

Understanding the Impact of Barnum Effect in Astrology: An Eye-tracking Study

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Abstract: *The Barnum effect refers to a psychological phenomenon in which people tend to believe personality descriptions that are vague and general. For instance, believers in astrology attribute themselves to astrological categorization and descriptions. This study leverages the eye-tracking method to explore the impact of the Barnum effect in astrology. In the experiment, 12 participants were randomly recruited at a shopping mall in China. The description of the western zodiac was used as stimuli. Participants read 12 zodiac descriptions without labeling the corresponding zodiac signs. And they were asked to choose items that they considered fit their personalities afterward. Participants were divided into two groups. In group one, there was no limit to the number of items they could choose. In group two, participants could choose only one item. During the experiment, an eye-tracker was used to capture their gaze patterns, which could provide quantitative data. According to the results, in group one, most participants chose at least two items, which is inconsistent with the zodiac rule. Meanwhile, group two participants showed significantly higher revisit counts than group one. This indicates it is more difficult for people to choose only one item. The finding indicates that zodiac descriptions are vague and general, which is consistent with the Barnum effect.*

Keywords: *Barnum effect, Astrology, Zodiac sign, Personality, Horoscope, Eye-tracking*

1. Introduction

In many cultures, people have the culture to divide individuals into different types of personalities according to their dates of birth. For example, the Chinese have their zodiac. In a twelve-year cycle, individuals are assigned to twelve zodiacs: rat (2020), ox (2021), tiger (2022), rabbit (2023), dragon (2024), snake (2025), horse (2026), goat (2027), monkey (2028), rooster (2029), dog (2030), and pig (2031). The cycle repeats itself every twelve years, with the Chinese Lunar New Year in each year as the division point. In the folklore culture, pig and dragon are two popular years to give birth to a child. Similarly, the western countries have their zodiac and sun-sign-effect. Depending on the date of birth, individuals are assigned to twelve astrological signs: namely Aries (March-April), Taurus (April-May), Gemini (May-June), Cancer (June-July), Leo (July-August), Virgo (August-September), Libra (September-October), Scorpio (October-November), Sagittarius (November-December), Capricorn (December-January), Aquarius (January-February), and Pisces (February-March). Each sign spans thirty calendar days. With globalization and increasing communication among civilizations, the public learn about and adopt multiple Zodiac systems^[1].

Within these Zodiac systems, astrologists have attributed immensely complicated, and sometimes inconsistent, personality description, luck cycles, and intra- and cross-zodiac systems. It is not rare for individuals to bring up their zodiac signs during a casual conversation and for them to pass zodiac-specific stereotypical impressions on each other. Such tendency intrigues researchers to explore whether there exists any correlation between people's personalities and astrological descriptions^{[2][3]}. Many researchers believe that there is no scientific basis of astrological personality theory. Some previous studies have explored the impact of astrological personality descriptions on people, while others suggest that people's traits affect their belief in personality descriptions^{[4][5]}. Moreover, the types of descriptions would also affect people's attitudes^{[6][7]}. For example, if a person is a Leo, and he identifies himself with the aggressive, leading image of Leo in astrological descriptions, that individual might behave accordingly; his behaviors will in turn cause a better match between his personality and the astrological description; such positive feedback loops happen again and again, making conversion of individuals' traits and behaviors to the standard astrological descriptions.

Apparently, categorizing individuals based on his date of birth or year of birth are not scientific.

Indeed, there exists no biological rationale under how birth date or year can impact one's physical and psychological development. Previous research shows that there exists no scientific basis for astrological personality descriptions, but the zodiac systems, both in the eastern and western societies, are still very popular. A psychology terminology, Barnum effect, also called Forer Effect, may explain the reason why people widely accept the description of the zodiac sign to match their perceptions of their own personalities and values. Barnum effect dictates that individuals can be gullible because they are presented with information about themselves when the latter is in fact generic and vague^[7].

To further explore the relationship between the zodiac description and the Barnum effect, this study leverages an eye-tracker, a device that utilized infrared light to track gazing patterns and pupil diameters of users. Specifically, an eye-tracking experiment is designed to investigate whether the zodiac descriptions are vague and general. The western zodiac descriptions are adopted as the experimental materials. The western zodiac has twelve signs: namely Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricorn, Aquarius, and Pisces respectively. According to the convention, each sign represents a type of personality, and the 12 signs have different characteristics. Based on one individual's date of birth, she or he would be attributed to one corresponding zodiac sign. In this study, participants were recruited and asked to read 12 items of zodiac descriptions, with names of these 12 signs covered. Then participants would choose items of descriptions that they think best resemble their own personal characteristics. During the experiment, their gazing patterns were captured by an eye-tracker. Participants were divided into two groups, with one can only choose a single item, whereas the other was not informed about the limit of number of items they can choose. Revisit counts, the number of times that users came back to an area of interest after initial views, are chosen as a measure of level of vagueness of zodiac descriptions. Age-old trades such as psychics, horoscopes, palm readers, crystal ball gazers make use of Barnum Effect to extract economic benefits from their customers in exchange for psychological comfort. While this study represents the very first one to use the eye-tracking method to explore the relationship between the Barnum effect and astrology, it has the potential of settling whether zodiac systems, like crystal ball gazing, rely on Barnum effect to gain believers. This new method could record how people read the zodiac descriptions and generate scientific and more quantitative data, thereby representing a novel angle for personality and astrology study compared to the previous study.

