Abstract: This study examines the relationship between disaster and religion by exploring three main questions: how religion shapes the interpretation of disasters and the subsequent recovery processes; how disasters transform religious practices; and how religious interpretations may coexist with scientific explanations of the same disaster. By focusing on the Aceh society’s experience after the 2004 tsunami, this paper argues that Islam, which serves as the central modeling system of Aceh culture, played two interconnected roles in the post-tsunami period: one of providing explanations for the inexplicable disaster and the other of guiding the ensuing actions. Furthermore, the tsunami had a significant impact on the practice of Islam in Aceh, as demonstrated by the shift toward the Sharia system to create a more Islamic Aceh society in the future. This phenomenon thus serves as an example of an explosive change in a semiosphere, as explained by Juri Lotman. This paper also identifies the coexistence of religious and scientific interpretations of the tsunami among the Acehnese, highlighting their distinct social functions.

Keywords: explosive changes; post-disaster recovery; religious interpretation of disaster; scientific explanation of disaster; semiotics of religion

1 Introduction

The practice of interpreting natural disasters through religious beliefs is an ancient phenomenon that continues to persist in modern times. According to a study that examined 49 volcanic eruptions between 1850 and 2002, only 16 cases did not show any evidence of religious responses (Chester et al. 2008). For instance, the 1815 Tambora eruption was seen by locals as God’s punishment for the bad behavior of the ruling class at that time (Wood 2014). Similarly, the 1755 Great Lisbon earthquake was perceived as a sign of God’s wrath toward the people (Kendrick 1957: 43). Currently, the people living near Mount Merapi in Indonesia believe that the periodic eruptions of the volcano are indications of the activities of the spirits dwelling on its peak (Dove 2010; Schlehe 2009). The 2006 earthquake in Yogyakarta and Central Java

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was also interpreted as a warning from the spirits to the ruling class, particularly the Sultan of Yogyakarta, to uphold Javanese traditions instead of being too modern and business-oriented (Schlehe 2010).

These religious beliefs are sometimes contrasted with scientific explanations for natural disasters (Kemkens 2013). While scientific explanations can support efforts to reduce disaster risks, religious interpretations of natural disasters may be perceived as incompatible with disaster risk reduction programs, particularly when people view disasters as divine destiny, which leads to a fatalistic attitude. For instance, Dibben (1999: 195) noted that some people may have a religious or fatalistic approach toward an impending disaster, believing that chance, fate, or God would determine its effect on them, leaving them with little control. Therefore, some studies have pointed out that religious beliefs can pose obstacles to pre-disaster preparedness and post-disaster emergencies and reconstructions (Aksa et al. 2020; Levy et al. 2009; Orr et al. 2021). However, other studies have demonstrated the extensive and significant roles of religion in pre-disaster mitigations, emergency responses, and post-disaster recovery processes (Falk 2010; Fountain and McLaughlin 2016; Gaillard and Texier 2010).

This study investigates the interplay between natural disasters and religion by focusing on the Aceh society following the 2004 Indian Ocean earthquake and tsunami. Specifically, it examines the roles that religion assumes in the aftermath of a natural disaster, the changes in religion’s societal and political position in relation to such events, and the concurrence of religious and scientific interpretations of the disaster. Juri Lotman’s cultural semiotic approach, particularly his notions of the semiosphere and explosive changes, provides the theoretical framework for this study. The semiosphere refers to the semiotic space in which all processes of meaning-making occur through the mediation of signs, including their creation and interpretation (Lotman 2005). This cultural semiosphere is characterized by the dynamic interplay between its center and periphery. The former consists of a stable space with fixed sign organizations and codes, while the latter is more fluid, serving as a translator of messages between the semiosphere and its surrounding extra-semiotic spaces (Lotman 1990: 134–137).

This abstract semiotic space serves as the foundation for comprehending cultural dynamics, which can be classified into two types: gradual change and explosive change (Lotman 2009). Lotman has employed the phenomena of technological progress and scientific discovery to illustrate both these dynamics in various contexts (Lotman 2013: 88–97, 2019: 201–223). The former involves predictable and gradual development based on the principles of linear progress, while the latter is characterized by novelty, innovation, and unpredictability. In gradual development, the semiotic structure of the given semiosphere remains stable. In contrast, explosive change denotes a fundamental shift in culture, causing the disruption of existing semiotic structures and resulting in a new center–periphery organization. Such
transformation may be initiated by a radical invasion from the extra-semiotic spaces to the center of the semiosphere, facilitated by its permeable boundary, which allows the translation of external messages into its internal language and enables communication with other semiospheres (Lotman 2005: 210–212). These two types of dynamics can occur sequentially or synchronically within the same historical period, wherein some phenomena facilitate innovation while others ensure succession (Lotman 2009: 12).

