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Good day for Leos:

Horoscope's influence on perception, cognitive performances, and creativity

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## **Highlights**

- Reading positive vs. negative horoscope increases positive interpretation of events.
- Reading positive vs. negative horoscope increases cognitive performance.
- Reading positive vs. negative horoscope increases creativity.
- The effect of horoscope is stronger for people with low internal locus of control.

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**Abstract**

Do people treat horoscopes as mere entertainment, or does reading horoscopes have more substantial consequences? Building upon research on the expectancy effect as well as on literature highlighting the influence of astrology on individuals, we hypothesized that reading positive versus negative horoscopes would affect people's perceptions, emotions, cognitions, and creativity. Across three experiments, reading positive versus negative astrological forecasts increased positive interpretation of ambiguous events (Experiment 1,  $N = 195$ ), cognitive performance (Experiment 2,  $N = 189$ ), and creativity (Experiment 3,  $N = 193$ ). Furthermore, positive (versus negative) horoscopes decreased negative emotions among people who believe in astrology and the effects of horoscopes on cognitive performances and creativity were stronger among people with a low internal locus of control. Opening newspapers and searching for daily horoscopes have more consequences than one may initially think.

Keywords: Horoscope, astrology, creativity, perception, cognition

### **Good day for Leos:**

#### **Horoscope's influence on perception, cognitive performances, and creativity**

“I don't believe in astrology; I'm a Sagittarius and we're skeptical.” — Arthur C. Clarke

“So few people admit to belief in astrology, but I am yet to meet anyone who doesn't know their star sign.” — Pamela K. Shaw

“We should take astrology seriously. No, I don't mean we should believe in it. I am talking about fighting it seriously instead of humoring it as a piece of harmless fun.”  
— Richard Dawkins

### **1. Introduction**

In the course of history, it has always been common for people to believe in astrology and other paranormal occurrences; these beliefs have in turn shaped how people behave. While modern people seem to reject magical beliefs, in fact, when measured via subtle techniques, some people do still endorse magical beliefs (Rozin & Nemeroff, 1990). In present day Europe, around 30% of people report that they believe in astrology (Boy, 2002) and 25% of Americans believe that the stars and planets influence their lives (Gallup, 2005). Nearly every day, millions of people read their daily horoscopes. It seems quite automatic and harmless to open a magazine and search for your Zodiac.

Nevertheless, as illustrated in the above quotes, whereas most people do not report believing in astrology, people do know their star sign and are exposed to astrology on a daily basis. Is reading horoscopes merely an entertainment or does it have more important implications for the way people will think or behave? In this paper, we aim to gain more insight into the possible impact of daily horoscopes on perception, emotions, creativity, and cognitive performances. The exposure to horoscopes, compared to mere positive or negative

stimuli (i.e. newspaper articles), might be especially pronounced and specific since it constitutes predictions about personal destiny and affects individual's expectancies. We hypothesized that an exposure to positive or negative horoscopes might influence, either positively or negatively (depending on the horoscope content), people's emotions, creativity, cognitive performances, and interpretation of ambiguous situations. These effects could go beyond merely priming positivity or negativity in individuals. Further, we investigate how the effect of horoscopes might be moderated by individual dispositions.

### **1.1. Expectancy effect: How horoscope influences people's lives**

The particularly strong effect of people's expectations on various domains such as perception, cognitive performance, emotion, or health, has been widely documented (Brief, Butcher, George, & Link, 1993; Carver, Blaney, & Scheier, 1979; Palmer, 1975; Wilson & Klaaren, 1992). For instance, prior positive (or negative) expectations about a food product have been found to increase (or decrease) the liking of the taste and the visual appeal of the product, thereby directly modifying the visual and sensorial perception of the product (e.g., Lee, Frederick, & Ariely, 2006; McClure et al., 2004; Yeomans, Chambers, Blumenthal, & Blake, 2008). Individuals' internalized expectations regarding their own performances have also been shown to boost or dampen objective cognitive performances. Indeed, classical work about expectations in the classroom has underlined how negative expectations about students' performances dampen their ulterior cognitive performances and even creativity (Rosenthal, Baratz, & Hall, 1974). This effect, known as the Pygmalion effect (Rosenthal & Jacobson, 1968), works as a self-fulfilling prophecy (Henshel, 1993; Merton, 1948) since a false definition of a situation (e.g., teacher's negative expectancies) is internalized and evokes behaviors that make the prophecy true (e.g., student produces bad performances). Although some questions remain open regarding the strength of the effect of teachers' expectancies on

students' performances, it seems clear that when students internalize these expectations the expectancy effect is stronger (Jussim & Harber, 2005).

Other studies in the context of disadvantaged minority groups showed how stereotypes (e.g., women are not good at math) create expectations (e.g., women will perform poorly at a mathematical test), which can be internalized by the target of stereotypes and, in turn, affect their cognitive performances (e.g. a woman performs poorly at a mathematical test thereby confirming the stereotype; Cadinu, Maass, Frigerio, Impagliazzo, & Latinotti, 2003; Schmader, Johns, & Forbes, 2008; Stangor, Carr, & Kiang, 1998). Negative and positive expectations about performances on a given task have indeed been consistently found to dampen or boost task performance (Atkinson, 1964; Bandura, 1977; Carver et al., 1979; Eccles, 1994). Finally, expectations have also been shown to modulate people's affective experience. For instance, when participants are told they will see a funny cartoon or film, they tend to experience more enjoyment when looking at the cartoon or film than participants who did not have this expectation (Klaaren, Hodges, & Wilson, 1994; Wilson, Lisle, Kraft, & Wetzel, 1989).

Horoscopes are particularly susceptible to consciously or unconsciously shape individuals' expectations. While it is not empirically proven that the position of planets has any influence (Dean, Mather, & Kelly, 1996), people continue to read horoscopes and may be affected in some way by their content. Surprisingly, little research has directly investigated the incidence of horoscopes on human behavior and cognition. One study has suggested that people's perceptions of their personality may be affected by what they read in horoscopes (Van Rooij, 1994). Moreover, in a study from Fichten and Sunerton (1983), when participants were presented with different profiles for each sign of the Zodiac, they tended to feel that the profile given for their own sign was the most similar to their personality. In the same vein, research found that people tend to match events they recently experienced with their

astrological forecasts (Glick, Gottesman, & Jolton, 1989; Munro & Munro, 2000; Tyson, 1982). This finding suggests that people are willing to match their lives with the content of their daily horoscope. Is it then the case that after reading their horoscope, people act or think in a way that creates this matching effect? We may consider that after reading their daily horoscope, people unconsciously form certain expectations regarding their upcoming day and will interpret events or behave consistently with their expectations. The expectancy effect accounts for how predictions become true; not through magic, but because people act and think consistently with the prediction.

