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Supernatural and natural seismic framing in a Tibetan Buddhist community

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Abstract
Based on a questionnaire survey conducted in the Yushu area, China, this study shows that for Tibetans, framing an earthquake as a punishment, will, or trial from gods may have similar connotations. Namely, the topology of positive and negative disaster attributions may not be applicable to Tibetans. Furthermore, in Tibetans' belief systems regarding disaster, supernatural and natural types framing are different, but not opposite. Indeed, this study reveals that earthquake experience shapes Tibetans' disaster framing. Specifically, vicarious earthquake experience (i.e., the frequency of discussing earthquake-related topics with others in daily life) increases their tendency to offer supernatural attributions, while harmful earthquake experience increases their likelihood to frame earthquakes as natural phenomena. In addition, Tibetan Buddhist religiosity is entwined with fatalism, whereby their greater general fatalism increases believers' tendency to frame earthquakes as supernatural signs. These findings thus enrich our knowledge of Tibetan Buddhist believers' disaster framing and have implications for designing culture-oriented disaster risk reduction strategies for communities that are saturated with a heavily Buddhist culture.

Keywords Tibetan Buddhist belief · Disaster framing · Fatalism · Previous disaster experience · Earthquake · China

1 Introduction

Increasing attention has been given to local knowledge systems in disaster risk reduction (DRR) strategies (Dekens 2007; McAdoo et al. 2006). Only a few scholars, however, have gradually begun to consider religion-related resources (Adiyoso and Kanegae 2013, 2015; Alawiyah et al. 2011; Gaillard and Texier 2010; Ghafory-Ashtiany 2009;

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Gianisa and Le De 2018; Joakim and White 2015; Reale 2010). For example, some studies have shown that the spiritual comfort of religious belief—postdisaster external aid provided by religious-based institutions, religious-based social capital, and religious ceremonies—is vital for the development of disaster resilience (Adiyoso and Kanegae 2015; Alawiyah et al. 2011; Falk 2010; Gianisa and Le De 2018; Joakim and White 2015; Reale 2010; Sun and Qi 2023). However, among these studies, an important topic that has rarely been investigated within the field of disaster and DRR is local disaster framing and its formation mechanism. Disaster framing, here, is the way in which individuals conceptualize or reorient their thinking about disasters (Sun and Qi 2023). Indeed, understanding how people frame hazards and/or disasters is important. As Bankoff (2004, p. 91) has emphasized, "behaviours that appear inappropriate or illogical to external agency or relief workers may be entirely consistent and rational actions" in the local cultural schema of disasters. Hence, theoretical models of the disaster behaviours of religious believers should allocate their disaster framing a prominent role.

Natural hazards and disasters do not only exist as objective events but also as shared meanings construed by actual and potential victims themselves (Bankoff 2004; Sun and Faas 2018). For any religious community, it has been clearly documented that the disaster framing of its members contains some supernatural and animistic components (for relevant review, see Sun et al. 2018). Admittedly, inquiring into the role of such disaster framing in DRR and its influential factors is rather complex. On the one hand, the supernatural framing of disasters is thought to enhance people's resilience and could be used as coping mechanisms (Ano and Vasconcelles 2005; Berberian 2014; Joakim and White 2015; Pargament et al. 2011; Schmuck 2000; Sun and Qi 2023). On the other hand, it has also been defined as an obstacle to people's active response due to its entwined, fatalistic attitude (Adiyoso and Kanegae 2015; Gaillard and Texier 2010; Joffe 2012; Paradise 2005; Paul and Nadiruzzaman 2013; Sun et al. 2019). However, regardless of whether it supports the incorporation of supernatural framing into instruments for resilience enhancement or warns that it might be the source of disaster vulnerability, scholars and DRR practitioners should first be well aware of such framing's specific manifestations and formation mechanism. However, as noted, this matter has been rarely studied within the literature on the disaster-religion nexus. Pragmatically, designing culture-oriented DRR strategies for religious communities calls for more research in this matter. In some contexts, for external experts and practitioners, the understanding of how disasters are framed by the local also entails the discovery of a significant source of cognitive social capital or a potential obstacle for DRR.

Tibetan Buddhism is an important branch of Buddhism. In China, it has a deep influence on nearly every aspect of Tibetans' daily lives (Sun et al., 2024). Currently, a large portion of the Tibetan people live in the Qinghai-Xizang Plateau and surrounding areas, which are prone to earthquakes. Taking earthquakes as a case study, this study attempts to understand Tibetans' disaster framing and explore its influential factors. Specifically, it presents the characteristics of earthquake framing among Tibetans and explores whether earthquake experience, Tibetan Buddhist religiosity, and general fatalism affect this framing. This study is also intended to provoke further discussion on religious believers' disaster framing. We structure the remainder of the article as follows: first, we provide a literature review. This is followed by an introduction of our research design, including the data, sample, and measurements. We then present our results and discuss them. Finally, we offer a summary of the main findings.

