103-114.
- Prentice, N. M., Manosevitz, M., & Hubbs, L. (1978). Imaginary figures of early childhood: Santa Claus, Easter bunny, and the tooth fairy. *American Journal of Orthopsychiatry*, 48, 618-628.
- Principe, G.F., & Smith, E. (2008). Seeing things unseen: Fantasy belief and false reports. *Journal of Cognition and Development*, 9, 89-111.
- Reisman, F. K., Pellegrini, A. D., Floyd, B., Paguio, L., & Torrance, E. P., (1980). Performance on Torrance's thinking creatively in action and movement as a predictor of cognitive development. Unpublished research report, Department of Early Childhood and Elementary Education, Univer. of Georgia. Cited in Torrance, E. P. (1981). *Thinking creatively in action and movement*. Bensenville, IL: Scholastic Testing Service.
- Rosengren, K. S., & Hickling, A. K. (1994). Seeing is believing: children's explorations of commonplace, magical and extraordinary transformations. *Child Development*, 65, 1605-1626.
- Russ, S. W., & Kaugars, A. S. (2001). Emotion in children's play and creative problem solving. *Creativity Research Journal*, 13, 211-219.
- Russ, S. W., Robins, A. L., & Christiano, B. A. (1999) Pretend play: longitudinal prediction of creativity and affect in fantasy in children. *Creativity Research Journal*. 12, 129-139.

- Scott, F. J., & Baron-Cohen, S. (1996). Imagining real and unreal things: evidence of a dissociation in autism. *Journal of Cognitive Neuroscience*, 8, 371-382.
- Scott, F. J., Baron-Cohen, S., and Leslie, A. (1999). If pigs could fly: a test of counterfactual reasoning and pretence in children with autism. *British Journal of Developmental Psychology*, 17, 349-362.
- Singer, D. L., & Singer, J. (1990) *The house of make-believe*. Cambridge, MA: Harvard Univer. Press.
- Singer, D, & Singer, J. (Eds.)(2001). *Handbook of children and the media*. Thousand Oaks, CA: Sage.
- Smith, G. J. W. (2005). How should creativity be defined? *Creativity Research Journal*, 17, 293–295.
- Subbotsky, E. V. (1985). Preschool children's perception of unusual phenomena. *Soviet Psychology*, 23, 91-114.
- Subbotsky, E. V. (2004). Magical thinking in judgements of causation: Can anomalous phenomena affect ontological causal beliefs in children and adults? *British Journal of Developmental Psychology*, 22, 123–152.
- Subbotsky, E. (2005) The permanence of mental objects: testing magical thinking on perceived and imaginary realities. *Developmental Psychology*, 41, 301-318.
- Subbotsky, E. (2010). *Magic and the mind. Mechanisms, functions and development of magical thinking and behavior*. New York: Oxford University Press.
- Suddendorf, T., & Fletcher-Flinn, C. M. (1999). Children's divergent thinking improves when they understand false belief. *Creativity Research Journal*, 12, 115-128
- Torrance, E. P. (1981). *Thinking creatively in action and movement*. Bensenville, IL: Scholastic Testing Service.

- Vygotsky, L. S. (1999). Tool and sign in the development of the child. In *The collected works of L. S. Vygotsky. Volume 6: scientific legacy*. New York: Kluwer/Plenum. Pp.3-68.
- White, R.W. (1959). Motivation reconsidered: The concept of competence. *Psychological Review*, 66, 297-333.
- Woolley, J. D. (1997). Thinking about fantasy: are children fundamentally different thinkers and believers from adults? *Child Development*, 68, 991-1011.

Table 1.

Means and *SDs* of summarised scores on Thinking Creatively in Action and Movement Test before and after watching the film in Experiment 1, as a function of Film (Magical vs. Non-magical) and Age (4 vs. 6 yr.)

Measure	Pre-film				Pre-film Diff (U)	Post-film				Post-film Diff (F)
	Non-magical		Magical			Non-magical		Magical		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
4-yr olds										
Fluency	4.5	1.6	6.5	2.9	43	6.2	2.61	14.00	5.84	123.4**
Originality	2.8	2.8	5.2	5.5	52	7.25	4.99	22.46	8.56	28.7**
Imagination						15.83	3.64	24.69	3.47	38.8**
6-yr olds										
Fluency	8.5	4.4	12.6	9.8	69.5	13.23	8.00	22.71	12.25	5.6*
Originality	10.31	12.5	15.3	15.6	78.5	16.38	10.25	37.21	23.45	8.7**
Imagination						14.00	4.74	24.40	4.10	37.0**

* $p < .05$. ** $p < .01$.

Table 2.

Means and *SDs* of summarised scores on Thinking Creatively in Action and Movement Test before and after watching the film in Experiment 2, as a function of Film (Magical vs. Non-magical) and Age (6 vs. 8 yr.)

Measure	Pre-film				Pre-film Diff (U)	Post-film				Post-film Diff (F)
	Non-magical		Magical			Non-magical		Magical		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
6-yr olds										
Fluency	6.3	1.8	6.1	2.1	114	9.69	4.23	13.06	4.84	4.4*
Originality	1.37	1.4	2.62	3.0	105	8.69	5.16	15.00	6.79	8.76**
Imagination						17.00	2.65	21.56	4.09	13.95**
8-yr olds										
Fluency	5.75	1.8	6.63	2.2	91.5	8.25	3.53	12.81	3.23	14.54**
Originality	1.19	1.6	2.75	2.4	80	8.25	5.52	16.37	6.89	13.53**
Imagination						18.75	3.82	22.69	3.80	8.52**

* $p < .05$. ** $p < .01$.

Table 3.
Means and SDs of scores for drawings before watching the film in Experiment 2, as a function of Film (Magical vs. Non-magical) and Age (6 vs. 8 yr.)

Measure	Non-magical		Magical		Diff. <i>t</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
6-yr olds					
Toy Originality	3.9	2.6	5.9	3.1	-2.55
Toy Non-existence	5.6	2.5	5.4	2.6	.27
Fruit originality	2.7	1.9	4.2	2.4	-1.96
Fruit Non-existence	2.4	2.1	3.2	2.4	.4
8-yr olds					
Toy Originality	6.7	1.9	3.9	2.7	3.36**
Toy Non-existence	5.8	1.5	3.7	1.5	4.05**
Fruit Originality	5.5	2.4	5.1	2.8	.39
Fruit Non-existence	5.4	2.4	3.5	2.0	2.37*

* $p < .05$. ** $p < .01$.

Table 4.
Means and *SDs* of summarised scores for drawings and mean scores and *SDs* of magical beliefs after watching the film in Experiment 2, as a function of Film (Magical vs. Non-magical) and Age (6 vs. 8 yr.)

	Non-magical		Magical		Diff. <i>t</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
6-yr olds					
Drawings Originality	21.7	4.7	29.0	5.0	-4.27**
Drawings Non-existence	21.3	6.5	25.5	5.0	-2.05*
Magical beliefs	9.6	8.8	15.4	12.9	-.1.48
8-yr olds					
Drawings Originality	26.9	5.5	27.6	8.0	.3
Drawings Non-existence	25.4	7.8	26.6	6.0	.5
Magical beliefs	13.6	8.7	16.3	10.9	-.78

* $p < .05$. ** $p < .01$.