



## Thinking Biases in Searching for Explanation: Plausibility Bias and Local Coherence

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**ABSTRACT** Authors' previous research demonstrated the existence of Post hoc Explanation Bias, which is contrary to scientific thinking. People did not prefer predictions to post hoc explanations. If this thinking bias reflects primitive "Searching for Explanation" mental set, the authors hypothesized that based on this mental set, people may emphasize on plausibility of every individual explanation than the existence of alternative explanations. This in turn generated the second hypothesis, that the attention on plausibility may lead to the neglect of the contradiction of existing explanations and induce local coherence. Two experiments were designed to test these hypotheses. In Experiment 1, 228 college students were asked to indicate to what degree they thought the explanation presented after each unusual event was acceptable. Results are consistent with the plausibility hypothesis: (1) participants demonstrated less acceptance of the explanation offered if he had own explanation; (2) the number of alternative explanations had no effect on participants' acceptance of the particular explanation offered. In Experiment 2, 284 college students were asked to evaluate the probability that an explanation was true (Argument A) in one story and the feasibility of a suggestion (Argument ~A) in the other. The result evidently supports the local coherence hypothesis.

### INTRODUCTION

Psychologists have long been referred human as "intuitive scientists" in the research field of thinking, social cognition and cognitive development (Kuhn 1989; Tetlock 2002). This assumption of human nature of thinking does not necessarily imply that human thinking follows the reasoning principle of real scientists. Nevertheless, it does imply that the human may have similar thinking characteristics or tendencies in understanding his world as a scientist. However, numerous studies on human induction and reasoning have indicated that human thinking does not always follow scientific rules (e.g., Dominowski 1995; Evans 1977; Evans et al. 1983; Griggs and Cox 1982; Klayman and Ha 1987). Recently, Wang and Lin (2005) demonstrated clearly the existence of Post hoc Explanation Bias which is contrary to scientific thinking, people did not prefer predictions to post hoc explanations.

Wang and Lin (2005) have conducted three experiments to provide evidence as to whether people think that predictive statements are superior to explanatory statements. Participants were

divided into three groups and provided different versions of fictional stories of unusual incidents. The prediction group was given the story with an occult or odd forecast before the incident; the explanation group was given a version with a post incident explanation, while the control group was given the story as plain description. After reading each story, all three groups were asked to evaluate the probability of two explanations (occult/odd vs. non-occult/normal) for each particular incident on a five-point scale. Results indicated that the participants not only did not display the preponderance of prediction mental set, but also astonishingly demonstrated that the mental set could be opposite under certain circumstances: simple hindsight explanations could overpower predictive statements. Wang and Lin (2005) referred to this post hoc explanation bias as the *explanation effect*, that is, an "argument" will become convincing as long as it can "explain" things reasonably without being affected by its predictive power. In addition, the explanation effect found is hard to account for by participants' lack of reasoning ability because the *explanation effect* in participants' thinking did not vary with their reasoning ability. The authors assumed this thinking bias as the sign of a primitive mental set, "Searching for Explanation" (similar concept "causal bias" was used by

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Goswami 2008), which reflects the mind set of “intuitive scientist”. To further explore this mental set, two hypotheses regarding human thinking bias derived from the *explanation effect* were proposed and tested in this research. The first was the *plausibility bias hypothesis* which hypothesized that the conviction of the argument of theory is mainly determined by the degree of plausibility and less affected by the number of alternative arguments. In other words, the key of the persuasiveness of an argument or a theory is neither its predictive power nor the existence of opposing arguments or rival theories, but its plausibility. Many incidents in daily life provide evidence for this plausibility hypothesis. For example, there are many theories about whether and how a supposedly incurable disease (e.g., cancer) can be cured. Without bothering providing evidence, unlicensed charlatans can easily win trust from patients with any plausible theory.