2. Method

2.1. Participants

A total number of 12 participants were randomly recruited at a shopping mall in Minhang District, Shanghai, China. Among the 12 participants, 9 participants were females and 3 participants were males ($M_{age}=31.5$). Participants were informed that they would read a single page of a Microsoft Word document on a screen for 2 minutes during the experiment. In addition, they were informed by the researcher about the potential risks of the experiment and all consented to participate. Participants were randomly divided into two groups. The first group, referred to as D1, contained 7 participants. The other group, referred to as D2, contained 5 participants.

2.2. Stimuli

Twelve items, each responding to one sign in the western zodiac system, were used as the stimuli in this study. The twelve descriptions were displayed on the same page of a Microsoft Word document. The corresponding zodiac signs were deleted, so that participants were unable to know the exact sign that each description corresponds to. The twelve items of descriptions were labeled from 1 to 12 instead. Labeling numbers were listed on the left-hand side, and items of descriptions were on the right-hand side. Each item of description had similar word counts and format layouts, which excludes irrelevant factors affecting participants gazing behaviors. Each item of the zodiac description is considered as one single area of interest (AOI).

2.3. Design and Procedure

The study used a between-subject design. Participants were asked to read a document as described above and choose items of descriptions of zodiac signs that they believed to fit their own characteristics. In D1, participants were not informed of any limitation on the number they could choose. In D2, participants were informed they could choose only one item. At the beginning, participants signed the consent form and filled out a questionnaire that collects basic personal information including age and

gender. Afterward, participants were led to sit in front of a screen that was connected to a laptop and an eye tracker (Tobii 4C). Following a successful 9-point calibration, the experiment started. After finishing reading the document displayed on the screen, participants would choose the number of descriptions that they deemed to match their personalities. Participants were awarded with small gifts after completing the experiment.

2.4. Data analysis

To analyze if there are statistically significant differences between eye-tracking parameters of D1 and D2, a number of t-tests were conducted in SPSS. In particular, three eye-tracking parameters were used for analysis, including the total fixation count (TFC), total fixation duration (TFD), and revisit counts (RC). The value of each eye-tracking parameter of 12 AOIs would be added up to generate results for the whole document as the stimuli.

3. Results

As shown in Table 1 below, D1 and D2 groups gazing patterns were exported and analyzed in SPSS. In particular, the total fixation count (TFC), the total fixation duration (TFD), and the revisit count (RC) of both groups were compared and their difference examined through t-tests.

From the t-tests, the total fixation count (TFC) of the multiple-choice group (D1) ($Mean_{D1}=106.6$, $SD_{D1}=17.79$) was not significantly different ($t=1.94$, $p=0.42 > 0.05$) from that of the single-choice group (D2) ($Mean_{D2}=103.2$, $SD_{D2}=31.97$). The total fixation counts generally represents the level of concentration for an average participant in each group.

In terms of the total fixation duration (TFD), the multiple-answer group ($Mean_{D1}=20.4$, $SD_{D1}=5.66$) demonstrated a TFD that was not significantly different ($t=1.98$, $p=0.46 > 0.05$) from that of the single-choice group ($Mean_{D2}=19.94$, $SD_{D2}=7.77$). The total fixation duration represents the time span for an average participant in each group to complete the test.

Lastly, in terms of the revisit count (RC), RC of the single-choice group ($Mean_{D2}=46.6$, $SD_{D2}=8.38$) was significantly higher ($t=1.81$, $p=0.02 < 0.05$) than that of multiple-choice group ($Mean_{D1}=34.57$, $SD_{D1}=9.76$). The revisit count represents the level of difficulties in understanding textual stimuli, in this case, the twelve astrological descriptions during the experiment.

