Journal of Environmental Psychology 44 (2015) 126–134

Contents lists available at ScienceDirect

Journal of Environmental Psychology

journal homepage: www.elsevier.com/locate/jep

# The more involved in lead-zinc mining risk the less frightened: A psychological typhoon eye perspective

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ARTICLE INFO

*Article history:*
Received 21 June 2014
Received in revised form
29 May 2015
Accepted 13 October 2015
Available online 22 October 2015

*Keywords:*
Lead-zinc mining
Psychological typhoon eye effect
Risk perception
Perceived benefit
Perceived harm

ABSTRACT

In China, the current situation is that people under *indirect* threat from unprotected lead-zinc mining tends to oppose it, whereas people under *direct* threat are likely to 'sail close to the wind'. To understand this puzzle-like phenomenon, we surveyed 220 residents in a lead-zinc mining area located in Fenghuang County of China. We found that: 1) The degree of risk perception of villagers living around the mining site correlated inversely with their degree of involvement in mining risk. We refer to this as the "involvement" version of the psychological typhoon eye effect. 2) Perceived benefit and perceived harm provided a satisfactory explanation for this "involvement" version of the psychological typhoon eye effect. 3) Risk perception was negatively related to support for the relevant policy which we viewed as constituting a sort of voting behavior. The results may have implications for better understanding how benefited individuals respond to environmental health risks.



## 1. Introduction

According to the U.S. Geological Survey 2013 (USGS, 2013), China is the world's largest producer of lead and zinc, accounting for nearly half of the global lead mine production (about 2.6 million tons in 2012) and more than a third of the global zinc mine production (about 4.6 million tons in 2012). Lead-zinc mining and smelting activities are, however, some of the primary sources of heavy metals pollution (Horvath & Gruiz, 1996; Tong, Schirnding, & Prapamontol, 2000). Lead exposure, which can cause increased blood-lead levels and affect many tissues and systems in the body, was responsible for about 143,000 deaths and 0.6% of the global burden of disease in 2004 and can seriously endanger human health (WHO, 2004, 2009). Where, then, should health and governmental policy makers place their concerns with respect to these issues?

The current situation is that the portion of the population (e.g., policy makers or public bodies) that is under *indirect* threat from unprotected lead-zinc mining opposes it, whereas the portion of the population (e.g., lead-zinc mine owners and mine workers) that is under direct threat continues to participate in dangerous mining practices. Such a puzzle-like phenomenon has been so robust that local villagers tend to continue to practice unprotected mining regardless of any legal prohibitions (Y. Li, Wang, Yang, & Li, 2005). For example, the situation in the Dabaoshan heavy metal mining areas has frustrated the public at large because local private mining still exists, even after being shut down by the government several times from 1993 to 2005. Such unprotected mining has caused at least 250 deaths from cancer in the last 20 years (M. Wang et al., 2011). This continued private mining by local individuals can be seen as an evidence of being likely to 'sail close to the wind' with respect to environmental issues. The problem raised in this study is how to understand such a puzzle-like phenomenon from the perspective of risk perception and risk analysis.

The existing risk perception literature has provided some insights into this puzzle. Wise (2009) described a compelling example of the disjuncture between fear and danger: Londoners who were subjected to German bombings regularly during the Blitz in World War II eventually grew blasé, while those in the suburbs became more fearful. Guedeney and Mendel (1973) reported that, in a local attitude survey about a nuclear power station in France,

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http://dx.doi.org/10.1016/j.jenvp.2015.10.002
0272-4944/

anxiety was lower among those living closer to the nuclear reactor. Maderthaner, Guttmann, Swaton, and Otway (1978) also found that people living far from a nuclear research reactor perceived it to be riskier than the nearer residents. Tilt (2006) reported that, although industrial workers labored on a daily basis under highly polluted conditions, they provided risk ratings that were well below those of farmers and commercial/service sector workers who were far from the polluting sources.

All these findings could then be captured under the umbrella of what is referred to here as the psychological typhoon eye effect: The closer to the center of a disaster area, the lower the level of concern felt by residents about safety and health (Li, Rao, et al., 2009; Li, Liu, et al., 2009). Contrary to conventional wisdom and to the ripple effect (Kasperson et al., 1988), that the impact of an unfortunate event decays gradually as ripples spread outward from a center, the psychological typhoon eye effect was observed one month after the 2008 Wenchuan Earthquake, where the post-earthquake concern of a convenience sample of 2262 adults was at its lowest level in the most severely devastated areas.