Since the persuasiveness of an argument lies in its plausibility as argued above, the validation of an argument would naturally be placed on whether it is plausible in its context, not across contexts. Therefore, contradictions between explanatory arguments made in different contexts can be easily neglected and thus contradictory arguments simultaneously accepted. Following this rationale, a second hypothesis was generated from previous hypothesis of plausibility: the *local coherence hypothesis*. In brief, when reviewing an argument, people tend to pay attention to whether it is reasonable and, consequently, neglect (1) alternative arguments available (the *plausibility hypothesis*) as well as (2) contradictions between other arguments and the one being evaluated (the *local coherence hypothesis*). The purpose of this research is to examine these two hypotheses in order to manifest the thinking bias based on the mental set of “searching for explanation”. The specific predictions to be tested are that people would pay more attention to whether arguments are plausible than to (1) whether alternative arguments are available and (2) whether arguments have contradictions.

### EXPERIMENT I: VALIDATION OF THE PLAUSIBILITY BIAS HYPOTHESIS

The purpose of Experiment I was to examine the *plausibility hypothesis*. The number of alternative arguments was manipulated to serve this

aim. Participants were told that there were one, two, or three explanations for an unusual incident described in each fictional story, while only one explanation was revealed to them. The function of this manipulation was to generate a belief of the multiplicity of explanations available in participants. According to the *plausibility hypothesis*, the authors predicted that the availability of alternative explanations should have only small effect on participants’ agreement on a particular explanation. However, the number of alternative explanations offered would lower the plausibility of each explanation; hence lessen the participant’s confidence in any particular one.

Naturally, some participants might have had their own explanation in mind in addition to the offered explanations. After reading the explanations proposed in text, if the participant generates or maintains his/her own explanations in mind, it is reasonable to assume that the participant consider his/her own explanation more plausible than others. In this sense, whether the participant had his/her own explanation was considered an essential variable in this study. According to the *plausibility hypothesis*, the existence of preoccupied personal explanation would naturally decline the acceptance of any other explanation offered.

## METHOD

### Independent Variables, Dependent Variables and Experiment Design

The independent variables in this experiment were the number of alternative explanations implied in the text and whether the participant had his/her own explanation. Both were between-subject variables. The dependent variable was participants’ agreement on a particular explanation offered for an unusual incident. This experiment employed a 3 (one, two, or three alternative explanations implied)  $\times$  2 (with or without own explanation) independent sample factorial design.

### Experiment Materials and Response Measures

Four fictional stories were used. Two were occult stories (Ghosts in the Pagoda Tree and The Haunted House) (Story 1 and 4 in Appendix 1) while the other two were non-occult stories

(Herbal Medicine and Hypnosis) (Story 2 and 3 in Appendix 1). The text of all four stories consisted of a simple description of an unusual incident. After each story, an explanation for the unusual incident was offered and the participant was asked to indicate to what degree they thought the explanation was acceptable on a five-point scale from 5 (*very possible*) to 1 (*impossible*).

### Manipulation of Independent Variables

(1) *The Number of Explanations Available*: after reading the story, participants were given different instructions according to their group. The One-Explanation group was asked to indicate, "To what degree do you think the following explanation is acceptable?" The Two-Explanation group was told, "For this incident, some scholars have proposed one explanation, but others propose what follows. To what degree do you think the following explanation is acceptable?" The Three-Explanation group was told, "For this incident, scholar A once proposed an explanation, scholar B proposed another explanation, but others propose what follows. To what degree do you think the following explanation is acceptable?" The alternative explanations referred to in the instructions were not actually provided.

(2) *The Existence of Own Explanation*: after participants responded, the following question was asked: "In addition to this explanation, can you think of any other possible explanation?" Participants marked "No" or "Yes" and finished the sentence "I thought of the following explanation(s)....." if he/she answered "Yes".

### Procedure

All the stories and questions were printed as questionnaire in three versions. Participants were randomly assigned to three groups accordingly. Participants were asked to read the texts and then respond to the questions followed each story text. There was no time limit for response.