### **1.2. The moderating influence of individual dispositions**

Horoscopes might influence people differently, according to their individual dispositions, and may not create equally powerful expectations for every individual. First, personality traits and more precisely, neuroticism has been found to interact with expectations. Individuals higher in neuroticism have been found, for instance, to respond better (higher performances) to a caffeine placebo when they believed they had actually received caffeine (e.g., Beedie, Foad, & Coleman, 2008). Furthermore, Fichten and Sunerton (1983) highlighted the influence of personality on believing in astrology. Individuals with high level of neuroticism were indeed found to consult their horoscope more often and to believe more strongly in astrology. This higher susceptibility to the expectancy effect and astrology among individuals high in neuroticism is probably due to their higher need for control (Irwin, 2000).

Second, individuals' locus of control may also play an important role in moderating the impact of daily horoscopes and related expectations. Astrology partly owes its success to the fact that it meets people's basic need for control (Sosis, Strickland, & Haley, 1980). Askevis-Leherpeux (1989) showed that believing that any factor will affect the destiny of the individual increases perceived control. Participants who experienced a lack of control are

therefore more likely to rely on horoscopes (Wang, Whitson, & Menon, 2012). Because astrological influences on behavior are outside the self, it stands to reason that people with an internal locus of control, who feel they control their own destinies, might be less susceptible to effects of reading horoscopes. Snyder and Larson (1972) indeed found that low internal locus of control was related with the acceptance of general personality descriptions found in astrology.

Finally, another potential source of moderation in the effect of expectations on attitudes and behavior is the credibility of the expectancy induction (Raudenbush, 1984). It is indeed more likely for individuals to develop strong expectations about their day, their performance, or the taste of a product when the information comes from a trustworthy, credible, and reliable source. Following this line of thoughts, it is reasonable to posit that individuals who strongly believe in astrology should take the information provided in their horoscope more seriously and judge it as more credible. Consequently, we investigated whether the extent to which individuals believe in astrology moderates the impact of reading horoscopes. To conclude, it seems particularly important to consider the role of neuroticism, locus of control, and beliefs in astrology in the potential impact of horoscopes on daily life.

### **1.3. The present research**

The main aim of this manuscript is to elucidate through three experimental studies whether and for whom astrological forecasts actually influence cognitions and daily life experiences. The impact of daily horoscopes on interpretation of ambiguous situations and emotions (Experiment 1), cognitive performance (Experiment 2), and creativity (Experiment 3) will be investigated. Indeed, on a daily basis, individuals are exposed to scenes and events that they automatically process and interpret, they experience various emotional states, and they are required to perform tests (i.e. mathematical, logical, or verbal tests), to solve problems, and to be creative (especially students). Does exposure to horoscope modulate how

individuals perceive and interpret events, the performances on an upcoming mathematical test, or the creativity during a problem solving task students may be confronted with? These questions will be examined in the present experiments. In addition, the role of relevant individual dispositions in moderating the horoscopes' effects will be investigated (i.e., neuroticism, locus of control, and beliefs in astrology).

## 2. Experiment 1

In the first experiment, the potential impact of horoscope reading on perception and emotions was investigated. After reading and summarizing their daily horoscopes (either positive or negative in valence), participants were asked to interpret pictures depicting ambiguous situations that may be interpreted as negative or positive. Furthermore, participants completed an emotion scale. In order to control for the mere positivity or negativity effect, two additional conditions including positive or negative news (found in newspapers) were added. Finally, personality, locus of control, and belief in astrology were measured since these individual dispositions may interact with the manipulation.

### 2.1. Method

#### 2.1.1. Participants.

Participants ( $N = 196$ ; 87% women) were French-speaking students in a Belgian University (96% from Belgium; 4% from France, Canada, and Luxemburg) who took part to the study in exchange for course credit. The study was advertised as investigating the ability to process written information and to summarize its content. Participants self-identified as Catholic (44%), atheist (35%), agnostic (15%), or "other" (6%, none of the major monotheistic religions). Mean age was 20.6 ( $SD = 2.0$ ).

#### 2.1.2. Material and Procedure.

**2.1.2.1. Summary task.** When entering the lab, participants were randomly assigned to one of the five experimental conditions and were asked to summarize a short text (around 10-

15 lines) in one or two sentences. Depending on the condition, the short texts presented were either a negative or a positive (in term of valence) horoscope (positive and negative horoscope conditions), a text involving a positive or negative news article taken from newspapers (positive and negative control conditions), or a technical text explaining the beer brewing process (neutral control condition)<sup>1</sup>. For instance, participants in the positive horoscope conditions produced text summaries such as “*Everything is in my favor today; My day will prove to be positive and I'll be happy*” or “*There will be something amazing for me; All the health, work and money will be positive; Nothing could go wrong*”. In contrast, participants in the negative horoscope condition wrote summaries like “*I'm basically going to fail at something and be very unhappy*” or “*It's going to be an awful day, filled with negative outcomes and unfortunate circumstances*”. In the two horoscopes conditions, participants were told that in order to make the task funnier, the short text to summarize would be their daily horoscope. They were then invited to pick the horoscope corresponding to their Zodiac sign. In order to ensure that the positive and negative news were similar in valence to the positive and negative horoscopes, their valence was pretested among a separate group of 25 French-speaking participants. The participants were asked to rate the valence of the four short texts (news and horoscopes) from  $1 = \text{very negative}$  to  $7 = \text{very positive}$ . As expected, the valence of the positive news text ( $M = 6.12, SD = .86$ ) and horoscope ( $M = 6.50, SD = .71$ ) as well as the valence of the negative news text ( $M = 1.73, SD = .78$ ) and horoscope ( $M = 1.85, SD = .73$ ) did not significantly differ (respectively,  $t[25] = -1.68, p = .106$  and  $t[25] = 0.65, p = .523$ ).