As noted and reviewed by Bonanno, Brewin, Kaniasty, and La Greca (2010), the research on reactions to the Wenchuan earthquake in Sichuan China 2008 is not the sole evidence for this effect. In fact, this phenomenon can be demonstrated in many contexts. In the context of terrorist attacks, a post-9/11 study of New York City public school children showed that children from the schools nearest to Ground Zero had significantly less psychopathology than children from more remote schools (Hoven et al., 2005). In the context of Severe Acute Respiratory Syndrome (SARS), it was reported that the level of exposure to SARS was not a primary determinant of experienced anxiety; nearness to the center of the epidemic was negatively related to anxiety levels (Xie, Stone, Zheng, & Zhang, 2011). Also in the context of earthquake, it was reported that a village closer to the epicenter of the earthquake (0.5 km) that occurred in 1998 in northern Hebei province, China, had considerably fewer cases of PTSD than one that was further away (10 km) from the epicenter (X. Wang et al., 2000). A similar study by J. Xie, Xie, and Gan (2011) showed that the perceived risk of experiencing an aftershock by residents of devastated cities (e.g., Hanwang, Panzhihua) was lower than the perceived risk of aftershocks in the devastated area by people in a non-devastated city (e.g., Beijing). All these studies assessed the relationship between a disaster and a social cognitive reaction as a function of geometric distance. As Harada (2011) pointed out in a special issue on "Cognitive Studies in the Real World" in *Psychologia*, "The results are especially insightful for Japanese readers after the Great East Japan Earthquake of 2011." (Harada, 2011).

Additionally, Li et al. (2010) conducted two sequential surveys of 5216 residents in non-devastated and devastated areas in September–October 2008 and April–May 2009. They observed two variations in the psychological typhoon eye effect and dubbed these variations as "*guanxi*" (关系) versions of the psychological typhoon eye: the closer the relationship between a respondent and victims who had suffered either *physical* or *economic* damage, the less the concern about safety and health felt by a respondent. These "*guanxi*" (relational) versions provide additional evidence to suggest that the degree of an individual's concern about safety and health did not grow with an increase in the devastation level as common sense had expected.

According to previous studies, risks can be categorized as human-caused risk (anthropogenic risk) vs. nature-caused risk (non-anthropogenic risk) due to differences in the source of the harm (Siegrist & Sütterlin, 2014; Xie, Wang, Zhang, Li, & Yu, 2011) and also can be categorized as chronic risk vs. acute risk due to differences in the rates of diffusion (Chakraborty, 2001; Chakraborty, Collins, Grineski, Montgomery, & Hernandez, 2014). The psychological typhoon eye effect was previously found and reported in acute nature-caused risk, acute human-caused risk, and chronic human-caused risk (see Table 1 for details). Given that the activities of lead-zinc mining and smelting are the primary sources of heavy metals pollution in Feng village and that the mining risks were constant and subtle, we categorized the risk investigated in the current study as chronic human-caused risk. Compared with acute risks (see the upper row in Table 1), such as the German bombing of London and earthquakes, lead-zinc mining risks are experienced more indirectly and more slowly.

Getting back to the discrepancy between outsiders' and insiders' reactions to lead-zinc mining risk, the reader will note that their risk perception and attitude seems likely to form another "*guanxi*" (关系) variation of the psychological typhoon eye effect. That is, those who are least involved in lead-zinc mining seem to reveal the greatest concern about mining safety and health, whereas those who are most involved in lead-zinc mining seem to reveal the least concern about personal safety and health. Therefore, the first aim of the present study was to empirically test this speculation: The degree of risk perception was expected to be inversely correlated with the degree of involvement in mining risk within an area.

Despite the fact that similar, interesting findings have appeared in many studies, the mechanism of the psychological typhoon eye effect is unclear. Attempts have been made to identify possible/alternative explanations. For instance, the psychological immunization theory assumes that resistance to adverse life events is naturally acquired through repeated exposure (Henderson, Montgomery, & Williams, 1972). Residents in devastated quake areas are presumed to be provided with an increased psychological immunity to the severe disaster by their natural exposure to hazardous stimuli. Some previous researchers (e.g. Li, Rao, et al., 2009; Maderthaner et al., 1978) viewed the psychological immunization theory as a possible explanation and mentioned it in their discussion. To test whether the psychological immunization theory could account for the psychological typhoon eye effect, Li et al. (2010) asked respondents to indicate the extent and frequency of their personal exposure to the earthquake damage, using a six-point scale (from "not at all" to "extremely strong" for the extent and from "never" to "always" for the frequency). The covariance analysis in Li et al.'s (2010) study revealed that the psychological typhoon eye effect was independent of the extent of exposure to hazardous stimuli. This result suggested that the psychological immunization theory is insufficient to account for the psychological typhoon eye effect. The residents did not receive increased psychological immunity to the severe disaster by personal exposure to hazardous stimuli. Before we can accept the conclusion that the residents had not received such increased psychological immunity, however, the distinctions between exposure to hazardous stimuli and people's subjective perceptions of the same stimulus (Brewer & Hallman, 2006; Howarth, 1988) should be taken into account.

Another possible explanation suggested by Maderthaner et al. (1978) and Li, Rao, et al. (2009) might be Festinger's theory of cognitive dissonance, which is defined as an uncomfortable psychological state in which two opposing cognitions, which ultimately need to be reconciled, are experienced (Festinger, 1962). As remarked in a blog by Gray (2010), the devastation of an area creates a sense of danger, yet an individual may have no choice but to remain close by, counter to their survival instinct. To reconcile these conflicting beliefs, the individual may unconsciously lower their self-assessed risk to justify remaining in the area. However, the cognitive dissonance account has not yet been directly tested, mainly because it is difficult to manipulate the levels of cognitive dissonance in a field study. Because the level of cognitive dissonance cannot be measured and manipulated in the center of the lead-zinc mining risk area, we decided not to test the cognitive