Table 1: TFC, TFD, and RC Results of D1 Group and D2 Group

Group	TFC(s)	TFD(s)	RC
D1	106.6	20.4	34.6
D2	103.2	19.9	46.6

4. Discussion

This research investigated whether the Barnum effect can be applied to the zodiac descriptions. The western zodiac descriptions were adopted as the experimental stimulus, which has 12 zodiac signs. Participants were asked to read the 12 zodiac descriptions without labeling the corresponding zodiac signs. Afterward, they were asked to choose items they considered match their personalities. One group was not informed about any limitations on the number of items of descriptions that they could choose, whereas the other group was told to constrain their choices to only one item. According to the results, compared to the multiple-choice group, people who were asked to choose only one item had significantly higher revisit counts. Revisit counts represent the number of times that participants looked back in areas of interest after initial views. In essence, a higher revisit count in this study means that participants considered there were more than one items match their perceptions of themselves. The re-reading behavior reveals that participants struggled to make the final decision of which item of description to choose. Thereby, it indicates the descriptions of the western zodiac system are not accurate. Meanwhile, in the first group, when not informed about the number of items of descriptions that they could choose, only one out of seven participants picked a single item. In the post-experiment interview, this participant mentioned the reason why she only chose one single item was that she was very familiar with the zodiac description. An interesting side observation from this particular participant is that there seems to be a global consensus in zodiac-sign-personality-description. All the rest participants chose multiple items, undermining the accuracy of zodiac-personality description. This also demonstrates the horoscope is not

accurate.

The findings of this study prove that the zodiac descriptions are vague and general, which fits the Barnum effect. It is also consistent with the results of some previous research. For instance, Dickson suggests people often agree with a general personality description and think it reveals their own characteristics very accurately [8]. Moreover, when people describe other individuals with broad and vague adjectives, the recipients tend to easily accept these comments, though the accuracy of whether these descriptions match the actual personalities of participants is actually low [9]. Meanwhile, there are some studies conclude that there are minor correlations between personalities and the zodiac. The reason that the correlation exists might be caused by priming and strengthening. Priming effects mean the general interference of individuals' values and behaviors through subconscious and conscious textual and vocal stimuli. For example, when one is exposed to gender-biased judgements on the social media platforms, he or she will be more likely to behave in gender-biased way afterwards. Of course, priming effects are known to be short-lived, lasting minutes to at most hourly. The strengthening effect refers to the positive feedback loop in which one reads his zodiac description, primed to act accordingly afterward, and in his review, makes the description more matching, leading to subsequent astrology study^{[10][11]}. In essence, when people attribute themselves to a particular group, they will encourage themselves to behave similarly to the rest of the group. Such group conformity has been demonstrated in numerous studies in behavioral economics and psychology. Another potential reason is that humans are social animals, and we as a group tend to long for finding like-minded individuals. The zodiac system provides a perfect opportunity for individuals' tendency to self-labelling by dividing the entire population into multiple groups. According to Maslow's Hierarchy of Needs, the sense of belonging and empathy, generated in the process of social interaction and identification, are what people need spiritually. Peer recognition and collective acceptance can also effectively help people realize their self-worth.

Because of the pandemic and limited budget, researchers in this study are constrained by a number of limitations, so there exists room for future improvements in further studies. Firstly, due to the budget, only a small number of participants were recruited in this study. In order to draw a meaningful and conclusive conclusion, more participants could be recruited to generate a larger sample and data size, which will make the results of this study more accurate and convincing. Besides, while this is beyond the scope of analysis of this research, it is speculated that different gender and age groups would react differently to the zodiac sign system. Indeed, it is hypothesized that females, the younger and the elder population are more inclined to believe in the zodiac sign system. Therefore, it will be meaningful to analyze the gender- and age-specific gazing patterns when participants are viewing zodiac descriptions. Last but not least, more control over the experimental conditions will improve the accuracy of the results. For example, participants could be asked to wear noise-cancelling headphones, which will mitigate the impacts of background noises on individuals' attention and behaviors. While this study is highly quantitative, qualitative observations and interviews are desired to derive valuable insights in participants' behaviors and decisions, which this study largely fails to do.

5. Conclusion

This present study shows that when zodiac descriptions are vague and general, consistent with the Barnum effect, participants will score very low accuracy in matching their zodiac sign with corresponding descriptions. Indeed, our participants considered multiple zodiac signs to be consistent with their personality. Multiple choices indicate that our participants are essentially vetoing the basic underlying logic of astrology, that individuals can be categorized into a limited number of zodiac signs and each sign corresponds to a certain type of personalities and values. Meanwhile, if participants were required to choose only one item when hiding the zodiac signs, their gazing patterns demonstrated significantly higher revisit count compared to those of the multiple-answer group. A higher revisit count can be explained by that our participants were not sure about which one description to choose, thereby referring to text of multiple descriptions multiple times before they made the choice. Indeed, it also reflects the high level of vagueness and generality in zodiac system, as highly specific personality descriptions would not require individuals to revisit often. While this study represents an original attempt of investigating the Barnum effects and astrology via the use of an eye-tracker, with limited budget, there exists several features in the experimental set-ups that can be improved in future studies, as described by the discussion part of this article.

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