### Participants

Participants in this study were 228 Chinese college students (38% were males and 62% were females age range was 18-23 except 6 participants were above 24). As some participants failed to answer some of the questions so the number of evaluation varies by story. The valid sample size in each group is shown in table 1.

**Table 1: Number of participants in each group of experiment 1**

Stories	Explanations available			Total
	One	Two	Three	
<i>Non-occult</i>				
Herbal	78	76	74	228
Hypnosis	74	73	68	215
<i>Occult</i>				
Ghosts	76	77	73	226
Haunted house	74	71	66	211

## RESULTS AND DISCUSSION

As predicted, a considerable portion of the participants had their own explanation for each unusual incident (Table 2).

**Table 2: Participants with or without own explanation in each story in experiment 1**

Stories	Own explanation	Explanations available			Total
		One	Two	Three	
<i>Non-occult</i>					
Herbal	No	16	19	16	51
	Yes	62	57	58	177
Hypnosis	No	48	46	37	131
	Yes	26	27	31	84
<i>Occult</i>					
Ghosts	No	37	39	37	113
	Yes	39	38	36	113
Haunted house	No	29	33	21	83
	Yes	45	38	45	128

The summary of the mean response of each group and the results of the analysis of variance (ANOVA) for each story are shown in table 3. For all stories, the number of explanations available had no main effect on the participants' response. In other words, even when the participants were specifically informed that alternative explanations were available for the unusual incident, their responses were not affected. In contrast, whether the participant had his/her own explanation did have a significant effect in all four stories. Acceptance of the explanation offered as possible was greatly reduced when the participant had his/her own explanation. However, the effect of own explanation did not vary with the number of explanations available. There was no interaction between these two variables.

In general, the results of Experiment 1 are consistent with the *plausibility hypothesis* in two ways. Firstly, participants demonstrated less acceptance of the explanation offered if he/she has own explanation. The reason is obvious: if the participant generated or kept his/her own expla-

**Table 3: Agreements on explanations offered of each group and variance analysis for each story in experiment 1**

Story	Has own explanation	Explanations available				F		
		One	Two	Three	Total	Explanation available	Has own explanation	Interaction
<i>Non-occult</i>								
Herbal	No	2.94	2.79	3.19	2.96	0.378	35.861 **	1.425
	Yes	2.23	2.25	2.12	2.19			
	Total	2.37	2.38	2.35	2.37			
Hypnosis	No	3.06	3.17	3.30	3.17	0.453	8.541 *	0.503
	Yes	2.88	2.74	2.87	2.83			
	Total	3.00	3.01	3.10	3.04			
<i>Occult</i>								
Ghosts	No	3.14	3.15	3.19	3.16	0.060	19.109 **	0.205
	Yes	2.69	2.74	2.61	2.68			
	Total	2.91	2.95	2.90	2.92			
Haunted house	No	3.07	3.18	3.24	3.16	0.376	14.324 **	0.167
	Yes	2.62	2.76	2.64	2.67			
	Total	2.80	2.96	2.83	2.86			

\*  $p < .005$  \*\*  $p < .001$

nation after reading the explanation offered, it is only natural that the participant might consider his/her own explanation *more plausible*. This result logically supported the prediction derived from the hypothesis. Secondly, another result also substantiated another prediction that the influence of the two independent variables, the number of explanations available and the existence of own explanation, should be additive, but not interactive. As predicted, there was no interaction between having own explanation and the number of explanations available. Therefore, these two variables may work differently and their influences can be additive at best.

On the other hand, results of Experiment 1 only partially supported the prediction in the effect of the existence of alternative explanations. According to the *plausibility hypothesis*, despite that the participants might focus on plausibility of the explanation, the existence of alternative explanations still will have limited influence on their acceptance of the explanation provided. However, empirical findings went further beyond the prediction of the hypothesis. Results indicated that the number of explanations available had no effect at all on participants' agreement on the particular explanation offered. Obviously, participants paid no attention to the existence of alternative explanations but focused on the plausibility of a particular explanation alone.