The paper goes beyond the application of semiotic methods to analyze religious phenomena by contributing to the development of a semiotic theory of religion. Moreover, it explores the semiotic frames of disasters and their role in driving social change (see also Nazaruddin 2022). Within the field of disaster studies, this study contributes to the hitherto rare academic studies focusing on the long-term social and cultural changes following a disaster (Oliver-Smith 1996), while focusing on the modeling and guiding function of religion in disaster mitigation and recovery.

This paper explores three interrelated subtopics that are central to the article’s focus. Firstly, it investigates how Islamic interpretations evolved after the tsunami, with religion serving as a central modeling system of the society. Secondly, the paper examines how the natural disaster influenced the status of religion in society as well as its constitution as a belief system. These post-disaster religious changes provide significant semiotic insights for the third issue, which is the adoption of scientific discourse to interpret natural disasters and the concurrence of religious and scientific frames of disaster.

2 Materials and methods

This paper is based on longitudinal fieldwork conducted in Banda Aceh and Aceh Besar, Indonesia, following the 2004 Indian Ocean earthquake and tsunami. My initial encounter with post-tsunami Aceh occurred from January to May 2005, when I volunteered in Aceh Besar and participated in various tsunami emergency responses, including aid distribution, emergency education and recreational activities, and psychological healing. In 2016 and 2017, I conducted qualitative fieldwork that focused on tsunami memorials, particularly the Aceh Tsunami Museum and the PLTD Apung Monument, where I interviewed local visitors. All the interviews were conducted in Bahasa Indonesia, and I have translated them into English for the quotations in this paper. One of the interview topics was how people interpreted the 2004 tsunami and learned to recognize signs of future tsunamis. In 2019, I conducted additional fieldwork, concentrating on the religious responses and cultural memory of the tsunami. During this five-month period, I collected empirical data through participant observations, semi-structured and open-ended interviews, and informal
discussions. I interviewed 50 residents, including village heads (*keuchik*), local leaders, Islamic leaders, writers, scholars, young people, activists, and government officials, focusing on their interpretations of the tsunami, memories of it, and cultural and religious changes after it. These informants were purposively selected based on their mastery of the interview topics.

In the data analysis phase, I conducted data reduction by selecting only the sections of the fieldwork notes and interview records pertaining to the interpretation of the tsunami and religious and cultural changes after the tsunami. Using the information gathered from my fieldwork, I developed the three abovementioned subtopics for this paper. These subtopics were then analyzed in the context of Lotmanian cultural theory, with a specific focus on concepts such as semiosphere, explosive change, and modeling systems.

### 3 Religion as a central modeling system of Aceh society

In the aftermath of a disaster, people often turn to religion to help them make sense of the unimaginable catastrophe and find a way to accept it (Kemkens 2013). Previous studies have highlighted the crucial role of religion in providing a framework for interpreting and understanding disasters (Adeney-Risakotta 2009; Samuels 2010). Many survivors in Aceh reported that they immediately turned to *dhikr* and prayer as soon as they found shelter on rooftops, second floors of houses, or other safe places, shortly after the waves hit (Samuels 2010: 217).

Islamic interpretations of the tsunami emerged in Aceh during the critical moments of post-tsunami emergencies, following the non-interpretive stage of denial that typically occurs immediately after a disaster (Morimoto 2015). This is a crucial step in the process of post-disaster trauma healing. It’s worth noting that religious responses to the disaster were already present even before the catastrophe hit, with people turning to religion when they knew the waves were approaching or when they were unsure if they would survive the disaster. For example, a woman in her late forties from Alue Naga, a fishing village in Banda Aceh, recounted her experience to me:

> After the earthquakes, people shouted: “The seawater is rising, the seawater is rising.” There was a thunderous roar, and the roar was getting bigger and bigger. When I ran back, the seawater was already very high, standing and black. I said to Grandpa, “Grandpa, get out, run to the mosque.” Grandpa said, “No need, kid, just you, it is my time.” We did not know where to run; people had scattered, crying, roads had been cut off. I just sat in the mosque; we gathered in the mosque, making *dhikr*. I saw a very high wave coming toward us. After that, boom, I did not know anymore; I was already in the water, I did not see anything anymore. (Interview, N, female, 40s, 31 July 2019)
In the aftermath of the catastrophe, there were a variety of interpretations of the tsunami based on Islam. The Acehnese viewed the disaster as a manifestation of God’s will, but in different ways, such as a test from Allah to fortify their faith, a warning from Allah, particularly as a strong signal to end the ongoing conflict between the Free Aceh Movement (GAM) and the Indonesian military forces, a punishment for sins related to the long and violent conflict, or a predetermined destiny independent of human actions (Idria 2010; Samuels 2016; Wieringa 2011). A local writer provided further insight into how the Acehnese attempted to discern God’s intentions behind the tsunami, which included increasing the quality of faith, providing an opportunity for individuals to earn religious merit, granting forgiveness for sins, showing mercy to those who accepted their fate with patience, and testing people to discover who truly had faith (Sanny 2008: 157–163).

These interpretations were at the same time explications of religion as the central modeling system in Acehnese culture, providing meaning to experiences and objects and guiding future behavior. Lotman (2011: 250) defines a model as “an analogue of an object of perception that substitutes it in the process of perception.” If culture is the subject of modeling, the substitution not only includes artifacts or objects but also the past and future, as well as the memories and expectations of the community. Russian philologist and semiotician Vyacheslav Ivanov viewed semiotic world models as programs for individual and collective behavior, and modeling systems as any semiotic resources that have a specific structure of elements and rules for their combination in modeling activity (Ivanov 1988 [1965]: 36–37; see also Pärn 2021: 111). Lotman further suggested that every culture possesses multiple modeling systems that can be divided into two levels: the primary modeling system of language, and other secondary modeling systems that use language as their basis, such as art, religion, or science (Lotman 2011).

Lotman proposed that religion and the magical model are the two most archaic sociocultural models (Lotman 2019: 49). The magical model is characterized by reciprocity, coercion, equivalence, and obligation as the basic features of the relations between the parties involved. On the other hand, religion is a system of relations characterized by the unconditional surrender of oneself to a higher power. The receiving party is acknowledged as more powerful, and there are no accompanying conditions (Lotman 2019: 49–50). Estonian theologian Thomas-Põder (2021) has further developed Lotmanian cultural semiotics along the lines of religion. He argues that religion, in comparison to the central position of art in Lotmanian works, could also serve as a primary tool for the semiotics of culture. According to Põder, religion reveals the creativity, unpredictability, and explosiveness of culture, making it an excellent tool for studying creativity in culture (Põder 2021: 47).

In monotheistic religions, God holds a central role in communication between the inside and outside of the semiosphere, where dynamic tensions arise between
predictability and unpredictability, certainty and uncertainty. According to Lotman (2019), each culture requires central mechanisms for cultural translations that provide rules for translating experiences or objects into the cultural memory of that culture. Lotman introduced the concept of a symbol that lies at the core of a culture as something archaic and stable and the most important element of the mechanisms of cultural memory (Lotman 2019). At this point, God as a sign possesses supreme symbol qualities: independence, invariability in essence, and a completed text in both content and expression. A symbol exists independently of any given text and already exists before being included in it (Lotman 2019: 165). According to Lotman, as an independent element, a symbol is always a complete text in both expression and content, which means it does not have to be included in a syntagmatic series. However, when it is included, it retains its conceptual and structural independence and can easily be separated from its semiotic surroundings and enter into a new semiotic context (Lotman 2019: 163).

On the other hand, God transcends the semiosphere as an essence that is unpredictable and indeterminate, the origin of ultimate unpredictability and indetermination. God’s omnipotence encompasses everything that lies beyond human description and possibility. Therefore, God symbolizes “the rootedness of religion in the ‘other’ of the semiosphere. In the space of possibilities or freedom, God is the asymmetrical ‘other’ in and of the semiosphere” (Põder 2021: 41).

Thus, in semiotic terms, God embodies a dual nature: as the central symbol located at the core of a particular culture, and simultaneously as the source of its indeterminacy. This dual meaning helps to sustain religion as the primary modeling system by compelling the culture to engage in constant self-reflection. Through this process, the culture can continuously communicate with and adapt to its extra-semiotic spaces. This tension between the two meanings, reflected in self-reflection, drives the explosive changes in the culture.

3.1 Explanatory modeling of religion

In Islamic societies, Allah is a central element of cultural expression, including art, literature, social, economic, and political realms. It is believed that all events occur with His permission, and therefore, every experience should be interpreted in relation to Him. Furthermore, every human action should seek His countenance. As a result, religion serves as a modeling system that reflects all experiences through the sign of Allah.