**2.1.2.2. Ambiguous situations.** After the summary task, five pictures depicting ambiguous situations were presented to the participants. The five pictures (i.e. a man crying in the arms of a women, a hand grasping a fallen wallet on the floor) were previously pre-tested among another sample of students ( $N = 20$ ) to be ambiguous ( $M > 4$  on a  $1 = \text{not ambiguous}$

to 7 = *totally ambiguous* Likert scale). The situations were ambiguous because the man could have been crying from joy or sadness, and the wallet could be seen as either being stolen or found. Participants were invited to imagine what was truly happening on the picture. Two independent coders (condition-blinded) rated participants' answers on a Likert scale ranging from 1 = *negative interpretation* to 7 = *positive interpretation* (inter-judge agreement ranging from  $r_s = .77$  to  $.94$ ,  $p_s < .01$ ). For each situation, judges' ratings were averaged to create a unique score of interpretation valence. For instance if a participant's interpretation of the picture of a man crying in women's arms (i.e., "A man just received very bad news and his wife comforts him") is rated "2" by the first judge and "3" by the second judge, the mean score for this participant will be "2.5". Finally, a general score of participants' interpretation of the ambiguous situations' was created by averaging the scores across the five situations. Across conditions, the ambiguous situations ratings was normally distributed ( $D = .498 - .924$ ,  $p = .940 - .360$ ).

**2.1.2.3. Emotions.** Participants were then asked to complete a short questionnaire including the PANAS to measure positive and negative emotionality (20 items; Watson, Clark, & Tellegen, 1988). Satisfactory reliability was found for the positive ( $\alpha = .84$ ) and negative ( $\alpha = .89$ ) emotions subscales. Positive and negative emotions were normally distributed across conditions ( $D = .534 - 1.130$ ,  $p = .938 - .152$ ).

**2.1.2.4. Individual dispositions.** After completing a distraction task (neutral words-search puzzle), we measured individual differences on (1) personality traits ( $r_s$  ranging from .26 to .63 for each dimension) using the Ten Item Personality Inventory (FTIPI; Gosling, Rentfrow, & Swann, 2003), (2) locus of control ( $\alpha_s$  ranging from .58 to .68 for each dimension), using the 24-item Levenson's (1981) scale, and (3) belief in astrology using a single item (7-point Likert scale for all measures). One-way analyses of variance (ANOVA) revealed no significant differences between conditions for neuroticism and belief in astrology

but participants in the positive horoscope condition were higher in internal locus of control than participants in the negative horoscope and text conditions,  $\eta^2 = .07$ ,  $F(4,191) = 3,756$ ,  $p = .006$ .

## 2.2. Results

Means, standard deviations, as well as mean differences for the interpretation of ambiguous events and emotions, broken down by condition, are detailed in Table 1. In this study, we followed a two-folded analytical strategy. As a first step, one-way analyses of covariance (ANCOVAs) and post-hoc comparisons (Tukey's HSD) were run to make sure that only the horoscopes conditions had significant effects on the variables of interest in the predicted direction while the control positive and negative texts did not significantly differ from the neutral condition. Once the confounding effect of positive and negative texts was discarded, multiple regressions were used to (1) test for the effect of positive and negative horoscope conditions on the variables of interest and (2) test for a possible interaction between individual dispositions and horoscope conditions. Because we had clearly defined a priori hypotheses, we followed the suggestion made by Abelson and Prentice (1997) and used contrasts to code for conditions that described the hypothesized rank ordering of the means. More specifically, since we hypothesized that people exposed to a negative horoscope would interpret ambiguous events more negatively, report more negative emotions, and report less positive emotions while people exposed to a positive horoscope should rate ambiguous pictures more positively, report less negative emotions, and report more positive emotions, a contrast reflecting this expected ordering of the means was created (-1 = negative horoscope condition; 0 = neutral; 1 = positive horoscope condition). Subsequently, the effect of this contrast of interest (-1, 0, 1) was tested in multiple regressions for each dependent variable as well as the interaction between this contrast and individual dispositions (i.e., belief in astrology, locus of control, and personality). Contrast analyses have been shown to provide

greater statistical power than ANOVAs without increasing the type 1 error rate when the researcher has a clear a priori hypothesis regarding the effect of conditions (Abelson & Prentice, 1997; Buckless & Ravenscroft, 1990; Cohen, Cohen, West, & Aiken, 2003). One-way analyses of covariance (ANCOVAs) and post-hoc comparisons (Tukey's HSD) showed significant differences between conditions (controlling for age and gender entered as covariates in the model) for the interpretation of ambiguous situations (see Table 1). Participants who summarized their positive horoscope interpreted ambiguous situations more positively compared with participants in the neutral control condition. Similarly, the interpretations of ambiguous pictures made by the participants exposed to their negative daily horoscope were significantly more negative compared with the neutral control condition. As expected, no difference was found between the control condition and the positive or negative news conditions. Nevertheless, no main effect of conditions on emotions was found.

[INSERT TABLE 1]

Subsequently, contrast analyses were run to test for (1) the specific effect of horoscope conditions, and (2) the possible interaction between individual dispositions and horoscope reading. According to Abelson and Prentice (1997), a contrast that described the hypothesized rank ordering of the means was created (Contrast 1: -1, 0, 1; corresponding respectively to the negative horoscope, the neutral, and the positive horoscope condition) and compared with an orthogonal one (Contrast 2: 1, 2, -1). Results would be considered consistent with the theoretical prediction when two conditions were satisfied: the contrast of interest was significant and the orthogonal contrast was not significant. Three multiple moderated regressions, one on the interpretation of ambiguous events, one on positive emotions, and one on negative emotions, were conducted. Each of them included the two contrasts, three moderators (i.e., belief in astrology, internal locus of control, and neuroticism), and the interactions of the latter with the contrasts as predictors. As expected given the previous

ANCOVA analyses, a main effect of the horoscope conditions (Contrast 1) was found on the interpretation of ambiguous events,  $R^2 = .23$ ,  $\beta = .48$ ,  $t(2,110) = 5.79$ ,  $p < .001$ , 95% CI [.22, .56], indicating that participants in the negative horoscope condition interpreted ambiguous situations more negatively than participants in the control conditions while participants in the positive horoscope condition tended to interpret ambiguous situation more positively (see Figure 1). No interaction effect between the conditions, belief in astrology, internal locus of control, or neuroticism was found.

[INSERT FIGURE 1]

No main effect of horoscope conditions was found on positive and negative emotions but a significant interaction was found between Contrast 1 and belief in astrology in predicting negative emotions,  $R^2 = .14$ ,  $\beta = -.18$ ,  $t(5,107) = -1.99$ ,  $p = .050$ , 95% CI [-.26, .00]. A simple slope analysis (illustrated in Figure 2) revealed that reading horoscopes had no effect on negative emotions among participants who do not believe in astrology (one SD above the mean),  $\beta = .07$ ,  $p = .585$ , 95% CI [-.15, .27]. However, reading a positive horoscope versus a negative horoscope decreased negative emotions among believers in astrology (one SD below the mean),  $\beta = -.31$ ,  $p = .025$ , 95% CI [-.51, -.03]. No other interaction effect between the conditions and the predicted moderators was found.