## EXPERIMENT 2: VALIDATION OF THE LOCAL COHERENCE HYPOTHESIS

In order to examine the *local coherence hypothesis*, which asserts that the attention on

plausibility in individual argument may lead to the neglect of contradictions between arguments, the authors devised two contradictory arguments ( $A$  and  $\sim A$ ) plausible in separate stories ( $A$  argument in story  $X$  and  $\sim A$  argument in story  $X'$ ) in Experiment 2. Participants are anticipated to agree on the arguments by how plausible each argument is in spite of the existence of opposing argument. In other words, as long as arguments are sufficiently plausible in individual context, participants are expected to accept two opposing arguments simultaneously. In that case, a *positive* correlation between the two responses of agreement towards each argument will be a clear implication of local coherence.

Apparently, to maximize the similarity of the two contradictory arguments, similar contexts are necessary. What's more, if the contradictions are too obvious, participants may be prompted and change their response. To avoid this possibility, different task forms were required for the two target stories in Experiment 2. In the first story, participants were asked to evaluate the probability that an explanation was true (*Argument A*). In the other story, they were required to evaluate the feasibility (how likely it will work in practice) of a suggestion (*Argument  $\sim A$* ). The two target stories were adequately separated by other filling stories.

In addition, to examine if the phenomenon of local coherence appears in all argument conditions, the first story in Experiment 2 was designed to have three versions: control, prediction, and explanation version. In the control version, the explanation was not provided in the story text but only presented after the participant finished

reading the story. In the prediction version, someone made a prediction and it turned out to be true eventually in the story text. In the explanation version, someone proposed an explanation after the incident occurred in the story text.

## METHOD

### Experiment Materials and Response Measurement

The first story in Experiment 2 was the same story used in previous research (Wang and Lin 2005). For this story, participants were required to use a five-point scale from *very possible* (5) to *impossible* (1) to evaluate the probability of the explanation of “constructing highway through the graveyard angered the dead” for the unusually frequent car accidents. For the second story, participants were asked to evaluate the feasibility of the suggestion of “constructing a highway through the graveyard so as to invite positive energy and expel negative energy” proposed in the story on a five-point scale from *worth every effort to try* (5) to *no need to try* (1). The greater a participant agreed on the suggestion worth trying indicated his/her deeper conviction that a highway through the graveyard can invite positive energy and expel negative energy. The key point is that the suggestion made in the second story contradicts the other explanation offered to participants in the first story.

### Procedure

These two stories plus four additional filling ones were printed and arranged so that the target stories were separated with distraction stories in between. Participants read the stories and completed the assigned task with no time limit.

### Participants

Participants in Experiment 2 were 284 Chinese college students (46% were males and 54% were females; age range was 18-24 except 4 participants were above 25). All participants read the same five stories except for “Highway noise angered the dead,” which had three versions. The control version (unusual incident only) was given to 95 participants, another 94 read the prediction version (unusual incident with occult fore-

cast), and the remaining 95 read the explanation version (unusual incident with occult post-event explanation).

## RESULTS AND DISCUSSION

Results of Experiment 2 are presented in table 4. As predicted, a significant *positive* correlation was found between the participants’ agreement on “Highway noise angered the dead” explanation and its opposing argument, “putting a highway through the graveyard would invite positive energy and expel negative energy” in all three groups. The overall correlation coefficient of all the data from the three groups was .317 ( $p < .001$ ). This result evidently supports the *local coherence hypothesis*.