2 Literature review and research questions

2.1 Natural and supernatural disaster framing

People have a tendency to interpret and evaluate the events occurring in their lives (Krull and Anderson 1997). Studies have argued that certain people are inclined to transform unexpected, uncontrollable, and painful events into something with a certain meaning (Gray and Wegner 2010; Stephens et al. 2013). Disasters are events that result in casualties, destroy buildings, cause psychological trauma; they naturally become objects for interpretation and meaning-making. Generally, such interpretations can be divided into two clusters, natural and supernatural. These two types of disaster framing typically emphasize whether disasters are caused by natural or supernatural forces.

With respect to supernatural framing, people believe that disasters are caused by an external spiritual force and/or denote a sign from god(s) (Berberian 2014; Paul and Nadiruzzaman 2013). A self-evident explanation for this phenomenon is that the absence of "scientific" knowledge drives people to seek supernatural interpretations for disasters (Dynes and Yutzy 1965; Ghafory-Ashtiany 2009). This might be true, but far from completely. Many recent field surveys have reported that some people still attribute disasters to god(s) (Adiyoso and Kanegae 2013; Chester et al. 2008; Ghafory-Ashtiany 2009; Paul and Nadiruzzaman 2013; Stephens et al. 2013; Sun et al. 2019), even when alternative scientific and secular interpretations are well known (Chester 2005). Moreover, studies suggest that these supernatural interpretations are expressed in complex ways and lack a unified format. Using the typology framework of religious psychology (Pargament et al. 2011; Pargament 1997), these interpretations can be categorized into negative and positive groups.

Negative attribution is more commonly mentioned in studies on the religion-disaster nexus. Namely, people can regard disasters as a punishment for their sins or gods' wrath. For example, such interpretations have been reported in the context of the Indian Ocean tsunami in 2004 (Paul and Nadiruzzaman 2013), Kashmir earthquake in 2005 (Reale 2010), Yushu earthquake in 2008 (Sun and Qi 2023), and Pakistan flood in 2010 (Shamsie 2010). However, regarding the role of negative disaster attribution in DRR, the arguments are mixed. Religious psychologists might categorize it as negative religious coping (Pargament et al. 2011), while in the eyes of anthropologists, even a punishment-type framing might represent a cultural adaptation to disaster because such an explanation can keep victims from "wasting time and energy asking why disasters happen to them and not others" (Schmuck 2000, p 85).

Via a positive attribution, a disaster is more likely to be interpreted as a trial from god(s). For example, based on fieldwork in Padang city, Indonesia, Gianisa and Le De (2018) have reported that beyond the view that disasters are due to peoples' misdeeds, some Muslims perceive disasters as trials and tribulations. In many cases, this type of framing represents spiritual support. Schmuck (2000) has found that although local residents in communities near the Jamuna River in Bangladesh accept flooding as an act of Allah and that nothing can be changed by them, they also believe that Allah will give them the strength to survive it. Similarly, Rahiem et al. (2017, p 506) have shown that some survivors of the Aceh 2004 Tsunami hold the belief that the tsunami was a test by God: "God only tests humans with actions that they can endure". In the context of Hurricane Katrina, Chan and Rhodes (2013) report that a similar framing was correlated

with survivors' posttraumatic growth, a subjective positive psychological change following a disaster (Tedeschi and Calhoun 1996).

Nevertheless, different religions and societies vary in how they link disasters and religious precepts (Gaillard and Texier 2010; Gianisa and Le De 2018; Paul and Nadiruzzaman 2013). Existing studies suggest that Buddhist concepts, such as *karma* (the idea that one reaps the consequences of their actions) and *impermanence* (the belief that nothing lasts forever), profoundly shape how Buddhist believers perceive the world (Brillenburg Wurth 2022; Finnigan 2022). It is therefore reasonable to infer that the way Buddhist believers interpret disasters may be influenced by Buddhist religious culture (Falk 2010; Sun and Qi 2023). However, the literature on disasters has provided limited insight into this area. Yushu is a historical earthquake-hit region where the majority of local inhabitants are Tibetan Buddhists. Thus, based on fieldwork in the Yushu area, this study specifically addresses the following question:

Q1 How do Tibetan people frame earthquakes?

2.2 Mechanism of people's supernatural disaster attribution

In an early study on the religious interpretations of disasters, Dynes and Yutzy (1965) argue that disasters are integral parts of human society and directly engage with religious concerns. Indeed, within the disaster literature, most of the reports on supernatural disaster attribution concern religious communities (for a review see Sun et al. 2019). Since religion entails a belief system based on spirituality, mysticism, and faith in divinity (Schipper et al. 2014) and provides answers and meanings in traumatic events (Falk 2010; Gray and Wegner 2010; Pargament et al. 1998), people likely frame hazards or disasters as supernatural phenomena that are subject to the influence of their religious culture. Empirical evidence for this is found in some recent studies, such as Chester et al. (2013), Joakim and White (2015) and Sun and Qi (2023). These authors argue that religious belief functions as a source of meaning-making when people interpret natural hazards and disasters (Chester et al. 2013; Joakim and White 2015; Sun and Qi 2023).