However, during regular daily experiences, this centrality of God is often not readily apparent, as it lies in the background of daily routines. The primary function of religion to explain the unexplainable and to translate the untranslatable emerges
as the prominent foreground during disruptive events, such as crises, conflicts, or disasters, which Turner (1969) describes as liminal moments. During such situations, religion’s modeling function takes place on two levels: explanation and action. According to Riesebrodt (2010: 173), “Religion not only makes it possible for the inexplicable to be explained; it also maintains people’s ability to act in situations in which they run up against their own limits.”

Initially, religion should explain the inexplicable and religion should be able “to describe as wide a range of objects as possible, which would include as many as yet unknown objects as possible” (Lotman et al. 1978: 222). The tsunami was believed to be a foreign message, an extraordinary event that must have originated from God. It was seen as God’s action, which likely had specific purposes that humans should reflect on. As previously explained, Islamic interpretations of the tsunami were diverse. Based on an examination of medieval Islamic texts, Akasoy (2009) has noted that the diversity of interpretations of natural disasters, especially earthquakes, has deep historical roots within Islamic scholarship. However, whatever the interpretation, in Aceh society, it is always traced back to Allah as the supreme cause of the tsunami, and no one would object to this final interpretation.

The primary religious ritual in post-tsunami Aceh that served the function of providing explanations was the weekly Friday sermon. During these sermons, the preachers often spoke about the tsunami as a divine destiny, citing specific verses from the Quran, hadiths, or Islamic scholarship traditions to explain why Allah, who is all-loving, merciful, and just, allowed such a terrible disaster to occur. This touches upon the issue of theodicy, which refers to “the attempt to reconcile God’s justice and love with the simultaneous existence of evil and suffering” (Chester 1998: 486).

However, what is crucial is how the speculative theodicy has been adapted to local contexts to meet the particular needs of grieving communities (see Merli 2010). During my four-month volunteer work for tsunami emergency response in Aceh Besar regency, I attended Friday prayers every week. The sermons mainly consisted of advising the community (ummah) on Islamic teachings, such as divine wisdom (hikmah), surrender (tawakkal), patience (sabar), sincerity (ikhlas), or acceptance (pasrah). In one of the Friday prayers in January 2005 that I documented, the preacher said:

There is always hikmah in every disaster. We have to contemplate this hikmah: Why did the disaster happen? Was it punishment, warning, or test? Then, why did Allah save us from that disaster? Only by the power of Allah have we survived the tsunami. In the face of the tsunami, humans were nothing. It is like Allah giving us a second chance at life. What for? Of course, to be a better Muslim, more pious, closer to the mosque, closer to Allah. (Fieldnote, 21 January 2005)

This sermon stressed the optimistic meaning of the tsunami for the local population. Despite varying religious interpretations of the disaster in Aceh, they all affirmed a
fundamental belief that God had saved the survivors from the catastrophe, and that “God cares for us in our suffering” (Adeney-Risakotta 2009: 239). Some scholars argue that the most notable feature of the Acehnese post-tsunami responses is their forward-looking interpretation, which emphasizes the tsunami as an opportunity for a better future life for the local people (Daly et al. 2016; Feener 2013; Feener and Daly 2016). Additionally, this interpretation, which had already emerged in the months following the tsunami, has become a critical cultural foundation for further post-tsunami changes that I will elaborate on below.

3.2 Religious modeling of action and recovery

The first function of religion, modeling of the reasons behind disasters, leads to the modeling of subsequent behavior and activities in the form of instructions and guidance. Riesebrodt (2010: 122) has argued that the nature of all religions is “averting misfortune, overcoming crises, and providing salvation.” With a transition from the modeling of reasons to the modeling of action, the translation of impossibility into possibility becomes more apparent, enabling people to overcome crises and move beyond their liminality, as “God is the sign of the primacy of possibility, a sign of promise” (Põder 2021: 41).

In this sense, religious interpretations themselves may serve as coping mechanisms. Annemarie Samuels conducted ethnographic fieldwork in the region three years after the tsunami and demonstrated that the understanding that the tsunami was an act of God enabled people “to accept the disaster and move on with their lives” (Samuels 2010: 218). Such interpretations may lead to religious commitment among survivors, manifested in practicing the five-times-daily prayers, exercising dhikr, giving help to others, or donating alms. In the aftermath of the tsunami, the fundamental belief in Allah was confirmed through different kinds of Islamic prayers and rituals to cope with the post-disaster sociopsychological effects (see also Gaillard and Texier 2010; Wisner 2010). Hoeberichts (2012: 391) has argued that religious practices may provide survivors a way to move beyond their individual sufferings by connecting them with “a Universal Self, God, Oneness, or Unity of Being.” Also, in the case of Buddhist communities in Southern Thailand, Falk (2010) has shown that religious faith and practices became a vital means of coping with post-disaster suffering.