[INSERT FIGURE 2]

### 2.3. Discussion

In line with our hypothesis, the exposure to positive versus negative horoscopes influenced how people interpreted ambiguous situations. After reading positive/negative horoscopes, participants tended to interpret ambiguous situations more positively/negatively. As expected, this effect is not due to mere positivity versus negativity since the exposure to positive and negative news did not produce the same effects. Furthermore, individuals who believed more strongly in astrology reported less/more negative emotions after reading a

positive/negative horoscope. The effects of reading horoscopes seems then to apply to the entire sample even if people who strongly believe in astrology are more influenced by horoscopes in the emotional domain.

### **3. Experiment 2**

The aim of Experiment 2 was to investigate whether the effect of horoscopes reading extend to cognitive performances. We tested whether the exposure to positive and negative horoscopes affect participants' performance on cognitive tests used to evaluate IQ. In this second experiment, participants completed an online survey following a similar procedure to Experiment 1. In order to ensure that participants were only affected by horoscopes of their own sign, two additional conditions including positive or negative horoscopes from another sign were added. Finally, as in Experiment 1, personality, locus of control, and belief in astrology were measured.

#### **3.1. Method**

##### **3.1.1. Participants.**

Prior to the analyses, non-US citizens ( $N = 3$ ), Muslims ( $N = 10$ ), and students in mathematics ( $N = 76$ ), since numerical tasks were used, were excluded. Muslims were excluded since astrology and horoscopes are proscribed in Islam. Participants ( $N = 189$ ; 76% women) were students from an American university (100% from United States) who took part in the online study in exchange for course credit. The study was advertised as a research study on information processing and cognition. Participants self-identified as Protestants (30%), Catholics (20%), atheist (8%), agnostic (11%), or "other" (no major religious group, 31%). Mean age was 18.5 ( $SD = 1.2$ ). When taking part in the experiment online, participants were randomly assigned to one of five conditions.

##### **3.1.2. Material and Procedure.**

**3.1.2.1. Summary task.** Participants were randomly assigned to one of the five experimental conditions and were asked to summarize a short text (around 10-15 lines) in one or two sentences. In addition to the control text, negative horoscope, and positive horoscope conditions (similar to Experiment 1), some participants were also invited to summarize a daily horoscope from another Zodiac sign than their own (positive and negative other sign conditions). As expected, participants used first person personal pronouns when summarizing horoscopes from their own Zodiac (similar to examples provided in Experiment 1) while they used third person pronouns when summarizing horoscopes of other Zodiac signs.

**3.1.2.2. Cognitive performance.** After the summary task, participants were asked to complete three different tests designed to assess numerical, non-verbal, and verbal cognitive performance: (1) ten Aros number series (Thurstone, 1938), (2) five Raven's progressive matrices (Raven, Court & Raven, 1998), (3) and seven verbal analogies (Miller, 1960). For more information about the tasks and the correct answers, please refer to the supplementary material. For each item, the correct answers were coded 1 (versus 0 for a wrong or missing answer) and added to obtain a score on each scale. Finally, since a factorial analysis revealed the existence of a single factor explaining 56.5% of the observed variance (factor loading > .726), a general mean score of cognitive performance was computed out of the three sub-scores (average of each score Z-transformed). Across conditions, cognitive performance was normally distributed ( $D = .730 - 1.02$ ,  $p = .660 - .241$ ).

**3.1.2.3. Individual dispositions.** After completing a distraction task (neutral words-search puzzle), individual differences in (1) personality traits using the Ten Item Personality Inventory, with two items for each Big Five subscale ( $r$ s ranging from .30 to .74) (TIPI; Gosling, Rentfrow, & Swann, 2003), (2) loci of control ( $\alpha$ s ranging from .55 to .81), using the 24-item Levenson's (1981) scale, and (3) beliefs in astrology using a single item (7-point Likert scale for all measures) were finally measured. One-way analyses of variance

(ANOVA) revealed no significant differences between conditions for neuroticism, internal locus of control, or belief in astrology.

### 3.2. Results

Means, standard deviations, as well as mean differences controlling for age and gender for the measures of cognitive performance are reported by condition in Table 2. We followed an identical two-folded analytical strategy as described in Experiment 1. First, one-way analyses of covariance (ANCOVAs) and post-hoc comparisons (Tukey's HSD) showed significant differences between conditions for the general cognitive performance measures (see Table 2). In general, individuals exposed to a positive horoscope from their own sign tend to show greater cognitive performances compared to participants who summarized their negative daily horoscope. As expected, we did not find a significant and consistent effect of the exposure to horoscopes from another sign.

[INSERT TABLE 2]

Similarly to Experiment 1, multiple regression analyses using contrast to code for conditions (see contrasts used for Experiment 1) were performed. First, as illustrated in Figure 3, we confirmed that participants in the positive horoscope condition presented better cognitive performances than participants in the negative horoscope condition, participants in the control condition falling in the middle,  $R^2 = .07$ ,  $\beta = .26$ ,  $t(2,123) = 3.05$ ,  $p = .003$ , 95% CI [.07, .34]. Distinctly by task, contrast analyses revealed a significant effect of horoscope conditions on the Aros number series performance,  $R^2 = .08$ ,  $\beta = .26$ ,  $t(2,123) = 3.01$ ,  $p = .003$ , 95% CI [.09, .43], the Raven matrices task,  $R^2 = .05$ ,  $\beta = .23$ ,  $t(2,213) = 2.63$ ,  $p = .010$ , 95% CI [.06, .46], but not the verbal analogies,  $R^2 = .01$ ,  $\beta = .09$ ,  $t(2,213) = 0.98$ ,  $p = .327$ , 95% CI [-.10, .30]. Finally, when testing for a potential moderator role of individual dispositions, the internal locus of control significantly interacted with the readings of horoscopes in predicting cognitive performances,  $R^2 = .09$ ,  $\beta = .18$ ,  $t(5,118) = 1.90$ ,  $p = .049$ ,

95% CI [.01, .39]. Reading positive versus negative horoscopes increased cognitive performances for individuals with low internal locus of control (one SD below the mean),  $\beta = .43$ ,  $p = .002$ , 95% CI [.15, .49] but not for participants with high internal locus of control (one SD above the mean),  $\beta = .06$ ,  $p = .602$ , 95% CI [-.12, .21]. No other interaction effect was found.