In addition to religious belief per se, another faith-associated factor, fatalism (Ruiu 2013), should not be ignored. Generally, fatalism refers to "the propensity of individuals or groups to believe that their destinies are ruled by an unseen power or are played out inevitably rather than by their will" (Maercker et al. 2019, p 2). Research not only indicates that fatalism is often entwined with one's religious beliefs but also reveals psychological reasons for it (Corcoran et al. 2011; Esparza et al. 2015; Maercker et al. 2019; Ruiu 2013). For example, studies from a psychological perspective argue that some people with dispositional traits view things as controlled by external factors and use this logic to make judgements (Esparza et al. 2015; Lindell and Perry 1992; Liu and Sun 2021; Turner et al. 1986). Thus, people with a generally fatalistic orientation might have fatalistic traits. In this sense, a supernatural disaster attribution might reflect one's particular external locus of control (Rotter 1992). In addition, although the supernatural attribution of disaster is definitely not equal to a low sense of control thereof (Adiyoso and Kanegae 2013; Chester et al. 2013), it can evoke a fatalistic attitude in response or a sense of powerlessness, according to some case studies (Baytiyeh and Naja 2014; Joffe 2012). Once disasters are attributed to uncontrollable factors such as a gods' will or act, in some people's cognition, nothing can be changed; one has to accept these results passively (Becker et al. 2013; Solberg et al. 2010; Sun et al. 2018, 2019). Thus, supernatural disaster attribution might be merely a specific

manifestation of one's fatalistic belief, regardless of whether this belief is mainly native, inborn or acquired through social learning (Sun et al. 2022). In terms of fatalism, then, we can anticipate that a general fatalism plays a role in disaster framing, especially in supernatural framing. As mentioned above, Tibetan people believe in *Karma*, and "although the *Karma* theory is not overtly fatalistic, in actual application it inevitably assumes a fatalistic colour" (Bhattacharji 1982, p 142). Therefore, when exploring Tibetan supernatural attributions to disaster, fatalism emerges as a factor that is hard to overlook.

Disaster experience, whether direct or indirect (Becker et al. 2017), may also be an important influential factor in the formation of peoples' disaster framing. Initial studies argued that frequent disaster experience contributes to the development of a disaster subculture in certain communities, where disaster-related values and beliefs become vital elements (Wenger and Weller 1972, 1973). Some more recent studies have also clearly documented how disaster experiences contribute to peoples' beliefs regarding disasters (Becker et al. 2013, 2017; Gallagher 2014; Gotham et al. 2017; McClure et al. 2001; Sun and Xue 2020). For example, frequent, nondestructive experiences might foster a *normalization bias* in people's risk perception (Mileti and O'Brien 1992; Sun and Xue 2020). When different forms of media information on building design are received by people, these can result in disparate attributions of earthquake damage (McClure et al. 2007). A recent study by Gao et al. (2020) shows that nonfatal earthquake experience can result in fewer risk beliefs concerning future earthquakes. Gao et al. (2020) also argue that such experiences can be incorporated into peoples' cognitive process, functioning as a salient anchor point that affects their decisions and judgements in terms of disaster risk, and thereby shaping their risk preferences (for details, see Gao et al. 2020). Hence, for religious believers, the extent to which they frame hazards or disasters as supernatural and/or natural phenomena might also be an output of what they have learned from their disaster experience.

Overall, few studies have specifically focused on the influential factors in religious believers' supernatural disaster framing. However, according to the abovementioned and sparse findings, we expect that religiosity and associated fatalistic belief, as well as salient experience, shape how religious believers frame disasters. Hence, based on an investigation in the Tibetan area Yushu, the second specific focus of the present study is as follows:

Q2 Do Tibetan Buddhists' religious belief, general fatalism, and earthquake experience affect their framing of earthquakes?

3 Research design

3.1 Data and sample

The Yushu area is our research site and is situated in the hinterland of the Qinghai-Xizang Plateau, China. A magnitude of 7.1 earthquake occurred in this area on 14 April 2010 (hereafter, the Yushu earthquake). It resulted in 2698 deaths and left 270 people missing, more than 10,000 injured, and 246,842 affected (State Council of the PRC 2010). Almost all the local residents are Tibetans, and the vast majority of them practise Tibetan Buddhism (Sun and Qi 2023). Tibetan Buddhism is deeply embedded in residents' spiritual and social lives and shapes their disaster perceptions and response behaviours (Sun and Qi 2023; Sun et al. 2019).

Table 1 Sociodemographic characteristics of respondents (%)

Gender		Age (years)		Education		AI (yuan)	
Female	48.0	18 < = Age < 25	25.1	SHS&B	49.9	< 10,000	65.6
Male	52.0	25 < = Age < 30	14.1	U&A	50.1	10,000 < = AI < 20,000	11.7
		30 < = Age < 40	20.3			20,000 < = AI	22.7
		40 < = Age < 50	20.0				
		50 < = Age < 60	16.5				
		> = 60	4.0				

SHS&B senior high school (including technical secondary school) and below, *U&A* undergraduate (including junior college) and above, *AI* annual income

In July 2022, we conducted a questionnaire survey in the Yushu area. With the assistance of a local expert from the Yushu Earthquake Administration, data were obtained through a questionnaire using convenience sampling. An electronic questionnaire that could be shared through the Chinese social media platform WeChat was created, and respondents were also encouraged to share the questionnaire across their social networks if they were willing to do so. Questionnaire data were thus collected in a snowballing manner. The focus of this study was earthquake disaster framing among the Tibetan people. Thus, respondents were asked to report their ethnicity (*Minzu*) by answering a specific question in the questionnaire, with the options: 1 = Tibetan, 2 = Han, 3 = Other. Individuals who were non-Tibetan or under the age of 18 were excluded. Ultimately, 375 respondents were included in this study. The sociodemographic characteristics of this sample are presented in Table 1: 52.0% were male, and 48.0% were female. Their age distribution ranged from 18 to more than 60 years old. Approximately half of the sample had a senior high school education (including technical secondary school) or below (49.9%). Most respondents (65.6%) earned under 10,000 yuan every year.