**Table 4 Intercorrelation of Participants’ Agreement on Contradictory Arguments between Two Target Stories in Experiment 2**

		<i>Constructing highway would expel negative energy</i>
Constructing highway angered the dead	Control	.316**
	Prediction	.278*
	Explanation	.381**
Overall		.317**

\*  $p < .005$  \*\*  $p < .001$

Taking participants’ response time in account, separation time from the first target story to the second one would be less than 10 minutes. Despite this short interval, participants’ responses to the two stories were still contradictory. That is, *positively* correlated. This result fully demonstrated the distinctiveness of the mental set of searching for explanation, the tendency to attend to the plausibility of individual argument and consequently pay no heed to the inconsistency between arguments.

In brief, the results of Experiment 2 demonstrated a thinking bias for local coherence whether it involves lack of awareness or indifference to contradictions between arguments due to emphasis on the plausibility of arguments.

## DISCUSSION

Starting from the *explanation effect* found (Wang and Lin 2005), the authors hypothesized the plausibility bias and local coherence as the thinking bias derived from the mental set of searching for explanation. Both hypotheses were



supported by the data of two experiments conducted. Consequently, the results evidently support the basic assumption behind the two hypotheses that there exists a dominant mental set of searching for explanation in human thinking (Goswami 2008; Keil 1998). The focus on plausibility over the discrepancy of opinions or contractions between statements implies that the notion of mental set in this article is similar to the concept of *set* or *Einstellung* (Mental Set) in problem solving (Greeno et al. 1979; Luchins 1942; Luchins and Luchins 1959) which would hinder the solver from identifying better and simpler solutions.

Naturally, whether the mental set of searching for explanation is innate remains an issue to be further clarified. In recent decades, researchers of cognitive development with core knowledge perspectives have conducted impressive studies on infants' innate knowledge about objects (Johnson and Aslin 1995; Mandler 1992; Spelke et al. 1992) and the human mind (Flavell 1999; Povinelli and DeBlois 1992) which are consistent with the assumptions in this article on innate mental set. If all these studies were oriented in the same direction, further investigation of children's thinking in terms of *plausibility bias* and *local coherence* would hopefully lead to a full understanding of human thinking system, especially the thinking biases in daily lives.

In addition, the findings of the present research stress the need for both plausibility bias and local coherence to elucidate their mechanism by specifying how and when these thinking biases will be invoked. For instance, as noted before, local coherence may be due to simple failure of noticing the contradiction or may be the result of deliberate thought independent of logical system. Of course, one possible way to clarify is to point out to participants that two arguments are contradictory so as to compare the difference between participants' responses with or without this notice. However, the notification itself may have suggestibility effect and thus confound the conclusions drawn from the results. As far as we see, this is as yet largely uncharted territory in the research of thinking that deserves more attention in the future.