[INSERT FIGURE 3]

### **3.3. Discussion**

As in Experiment 1, the reading of daily horoscope seems to have an overall impact on cognitive performances. People who read positive compared to negative horoscopes tend to perform better in cognitive tasks. Unlike Experiment 1, the belief in astrology does not interact with the exposure to horoscopes. Nevertheless, horoscope readings had a greater influence on cognitive performances for people displaying low internal locus of control. No interaction between priming and personality traits was found. Finally, the effect of horoscopes seems to mainly occur when participants are exposed to the horoscope of their own sign and not when reading horoscopes presented as applying to people with other astrological signs.

## **4. Experiment 3**

In this last experiment, the effect of positive versus negative horoscopes on creativity was investigated. Participants were invited to complete an online survey following a similar procedure to Experiments 1 and 2. Because Experiments 1 and 2 showed no significant effect of positive vs. negative news or horoscopes for other signs, participants in Experiment 3 were only assigned to three conditions (control, positive, and negative horoscopes). Finally, in line with the previous experiments, personality, locus of control, and belief in astrology were also measured.

### **4.1. Method**

#### **4.1.1. Participants.**

Prior to the analyses, Muslims ( $N = 7$ ) were excluded from the sample as in Experiment 2. Participants ( $N = 193$ ; 68% women) were English-speaking adults (100% from the United States) who took part in an online study in exchange for course credit. The study was advertised as research investigating information processing and logical reasoning. When taking part in the online experiment, participants were randomly assigned to one of three conditions. Participants self-identified as Catholics (32%), agnostic (17%), atheist (12%), Protestants (7%), Buddhists (2%), or “other” (no major religious group, 30%). Mean age was 21.4 ( $SD = 3.2$ ).

#### **4.1.2. Material and Procedure.**

**4.1.2.1. Summary task.** Participants were randomly assigned to one of the three experimental conditions and were asked to summarize a short text (around 10-15 lines) in one or two sentences. Depending on the conditions, participants had to summarize a neutral text (control condition), a positive horoscope, or a negative horoscope that matched their specific zodiac sign (positive vs. negative horoscope conditions).

**4.1.2.2. Creativity.** Two distinct tasks were used to assess creativity. Participants were first invited to complete 12 remote associate problems (RAT; Mednick, 1962). For each item, three words were presented and participants are asked to generate a fourth word. The generation of this associated word requires creative thought. For each correct answer, participants received one point and a total score was then computed. Subsequently, participants were asked to solve the Duncker's candle problem (Duncker, 1945). The score for this task was dummy-coded (1 = success; 2 = failure). A general score for creativity for each participant was then computed as the mean of the two sub-scores (average of the two scores after being standardized). Across conditions, creativity was normally distributed ( $D = .760 - 1.05$ ,  $p = .611 - .221$ ).

**4.1.2.3. Individual dispositions.** As in the previous experiments, participants completed additional measures of personality ( $r$ s ranging from .30 to .82 for the two items going into each dimension), locus of control ( $\alpha$ s ranging from .54 to .77), and belief in astrology. One-way analyses of variance (ANOVA) revealed no significant differences between conditions for neuroticism, internal locus of control, and belief in astrology.

## 4.2. Results

Means, standard deviations, as well as mean differences for the creativity tasks, separated by condition, are detailed in Table 3. One-way analyses of covariance (ANCOVAs) and post-hoc comparisons (Tukey's HSD) showed significant differences between conditions (controlling for age and gender entered as covariates in the model) for the two tasks designed to capture creativity (see also Table 3). Participants who summarized their positive horoscope demonstrated higher creativity than participants in the control or in the negative horoscope conditions. The creativity scores did not significantly differ between participants exposed to a neutral text or to their negative daily horoscope, even if the mean scores were in the hypothesized direction.

[INSERT TABLE 3]

Furthermore, similar contrast analyses to Experiments 1 and 2 were run. As expected (see Figure 4), participants who read a positive horoscope presented higher creativity scores than participants in the neutral conditions while participants who read a negative horoscope obtained lower scores,  $R^2 = .10$ ,  $\beta = .31$ ,  $t(2,190) = 4.44$ ,  $p < .001$ , 95% CI [.15, .40]. In addition, a significant interaction was found between conditions (Contrast 1) and the internal locus of control,  $R^2 = .14$ ,  $\beta = -.15$ ,  $t(5,187) = -2.13$ ,  $p = .034$ , 95% CI [-.36, -.01]. The simple slope analysis revealed that reading horoscopes had no effect on creativity among participants who displayed a strong internal locus of control (one SD above the mean),  $\beta = .15$ ,  $p = .123$ , 95% CI [-.04, .31]. However, reading positive horoscope versus negative horoscopes

increased creativity among participants with low level of internal locus of control (one SD below the mean),  $\beta = .45$ ,  $p < .001$ , 95% CI [.24, .57]. No other interaction effect was found.

[INSERT FIGURE 4]

### **4.3. Discussion**

In this last experiment, exposure to positive versus negative horoscopes was found to increase overall creativity. Whereas the effect of horoscope reading on creativity seems to be independent of personality traits, belief in astrology and the extent to which participants displayed an internal locus of control matters. Similarly to Experiment 2, the exposure to positive/negative horoscopes increases/decreases creativity mainly among people with low internal locus of control.

## **5. General Discussion**

Across three experiments, reading horoscopes produced consistent effects. Participants reading their respective bogus positive or negative horoscopes showed differences in subsequent tasks. Reading positive (versus negative) horoscopes made participants interpret ambiguous stimuli positively (or negatively), perform better (or worse) on a cognitive test, and display greater (or poorer) creativity. The exposure to horoscopes was found to interact with the internal locus of control in predicting cognitive performances and creativity. People who generally explain events as being due to their own efforts and skills are less influenced by daily horoscopes, probably because they are less likely to rely on faith or destiny. Furthermore, reading horoscopes was found to affect negative emotions only among participants who believe in astrology. In sum, whereas reading positive or negative horoscopes seem to affect everybody to a certain extent, it seems to affect to a greater extent people who believe in astrology and with lower internal loci of control. Importantly, these effects of positive or negative horoscope reading were not present after reading other positive or negative news that one may typically find in the same magazine or newspaper. In addition,

these effects did not extend to reading *any* horoscope (i.e., horoscope of another Zodiac sign) but were restricted to one's own horoscope. It seems clear then that reading a horoscope is not a task that produces mere entertainment, but actually affects people's cognitions and performance.