3.2 Measures

3.2.1 Dependent variable

Natural and supernatural attributions of earthquakes Participants were asked to indicate the extent to which they agreed with the following statements about earthquakes (Sun et al. 2019): "An earthquake is a punishment from gods" (Punish_Attri), "An earthquake is a trial from gods[1]" (Trial_Attri), and "An earthquake is a natural phenomenon" (Natural_Attri). In addition, we added another item, "An earthquake is the will of gods" (Will_Attri). This item just emphasizes the *supernatural* connotation of a disaster perception without further highlighting disaster as a punishment or trial. The response options were based on a 7-point Likert scale with scores ranging from "strongly disagree" (1) to "strongly agree" (7).

[1] The terms "punishment," "gods," "trial," and "will" in the subsection were translated from the Chinese phrases "惩罚" "神灵或者上天" "考验" and "意志"in the original questionnaire.

3.2.2 Independent variables

Earthquake experience Following previous studies (Sun et al. 2022; Sun and Xue 2020), respondents' harmful earthquake experience, vicarious earthquake experience, and training experience were measured in this study. In terms of their harmful earthquake experience, respondents were asked to assess the extent to which their daily life and livelihood had been affected by the Yushu earthquake on a 7-point Likert scale with scores ranging from "very small" (1) to "very serious" (7). Regarding their *vicarious earthquake experience*, respondents were asked to address how often they discuss earthquake-related topics with others in their daily life. The response options were based on a 7-point Likert scale with scores ranging from "*never*" (1) to "*always*" (7). In terms of their *training experience*, respondents were asked whether they had completed earthquake-related training. Never, once, or many times were coded as 1, 2 or 3, respectively.

Religiosity of Tibetan Buddhism The five-item Duke University Religion Index (DUREL) scale, developed by Koenig et al. (1997), was employed to measure respondents' Tibetan Buddhism religiosity. Certain expressions related to Tibetan Buddhist traditions, such as the word "church" being replaced with "temple," were adopted following Koenig and Büssing (2010). The DUREL scale encompasses the measurement of three dimensions of religiosity: organizational religious activity (ORA), measured through 1 item; nonorganizational religious activity (NORA), measured through 1 item; and intrinsic religiosity (IR), measured through 3 items (for details see Koenig et al. 1997). The 3-item subscale of IR in this study yielded a Cronbach's alpha of 0.74. The sum of the three items was calculated to derive the value of IR.

General fatalism The six-item fatalism scale of Esparza et al. (2015) was adopted in this study. Previous studies have shown that this scale has cross-cultural measurement validity (Maercker et al. 2019) and is applicable to Chinese samples (Sun et al. 2022). The option format was a 5-point Likert-type scale with a range from 1 to 5. We calculated the mean of the six items to obtain individuals' general fatalistic orientation. Higher values implied a stronger fatalistic orientation. The Cronbach's α was 0.93.

3.2.3 Control variables

Demographic characteristics were included in our study as control variables. These variables were coded as follows: gender (male = 1 and female = 0); age (greater than or equal to 18 but less than 25 years = 1, greater than or equal to 25 but less than 30 years = 2, greater than or equal to 30 but less than 40 years = 3, greater than or equal to 40 but less than 50 years = 4, greater than or equal to 50 but less than 60 years = 5, greater than or equal to 60 = 6); level of education (senior high school or technical secondary school and below = 0, undergraduate or junior college and above = 1); and economic level (annual income below 10,000 yuan = 1, greater than or equal to 10,000 yuan but less than 20,000 = 2, greater than or equal to 20,000 = 3).

3.3 Methods

Descriptive analysis, involving the calculation of means and standard deviations, was initially employed to gain an understanding of how earthquakes were framed by participants. Following this, correlation analysis was utilized to investigate the intercorrelations among the key variables. Subsequently, regression analysis was conducted to assess the impact of

participants' religious beliefs, general fatalism, and earthquake experiences on their attributions of earthquakes, both in terms of supernatural and natural ways.

4 Results

4.1 Descriptive analysis

Figure 1 illustrates how the respondents frame earthquakes. The means for the supernatural earthquake attribution fall between 3.0 and 3.5. Hence, the respondents moderately agree that earthquakes are supernatural signs from gods. The mean of natural earthquake attribution reaches up to 5.77. Obviously, in contrast to any supernatural attribution, respondents are more inclined to accept earthquakes as natural phenomena. In addition, Fig. 1 indicates that there are no great score differences among the three supernatural attribution variables. Hence, for the respondents, perceiving earthquakes as gods' will, punishment, or trial may have similar connotations. If this is case, statistically, these three variables should be highly intercorrelated and have high internal consistency reliability. The following analysis thus further evaluates this conjecture.