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## REFERENCES

- Dominowski RL 1995. Content effects in Wason's selection task. In: SE Newstead, J St BT Evans (Eds.): *Perspectives on Thinking and Reasoning: Essays in Honour of Peter Wason*. Hillsdale: Lawrence Erlbaum Associates, pp. 41-65.
- Evans J St BT 1977. Linguistic factors in reasoning. *Quarterly Journal of Experimental Psychology*, 29: 297-306.
- Evans J St B T, Barston J L, Pollard P 1983. On the conflict between logic and belief in syllogistic reasoning. *Memory and Cognition*, 11: 295-306.
- Flavell JH 1999. Cognitive development: Children's knowledge about the mind. *Annual Review of Psychology*, 50: 21-45.
- Goswami U 2008. *Cognitive Development: The Learning Brain*. Hove, East Sussex: Psychology Press.
- Greeno JG., Magone ME, Chaiklin S 1979. Theory of constructions and set in problem-solving. *Memory and Cognition*, 7: 445-461.
- Griggs RA, Cox JR 1982. The elusive thematic-materials effect in Wason's selection task. *British Journal of Psychology*, 73: 407-420.
- Johnson SP, Aslin RN 1995. Perception of object unity in 2-month-old infants. *Developmental Psychology*, 31: 739-745.
- Keil FC 1998. Cognitive science and the origins of thought and knowledge. In: W Damon (Ed.): *Handbook of Child Psychology: Vol 1, 5th Edition*. New York: John Wiley and Sons, pp. 341-414.
- Klayman J, Ha YW 1987. Confirmation, disconfirmation, and information in hypothesis testing. *Psychological Review*, 94: 211-228.
- Kuhn D 1989. Children and adults as intuitive scientists. *Psychological Review*, 96: 674-689.
- Luchins AS 1942. Mechanization in problem-solving — The effect of Einstellung. *Psychological Monographs*, 54: Serial No. 195.
- Luchins AS, Luchins EH 1959. *Rigidity of Behavior: A Variational Approach to the Effect of Einstellung*. Miami: University of Miami Press.
- Mandler JM 1992. How to build a baby: II. Conceptual primitives. *Psychological Review*, 99: 587-604.
- Povinelli DJ, De Blois S 1992. Young children's (Homo sapiens) understanding of knowledge formation in themselves and others. *Journal of Comparative Psychology*, 106: 228-238.
- Spelke ES, Breinlinger K, Macomber J, Jacobson K 1992. Origins of knowledge. *Psychological Review*, 99: 605-632.
- Tetlock PE 2002. Social functionalist frameworks for judgment and choice: Intuitive politicians, theologians, and prosecutors. *Psychological Review*, 109: 451-471.
- Wang JW, Lin WY 2005. Explanation effect in superstitions thinking. *Chinese Journal of Psychology*, 47: 39-60.

## APPENDIX 1. STORIES USED IN EXPERIMENT 1

### Story 1: Ghosts in the Pagoda Tree

One year ago, the Hsieh family moved to the countryside in southern Taiwan. Near their door was a huge pagoda tree that provided cool shade in the summer. Their four-year-old son often played in the shade of the tree, and he passed his urine there. Strangely, after playing under the tree, he would often have nightmares and sleep poorly. Local rumor had it that, several people killed in the 228 Incident\* were buried under that tree.

*Explanation Offered:* “The Hsieh boy might have offended the ghosts.”

\*The 228 Incident was a local uprising in February 1947 that was brutally suppressed by the Kuomintang government, resulting in the death of around 30,000 civilians.

### Story 2: Herbal Medicine

Recently, Miss Chen had suffered from poor appetite, fatigue, frequent diarrhea, and colds, but physical examinations failed to reveal anything abnormal. She decided to try herbal medicine and visited three shops, each of which recommended a different kind of medicine. She bought all of them and took them all together. Miss Chen did not know that pharmacological tests had shown that none of these medicines would have any effect. However, she gradually recovered after taking the herbs.

*Explanation Offered:* “Although the individual herbs do not provide any healing effect, taking them together could produce results.”

### Story 3: Hypnosis

Da-Do Fan, a ninth grader, had very little interest in studying. He often scored in the bottom five in his class on tests, causing his mother to be concerned. One day, a guest who knew hypnosis visited his family, and the whole family decided to try out hypnosis. The guest found that Da-Do could enter a deep hypnotized sleep easily. Since then, whenever this guest visited Da-Do’s family, the guest would hypnotize Da-Do. Coincident or not, during this period, Da-Do’s test scores improved greatly in school.

*Explanation Offered:* “Deep hypnosis awakened Da-Do’s potential.”

### Story 4: The Haunted House

After getting married, Mr. Wu rented a suburban house located in the south-east of the city facing the hills with a river behind it. The house was very old and gloomy. The couple has had no peace since they moved in. For example, when Mrs. Wu wakes up at night, she hears footsteps outside the bedroom, yet finds nothing if she opens the door. Their dog often hides in a corner of the living room and growls. Mrs. Wu used to be very optimistic, but now she is suffering from depression.

*Explanation Offered:* “The house is so gloomy that only ghosts can stay there; humans should leave.”