As put forth in the introduction, expectation effects (e.g., Jussim & Harber, 2005) provide one plausible explanation for the present results. Because horoscopes provide information about how one's day will look like, expectations can be formed and surreptitiously influence actual thoughts, feelings, and behaviors. The present studies provide initial evidence that horoscopes represent another source of expectations along with the more studied topics of stereotypes and teacher's evaluations. Future research should unpack the mechanisms of this effect and explore additional pathways through which reading horoscopes may indirectly influence people. For example, regarding cognitive performance, a positive horoscope may provide the extra boost of confidence necessary to perform well on a mathematical test. Regarding creativity, positive horoscopes may place people in a good mood, which has been found to support creativity (Isen). More generally, past research has found that self-verification processes, i.e., people's basic desire to confirm their self-concepts (Swann, 1987), represent one mechanism of self-fulfilling prophecies (Madon et al., 2008). By virtue of changing the reader's self-views, horoscope reading can alter the reader's outcomes (see for a review, Madon, Willard, Guyll, & Scherr, 2011). Interestingly, the present results suggest that, overall, positive horoscopes drove the effects, suggesting that people are more ready to match their cognitions and performances with positive predictions versus negative ones.

Nevertheless, the studies have several limitations. First, the effects, despite being significant, were overall small ( $\eta^2 = .05-.17$ ). This is probably due to the non-naturalistic character of the studies (either in the lab or online). Second, we did not control for the time of

the day that participants were completing the study. One may indeed expect a greater effect of reading daily horoscopes in the morning since they provide predictions about the rest of the day. Third, whereas the online surveys used in Experiments 2 and 3 ensured a double-blind design, the experimenter in the lab (Experiment 1) did know whether participants were assigned to a horoscope condition or not (in order to ask for the Zodiac sign) but was unaware of the positivity or negativity of the horoscope.

Since millions of individuals are confronted with their horoscopes on a regular basis, a better understanding of horoscopes' influence on people's lives is essential. Surprisingly, very few studies have explored this. Across the present experiments, the actual incidence of horoscopes on perception, cognitive performance, emotions, and creativity is explored for the first time. Furthermore, the possible impact of individual differences has been investigated. For these reasons, we think the experiments presented are of a high practical interest, since according to our results, one should now pay attention to reading an horoscope before engaging in mathematical exercises or creative problem solving tasks. Horoscopes indeed influence our performances, even among present day Americans and Europeans who might be thought to be more scientifically minded and less subject to superstitions. The aim of this paper is not to provide evidence that astrology is real since the horoscopes used were created internally and have no real predictive value. Our main point is that people who are led to believe that their circumstances will be good, will actually make these positive circumstances happen.

**Footnotes**

<sup>1</sup>The material used in all the described experiments is available in a supplementary file.

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Table 1

*Means, Standard Deviations, and Between-Condition Comparisons of Interpretation of Ambiguous Pictures and Emotions (Experiment 1)*

	Horoscop <sup>-</sup> <sub>a</sub>	Negative <sub>b</sub>	Neutral <sub>c</sub>	Positive <sub>d</sub>	Horoscop <sup>+</sup> <sub>e</sub>	Mean differences		
	<i>N</i> = 39	<i>N</i> = 39	<i>N</i> = 39	<i>N</i> = 41	<i>N</i> = 38	$\eta^2$	<i>F</i> (6, 188)	<i>p</i>
	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )			
Interpretation	3.42 <sub>bce</sub> (0.7)	3.75 <sub>ae</sub> (0.6)	3.78 <sub>ae</sub> (0.4)	3.72 <sub>e</sub> (0.4)	4.13 <sub>abcd</sub> (0.5)	.17	9.80**	.000
Positive emotions	4.45 (1.2)	4.19 (0.9)	4.10 (0.8)	4.13 (0.8)	4.06 (0.9)	.02	1.09	.333
Negative emotions	1.84 (1.0)	1.81 (0.9)	1.81 (0.9)	1.81 (0.9)	1.62 (0.7)	.01	0.85	.356

*Note.* The letter symbols indicate the statistically significant (Tukey's HSD post hoc test,  $p < .05$ ) differences between the conditions a-e.

\*\* $p < .01$ .

Table 2

*Means, Standard Deviations, and Between-Condition Comparisons of Cognitive Performance Tests (Experiment 2)*

	Horoscop <sup>-a</sup>	Other sign <sup>-b</sup>	Neutral <sup>c</sup>	Other sign <sup>+d</sup>	Horoscop <sup>+e</sup>	Mean differences		
	<i>N</i> = 42	<i>N</i> = 28	<i>N</i> = 43	<i>N</i> = 36	<i>N</i> = 41	$\eta^2$	<i>F</i> (6, 183)	<i>p</i>
	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )			
Number suits	4.52 <sub>e</sub> (1.3)	4.93 (1.8)	4.70 (1.1)	4.67 (1.9)	5.39 <sub>a</sub> (1.5)	.04	1.98+	.100
Raven Matrix	3.17 <sub>e</sub> (1.6)	3.12 (1.6)	3.65 (1.4)	3.03 <sub>e</sub> (1.7)	4.00 <sub>a</sub> (1.3)	.06	2.93*	.022
Language test	4.38 (1.6)	4.41 (2.1)	4.61 (1.6)	4.67 (1.3)	4.71 (1.3)	.01	0.66	.662
Cognitive performance	-0.15 <sub>e</sub> (0.7)	-0.11 (0.8)	0.03 (0.6)	-0.9 (0.7)	0.26 <sub>a</sub> (0.6)	.05	2.45*	.048

*Note.* The letter symbols indicate the statistically significant (Tukey's HSD post hoc test,  $p < .05$ ) differences between the conditions a-e.

+ $p = .10$ . \* $p < .05$ .