4.2 Correlation analysis

Table 2 lists the results of the correlation analysis. As inferred via Fig. 1, the three supernatural earthquake attribution variables are highly intercorrelated: the correlation coefficient between Will_Attri and Punish_Attri is 0.877. The correlation coefficient between Will_Attri and Trial_Attri is 0.854. The correlation coefficient between Trial_Attri and Punish_Attri is 0.908. Cronbach's alpha of these three items was also calculated. A value of 0.956 confirms their high internal consistency reliability. Hence, regarding supernatural earthquake attribution, these correlation analysis and Cronbach's alpha results show that

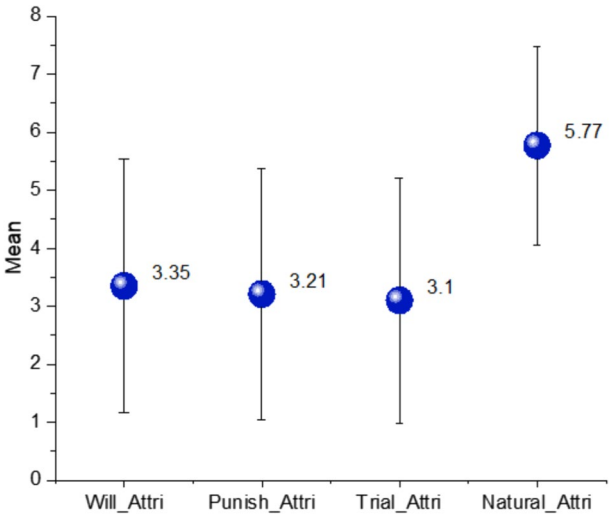

Fig. 1 Respondents' supernatural and natural earthquake attributions (mean ± standard deviation)

Table 2 Intercorrelations among the variables

	1	2	3	4	5	6	7	8
1. Gender	1							
2. Age	0.116*	1						
3. Education	−0.136**	−0.559**	1					
4. Economic level	0.049	0.021	0.222**	1				
5. Harmful earthquake experience	−0.119*	0.103*	0.064	0.039	1			
6. Vicarious earthquake experience	−0.089	0.042	0.079	0.091	0.393**	1		
7. Training experience	−0.030	−0.222**	0.260**	0.003	0.055	0.176**	1	
8. ORA	0.084	0.057	−0.133*	−0.101*	0.006	−0.036	0.030	1
9. NORA	0.034	0.032	−0.094	−0.084	0.047	−0.090	0.043	0.563**
10. IR	0.129*	0.002	−0.086	−0.143**	0.015	0.047	0.045	0.414**
11. Fatalism	0.000	0.062	−0.051	−0.040	0.226**	0.200**	−0.044	0.183**
12. Will_Attri	−0.019	0.055	0.000	−0.056	0.124*	0.286**	−0.039	0.105*
13. Punish_Attri	−0.004	0.003	−0.025	−0.091	0.055	0.245**	−0.042	0.136**
14. Trial_Attri	0.001	0.009	−0.035	−0.096	0.086	0.222**	−0.026	0.119*
15. Natural_Attri	−0.048	−0.025	0.107*	0.060	0.306**	0.214**	0.105*	−0.049

	9	10	11	12	13	14	15
9. NORA	1						
10. IR	0.525**	1					
11. Fatalism	0.124*	0.262**	1				
12. Will_Attri	−0.018	0.110*	0.394**	1			
13. Punish_Attri	0.033	0.118*	0.366**	0.877**	1		
14. Trial_Attri	−0.002	0.096	0.367**	0.854**	0.908**	1	
15. Natural_Attri	0.061	0.044	0.122*	−0.037	−0.077	−0.082	1

SD standard deviation

*p < 0.05, **p < 0.01, **p < 0.001, two-tailed.

there may be no significant distinctions between the negative and positive modes of supernatural earthquake attribution among the respondents.

In addition, we found no significant correlations between supernatural earthquake attribution and the counterpart variable Natural_Attri ($p > 0.05$). Thus, to what extent one frames earthquakes as natural phenomena might be independent from one's supernatural framing. Table 2 also indicates that the three dimensions of respondents' religiosity are related. Furthermore, these results show that general fatalism orientation is positively correlated with ORA ($r = 0.183$, $p < 0.01$), NORA ($r = 0.124$, $p < 0.05$), and IR (0.262, $p < 0.01$).

The following regression analysis therefore examine the effects of these independent variables on respondents' supernatural and natural earthquake attributions.

4.3 Regression analysis

Tables 3 and 4 list the results of our ordinary least squares (OLS) regression analysis of supernatural and natural earthquake attribution, respectively. Following Koenig and Büssing (2010), to avoid the multiple collinearity of ORA, NORA, and IR, we examine their effects in separate regression models. Similarly, we analyse the effects of fatalism in a separate regression model, as religiosity could interfere with an accurate evaluation of the effect of general fatalism. The variance inflation factor (VIF) values of all the variables in these models in Tables 3 and 4 are less than 3. This suggests that any multicollinearity problems among these variables in each model are less likely to exist (Shrestha 2020).