Table 3

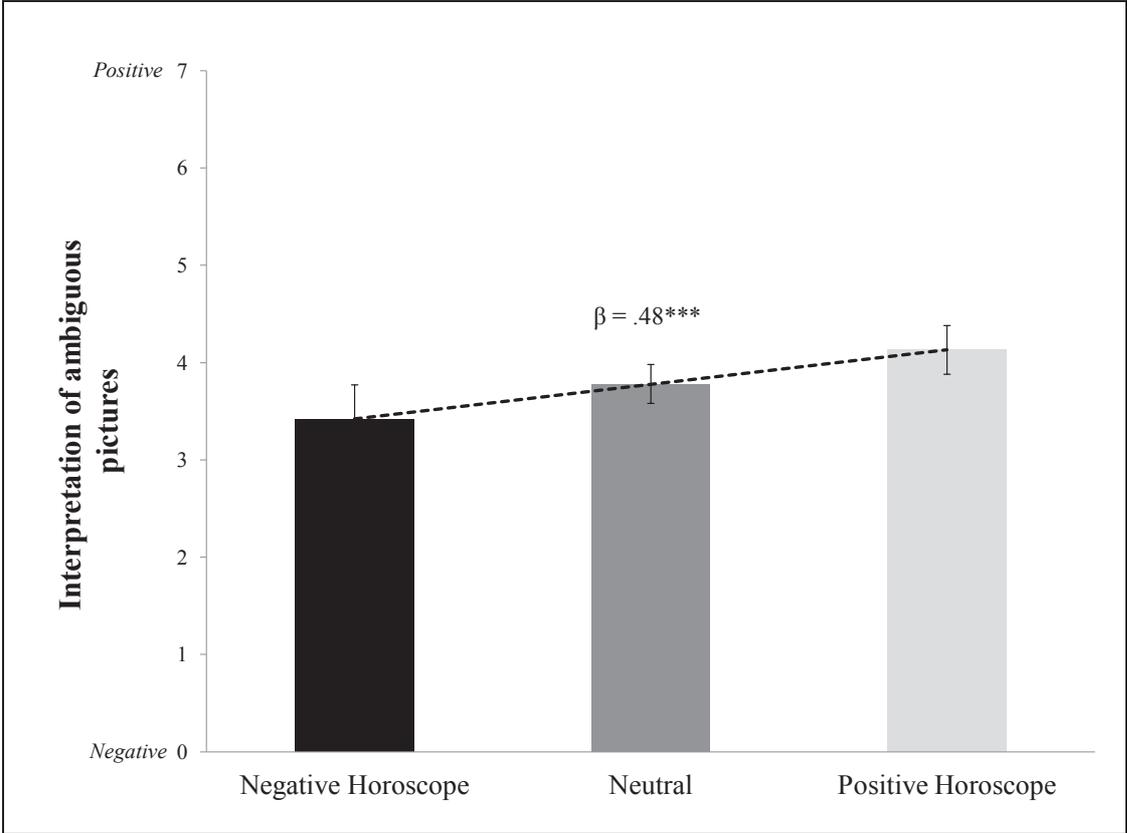
*Means, Standard Deviations, and Between-Condition Comparisons of Creativity Measures (Experiment 3)*

	Horoscop <sup>-</sup> <sub>a</sub>	Neutral <sub>b</sub>	Horoscop <sup>+</sup> <sub>c</sub>	Mean differences		
	<i>N</i> = 63	<i>N</i> = 65	<i>N</i> = 65	$\eta^2$	<i>F</i> (6, 188)	<i>P</i>
	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )			
RAT score	4.16 <sub>c</sub> (3.2)	5.4 (3.1)	6.12 <sub>a</sub> (3.6)	.06	6.19**	.002
Candle task	0.35 <sub>c</sub> (0.5)	0.37 <sub>c</sub> (0.5)	0.61 <sub>ab</sub> (0.5)	.06	6.20**	.002
General creativity	-0.26 <sub>c</sub> (0.7)	-0.06 <sub>c</sub> (0.6)	0.29 <sub>ab</sub> (0.7)	.10	10.7**	.000

*Note.* The letter symbols indicate the statistically significant (Tukey's HSD post hoc test,  $p < .05$ ) differences between the conditions a-c.

\*\* $p < .01$ .

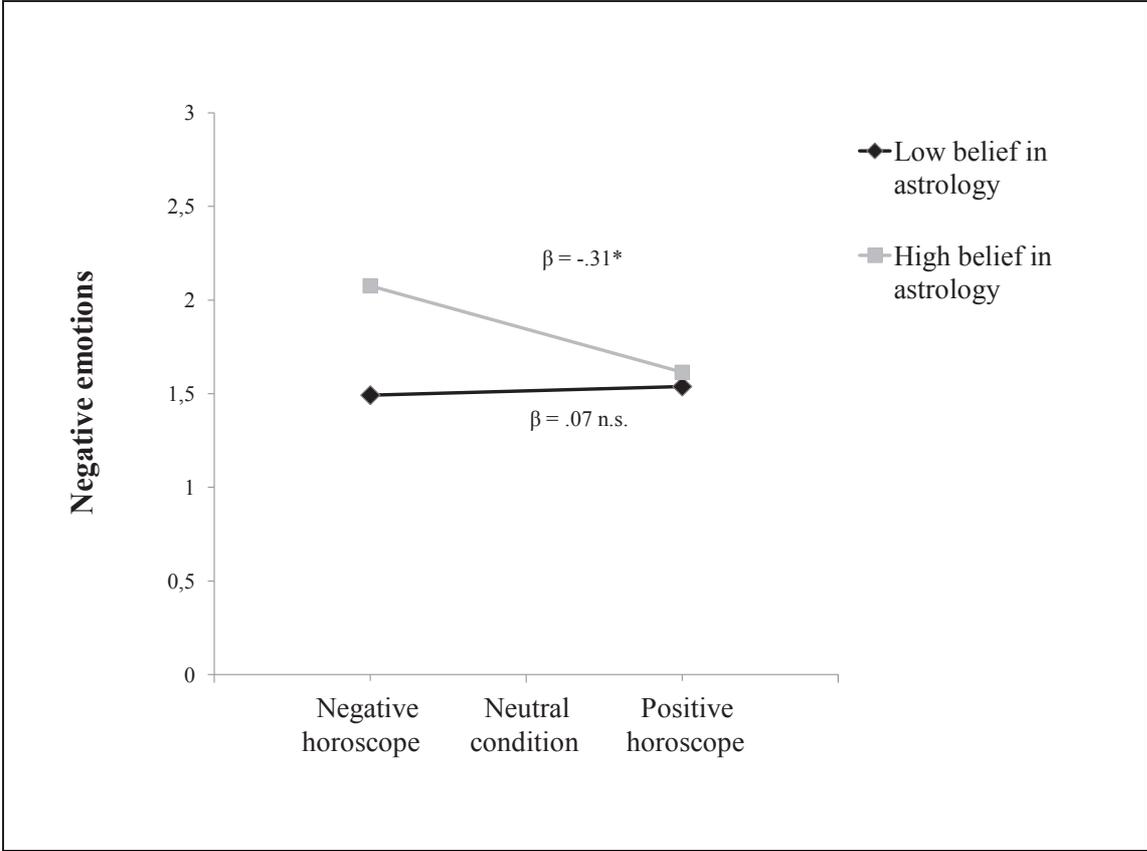
Figure 1. Reading positive vs. negative horoscope increases positive interpretation of ambiguous pictures.



Note. Numbers represent standardized regression coefficients.

\*\*\* $p < .001$ .

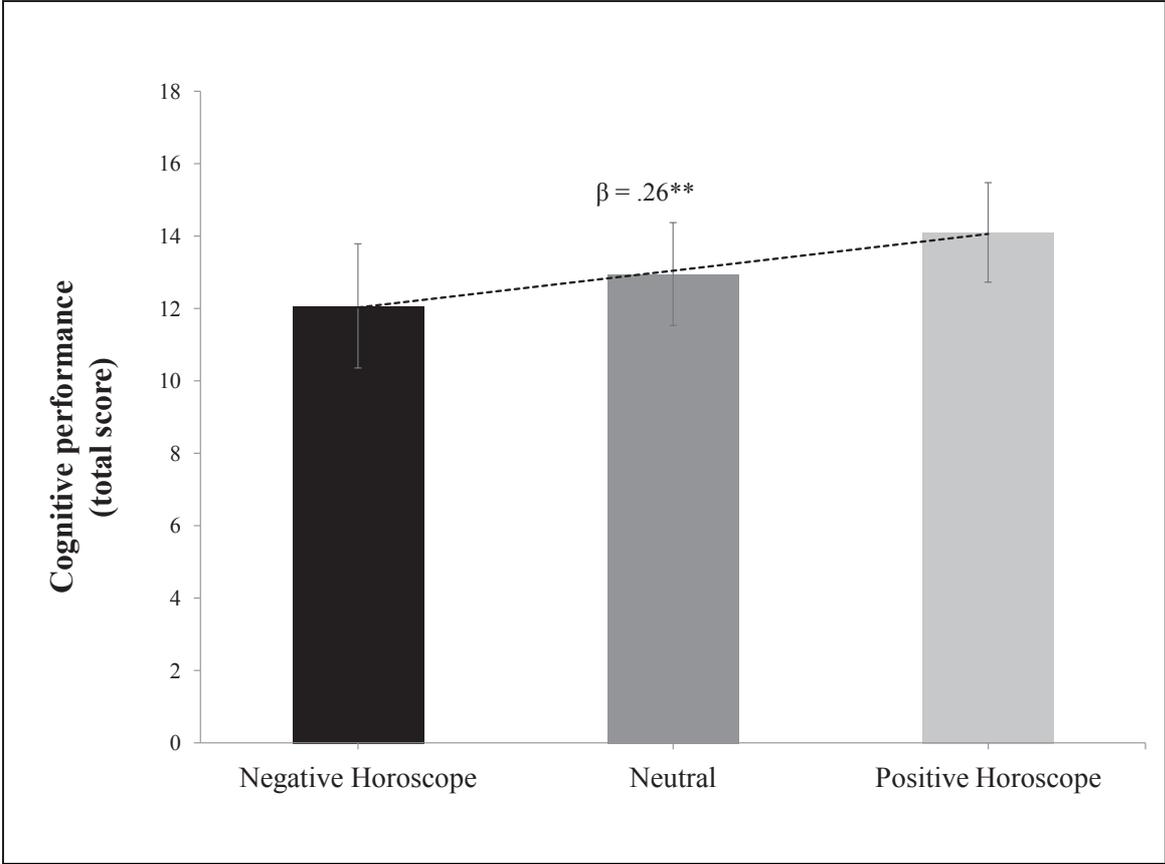
Figure 2. Reading positive vs. negative horoscope decrease negative emotions for people who believe in astrology.



Note. Numbers represent standardized regression coefficients.

\* $p < .05$ .

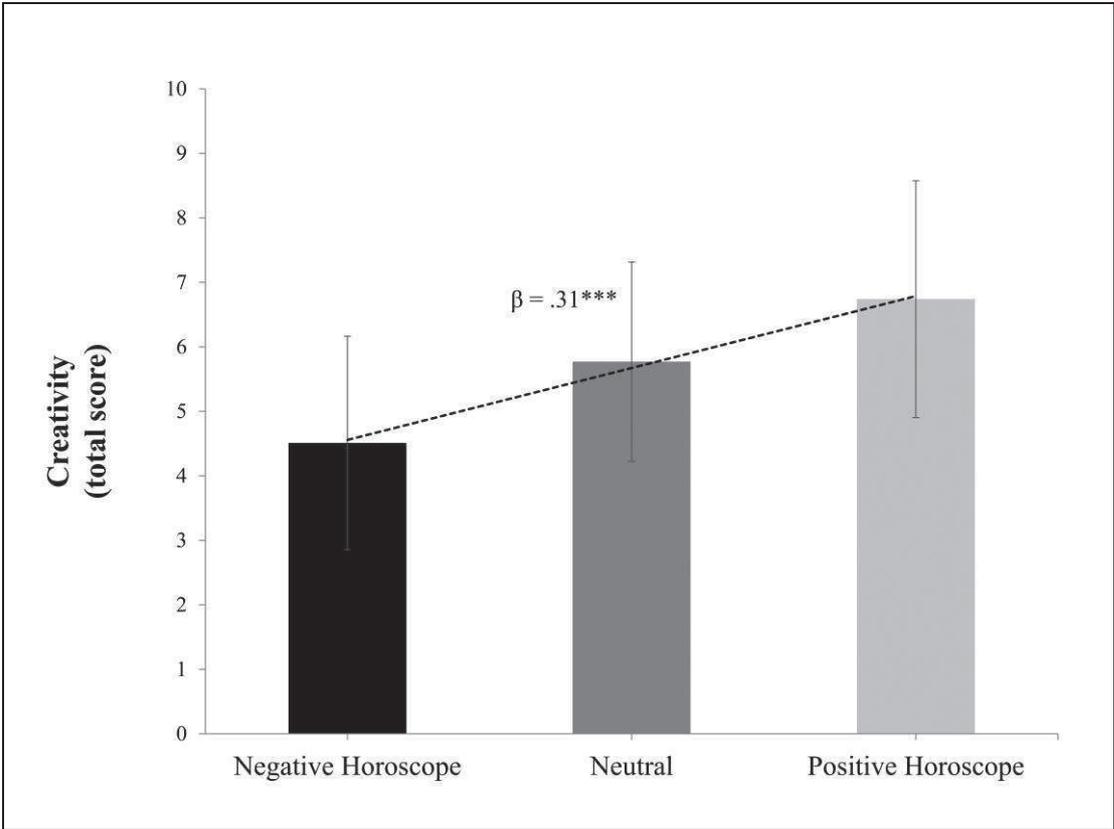
Figure 3. Reading positive vs. negative horoscope increases cognitive performances.



Note. Numbers represent standardized regression coefficients.

\*\* $p < .01$ .

Figure 4. Reading positive vs. negative horoscope increases creativity.



Note. Numbers represent standardized regression coefficients.

\*\*\* $p < .001$ .