For earthquake experience, the results show that vicarious earthquake experience positively affects respondents' supernatural earthquake attribution. The regression coefficients of this variable in all models in Table 3 range from 0.30 to 0.40 and are statistically significant ($p < 0.001$). Accordingly, this indicates that discussing earthquake-related topics in their daily life increases the tendency to view earthquakes as supernatural signs from gods. With respect to natural earthquake attribution, only the variable harmful earthquake experience has a positive effect (see Table 4). These regression coefficients range from 0.25 to 0.30 and are statistically significant ($p < 0.001$).

With respect to Tibetan Buddhist religiosity, only ORA has a significant positive effect ($b = 0.208$, $p < 0.05$). The expected positive effects of general fatalism are also supported ($b = 0.095$, $p < 0.001$). This suggests that more organizational Tibetan Buddhist activities and a greater fatalistic cognitive orientation result in a stronger endorsement of earthquakes as supernatural signs. Moreover, neither religiosity-related variables nor fatalism have significant effects on respondents' natural earthquake attribution ($p > 0.05$, see Table 4).

5 Discussion

5.1 Findings

5.1.1 Earthquake framing

Regading Q_1, the roughly equal average values of Will_Attri, Punish_Attri and Trial_Attri and their high intercorrelations and internal consistency reliability indicate that there may be no obvious connotation distinctions among these three types of framing. In addition, compared to framing earthquakes as signs from gods, respondents more often frame them

Table 3 Results of regression analysis of supernatural attribution

Dependent variables	Supernatural attribution			
	Model 1	Model 2	Model 3	Model 4
Independent variables				
Harmful earthquake experience	−0.022	−0.019	−0.018	−0.100
	(−0.073)	(−0.074)	(−0.073)	(−0.07)
Vicarious earthquake experience	0.382***	0.379***	0.368***	0.306***
	(−0.07)	(−0.071)	(−0.07)	(−0.067)
Training experience	−0.247	−0.230	−0.234	−0.163
	(−0.131)	(−0.132)	(−0.131)	(−0.123)
ORA	0.208**			
	(−0.08)			
NORA		0.037		
		(−0.07)		
IR			0.056	
			(−0.032)	
General fatalism				0.095***
				(−0.013)
Control variables				
Gender	0.047	0.084	0.036	0.043
	(−0.21)	(−0.211)	(−0.212)	(−0.197)
Age	−0.005	−0.006	−0.000	−0.005
	(−0.084)	(−0.085)	(−0.085)	(−0.08)
Education	0.090	0.032	0.052	0.084
	(−0.266)	(−0.268)	(−0.266)	(−0.249)
Economic level	−0.253	−0.274*	−0.247	−0.231
	(−0.129)	(−0.13)	(−0.13)	(−0.121)
Constant	1.739**	2.187***	1.794**	0.756
	(−0.616)	(−0.615)	(−0.646)	(−0.584)
F value	5.37***	4.48***	4.87***	11.81***
R^2	0.11	0.09	0.10	0.21
Adjusted R^2	0.09	0.07	0.08	0.19

Unstandardized regression coefficients are displayed, with standard errors in parentheses

*p < 0.05. **p < 0.01. ***p < 0.001. The VIF of all variables in the models is less than 3

as natural events. This finding is consistent with Dynes and Yutzy's (1965) argument, i.e., even in communities that are immersed in a religious culture, natural explanations may be more common than supernatural attributions.

Additionally, if one frames earthquakes as natural phenomena, abandoning the framing of earthquakes as signs from gods, significantly negative correlations between natural and supernatural attribution variables should be found. However, these coefficients are not statistically significant in Table 2. This suggests that, for Tibetans, the distinction between natural and supernatural framings of earthquakes may not be strictly defined, at least within the natural-supernatural conceptual framework of this paper. Thus, the results of this study

Table 4 Results of regression analysis of natural attribution

Dependent variables	Natural attribution			
	Model 1	Model 2	Model 3	Model 4
Independent variables				
Harmful earthquake experience	0.290***	0.281***	0.288***	0.278***
	(−0.06)	(−0.06)	(−0.06)	(−0.061)
Vicarious earthquake experience	0.098	0.109	0.097	0.091
	(−0.057)	(−0.058)	(−0.057)	(−0.058)
Training experience	0.121	0.104	0.111	0.123
	(−0.107)	(−0.107)	(−0.107)	(−0.107)
ORA	−0.052			
	(−0.066)			
NORA		0.075		
		(−0.057)		
IR			0.023	
			(−0.026)	
General fatalism				0.012
				(−0.011)
Control variables				
Gender	0.014	−0.002	−0.017	−0.001
	(−0.172)	(−0.172)	(−0.173)	(−0.172)
Age	−0.017	−0.015	−0.014	−0.016
	(−0.069)	(−0.069)	(−0.069)	(−0.069)
Education	0.164	0.205	0.194	0.189
	(−0.218)	(−0.217)	(−0.217)	(−0.217)
Economic level	0.055	0.068	0.073	0.067
	(−0.106)	(−0.105)	(−0.106)	(−0.105)
Constant	3.370***	3.028***	3.031***	3.034***
	(−0.506)	(−0.5)	(−0.528)	(−0.508)
F value	5.98***	6.13***	6.00***	6.06***
R^2	0.12	0.12	0.12	0.12
Adjusted R^2	0.10	0.10	0.10	0.10

Unstandardized regression coefficients are displayed, with standard errors in parentheses

*p < 0.05. **p < 0.01. ***p < 0.001. The VIF of all variables in the models is less than 3

also corroborate the argument that supernatural and natural disaster attributions are not mutually exclusive (Chester 2005; Sun et al. 2018, 2022; Yari et al. 2019).

However, fully unpacking the reasons for Tibetans' patterns of disaster framing is a rather complex process. As mentioned in the literature review subsection, studies indicate that Buddhist concepts, including *karma* and *impermanence,* may play vital roles in Buddhists beliefs regarding disasters (Falk 2010; Sun and Qi 2023). Thus, these concepts might also account for why trial and punishment attributions of earthquakes are reconciled in Tibetans' disaster belief systems. For example, according to *karma*, an earthquake might be a punishment by gods for previous bad deeds. Accepting this punishment per se might represent both good *karma* and trial in the present, which

will result in positive results in the future. Furthermore, under the doctrine of *impermanence*, regardless of punishment or trial, there is no sharp distinction between them because *nothing lasts forever*.

Comparing the results for natural and supernatural earthquake attributions, these suggest that secularization may be the dominant method for earthquake framing among Tibetans in the Yushu area. However, further exploration of the mixed natural-supernatural framing of earthquakes in local connections may entail the topic of Tibetan Buddhism-science relationship in the Tibetan area of China, which is beyond the scope of this study. Nevertheless, it is worth noting that, in terms of the topology of the science-religion relationship proposed by Barbour (i.e., conflict, independence, dialogue, and integration, also see Barbour 2002), the present findings combined with those in the literature on the Tibetan area (Sun and Qi 2023; Sun et al. 2019) support the following statement: regarding earthquake framing, Tibetan Buddhist belief and science are neither in *conflict* nor *independent*. In a broad sense, as Gould's concept of "Non-Overlapping Magisteria" suggests, religion and science occupy distinct domains of inquiry—religion seeks to interpret meaning and values, while science is concerned with empirical facts (Gould 2002). Similarly, Plantinga argues that there is no fundamental conflict between theistic Christianity and science, and that the Christian worldview can provide a solid foundation for scientific inquiry (Plantinga 2011). Although these arguments are not specifically tailored to the Tibetan context, they offer enlightenment into our findings. In Tibetan Buddhist belief area, those believers may interpret various aspects of earthquakes (e.g., factual and moral dimensions) through the combined lenses of scientific reasoning and Buddhist beliefs. While some disaster framings may appear conflict on the surface, they remain internally coherent within a broader framework that encompasses both scientific understanding and Tibetan Buddhist beliefs.

Hufford's (1982) seminal work on "traditions of disbelief" highlights that much academic work on supernatural belief, either explicitly or implicitly, is based on the premise that supernatural beliefs arise from erroneous concepts. The "traditions of disbelief" in academia often lead relevant research to focus on the source of these "erroneous concepts" rather than the grounds and processes of supernatural beliefs (Hufford 1982). We embrace Hufford's perspective, continually reflecting on our own research process and maintaining an objective stance that remains independent of our own cultural beliefs (e.g., no judgments about which beliefs are right or wrong). Since this study is based on fieldwork in a historically earthquake-prone area, the following section specifically discusses the roles of religiosity, general fatalism, and earthquake experience in shaping the earthquake framing of Yushu's residents.

5.1.2 Influential factors and mechanism

Regarding Q_2, other than the positive effects of ORA on supernatural earthquake attribution, we found no statistically significant relationships among the other religiosity variables (i.e., NORA and IR) and disaster framing variables. Notably, this result does not mean that Tibetan Buddhist religiosity plays a limited role in peoples' disaster attribution. In contrast, as noted in the literature review (Sect. 2.2), their religiosity may contribute greatly, albeit in a complex way, to people's disaster framing. For example, according to Sun and Qi (2023), both Tibetans' supernatural and natural explanations of disasters can be affected by Tibetan Buddhist culture. *Karma*, for instance, results in a punishment-type explanation of earthquakes, while the *four primary elements* in Buddhist belief provide believers with rationales for how earthquakes can naturally occur (Sun and Qi 2023). Similar findings

have also been reported for Muslims. Muslims who view disasters as gods' punishment and those supporting a natural attribution can thus quote the Holy Qur'an to support their arguments (Adiyoso and Kanegae 2013). Hence, the nonsignificant relationship observed between the religiosity (i.e., NORA and IR) and disaster framing variables might be mainly attributed to the methodology of this study. That is, the above measurements cannot distinguish samples that are subjected to the religiosity-supernatural attribution impact pathway from those subjected to the religiosity-natural attribution impact pathway.

However, as expected, the above results show that Tibetan Buddhist religiosity is closely correlated with Tibetans' general fatalism. This finding is consistent with Ruiu (2013) concerning the origin of fatalism, i.e., religious affiliation entails an increase in fatalistic attitude. More importantly, we have found that a higher general fatalism implies a stronger endorsement of earthquakes as supernatural signs. One plausible explanation for this is that both a general fatalism and supernatural earthquake attribution in religious communities are generated by similar sociocultural and psychological mechanisms. Namely, both are the output of a formation mechanism in which disaster experience, religious culture, and individual personality play roles (Ruiu 2013; Sun et al. 2022). The second possible explanation is that one's general fatalism suggests that an individual tends to attribute the causes of *things* to external factors. For people in religious communities, the forces of gods(s) are thus salient external factors. In regard to one's interpretation of earthquakes, gods(s), as salient cognitive resource(s), may more easily enter into one's (particularly an individual with external attribution tendencies) judgement process (Tversky and Kahneman 1973), resulting in a supernatural earthquake attribution.

With regard to the effects of experience, the results show that their harmful experience is positively correlated with respondents' natural earthquake attribution but not any supernatural variables. However, vicarious earthquake experience (i.e., the frequency of discussing earthquake-related topics with others in daily life) positively affects only supernatural earthquake attribution. Furthermore, neither supernatural nor natural attributions significantly correlate with training experience. This finding on harmful experience is inconsistent with the findings of Dynes and Yutzy (1965) and Stephens et al. (2013), which suggest that greater disaster losses or more disruptive experiences result in more supernatural interpretations. We therefore infer that for Tibetan people, distinct mechanisms guide the formation of natural or supernatural disaster framing. Greater earthquake experience might render people further cognizant of the power of nature, and as a result, they may tend to adopt a naturalistic interpretation of earthquakes. The influence of the frequency of earthquake topic discussion in daily life on supernatural attribution might reflect how survivors commemorate traumatic disaster events. Indeed, in the post-Yushu earthquake era, local periodic earthquake commemoration activities usually involve religious activities such as prayer and chanting (Sun and Qi 2023). Daily discourses concerning earthquakes that are immersed in a supernatural atmosphere might strengthen peoples' inclination to regard earthquakes as supernatural signs. Clearly, further evidence to support these plausible explanations needs to be collected in future studies.

5.2 Implications

The findings in this study extend the disaster perception and behavioural literature and have implications for the design of DRR strategies. First, for those providing external disaster relief and services to Tibetan communities, strategies for improving their cultural competence (Collins and Arthur 2010) should be incorporated into their knowledge on

how Tibetans may frame disasters. Second, particularly for psychological interventions in communities with a Tibetan Buddhist atmosphere, negative and positive religious coping should be re-evaluated. Third, this study has shown that fatalism, harmful earthquake experience, and vicarious earthquake experience play roles in Tibetans' disaster framing. This finding has implications for earthquake disaster educators and designers of risk communication. That is, communities that are saturated with a strongly fatalistic atmosphere but with nonharmful disaster experience and frequent exposure to disaster information might require customized strategies.

5.3 Limitations

Notably, this study has limitations. First, this study was based on convenience sampling. Therefore, generalizing its findings to the whole Tibetan group should be performed with caution. However, previous fieldwork in the Yushu area and some relevant findings in other studies on Tibetan peoples' disaster perceptions (Sun and Qi 2023; Sun et al. 2019) provide partial triangulation evidence for the findings in the present study. Second, this study used only a four-item scale to measure Tibetans' disaster framing. Tibetan Buddhists' explanations for disasters are complex, and their religious beliefs can be reflected in both natural and supernatural framings. A four-item scale may not fully capture the rich connotations of Tibetans' earthquake framings. Another limitation in measurement arises from how the study assessed respondents' general fatalism. In this study, after answering gods-related questions on earthquake framing, respondents were asked to complete the fatalism scale developed by Esparza et al. (2015). This sequence may have prompted respondents to express a stronger sense of fatalism. Therefore, future studies should consider designing more elaborate and culture-specific scales, along with a more logical order of measurement, to better assess Tibetans' disaster framing and fatalistic beliefs. Third, it is essential to acknowledge that employing quantitative methodologies to capture the intricate religious belief systems prevalent in many regions of Asia presents a considerable challenge. In fact, numerous individuals in Asia may concurrently adhere to a multitude of practices and beliefs, encompassing elements of Buddhism, Taoism, Confucianism, secularism, and science, without displaying distinct preferences or rejections (Gellner et al. 2020; Yang 1970). These diverse components may provide complementary frames of reference that have the potential to influence individuals' disaster framing. To comprehensively investigate the interplay between religious beliefs and disaster framings, future research agendas should consider the incorporation of qualitative and mixed research approaches (i.e., combining both qualitative and quantitative methodologies).

6 Conclusions

This study focuses on Tibetans' types of earthquake framing and their influential factors. First, it shows that for Tibetans, framing earthquakes as gods' punishment, will, or trial may have similar connotations. Namely, the topology of positive and negative disaster attribution may not be applicable to Tibetan Buddhist believers. Furthermore, Tibetans' beliefs regarding disasters, their supernatural and natural framing, are different but not opposite. Second, their earthquake experience shapes how Tibetans frame disasters. Specifically, vicarious earthquake experience increases their tendency to

provide a supernatural attribution, while harmful earthquake experience increases their likelihood to frame earthquakes as natural phenomena. Third, Tibetan Buddhist religiosity is entwined with believers' general fatalism, which further affects their supernatural attribution.

Author contributions Lei Sun: Methodology, Formal analysis, Writing-Original draft preparation. Jun Guo: Conceptualization, Writing—Reviewing and Editing.

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Declarations

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