Based on my fieldwork, I would add that religious rituals may be modified and recreated during a crisis. A story from a keuchik (village head) who had initiated the return of the community to their destroyed village only a few weeks after the tsunami shows how they had created a special set of rituals during the emergency that aided in healing the psychological crisis after the disaster:
This tsunami was a trial from Allah. In principle, Allah says you are near, I am near; you are far, I am far away. For our brothers who were no longer here, we were willing to let them go. We did not have to cry over what happened. Every day, after the Maghrib prayer, we pray and dhikr. So, during the day, we evacuate the bodies and arrange the debris while the women prepare the food. After sunset, we pray for the dead, also do dhikr. We have been doing this for almost a year; in less than a year, the trauma and sadness have disappeared. (Interview, B, male, 60s, 10 June 2019)

According to Barnett (2011), the history of humanitarianism shows that the desire to help others, even those far away, is rooted in the history of Christianity and other religions. As Wisner (2010: 129) has noted, local religious institutions often play a critical role as first responders and providers of immediate assistance during times of crisis. Ferris (2005: 325) has also observed that local religious communities were among the first to respond and provide aid to survivors in the aftermath of the 2004 tsunami, even before international aid arrived. For example, mosques in a village in southeast Sri Lanka and Buddhist temples in Southern Thailand played important roles in disaster relief efforts (Falk 2010; Hasbullah and Korf 2009).

In the aftermath of the tsunami in Aceh, similar patterns could be observed. Local religious institutions, communities, and leaders were among the first to respond to the emergency and provide aid to survivors. Many evacuation camps were established in the courtyards of mosques, meunasahs (small or hamlet-level mosques), and dayahs (Islamic boarding schools) located in interior areas far from the coasts. Life in these interior areas, which were not directly affected by the tsunami, continued as usual. The mosques, meunasahs, and dayahs organized the camps, distributed aid, provided trauma healing, and fulfilled other emergency functions. Local Islamic leaders, or tengku, served as psychological consultants, assisting in the healing of psychological trauma during the emergency period through daily or weekly Islamic sermons and personal talks with survivors.

During the recovery process, Islamic leaders continued to play an important role as informal psychological healers, listening to survivors' tsunami stories and offering consultations on various daily problems. Some Islamic groups held routine daily or weekly activities in temporary shelters, such as teaching the Quran to children and youth, providing skill training for adults, offering informal consultations, and organizing educational and recreational activities. This psychological recovery was crucial, as the government and other aid agencies primarily focused on physical reconstruction, building public infrastructure, and establishing new settlements. The issue of psychological trauma and the collective memory of the tsunami were not given adequate attention by these agencies (Clarke et al. 2010). This psychological recovery process of the tsunami survivors strongly supported the rapid physical reconstruction efforts. Psychologically recovered survivors actively monitored the implementation of reconstruction programs and pushed for the quick completion of
human settlement development (Grayman and Bronnimann 2019). Many survivors also worked in the reconstruction sector, ranging from daily construction workers to field forepersons.

4 The trajectories of religious change after the tsunami

In the aftermath of a disaster, there are often fundamental questions about what occurred, why it happened, and how to move forward. Potential answers to these questions can lead to diverse interpretations, resulting in a state of ambiguity and inconclusive meaning. However, this ambiguity and diversity may not last long, as it can create cultural uncertainty and instability. To avoid this, certain meanings must be selected, whereby “certain tendencies are suppressed, while others undergo further development” (Lotman 2019: 230). This selection process is accompanied by the processes of self-description, which are essential for the preservation of cultural unity and integration. In the following section, we will examine how the initial diversity of post-disaster interpretations in Aceh was replaced by specific trajectories of religious change and the fixation of disaster-related meanings.

4.1 The politics of naming the tsunami

Along with the reconstruction and recovery efforts, the interpretation of the tsunami has become more consistent and clearer, with many viewing it as a test from God. According to this belief, those who lost their lives were not sinners but considered martyrs (syuhada). At the same time, this interpretation serves as an important coping mechanism, providing comfort to survivors who are able to move forward with the belief that their loved ones are already in heaven (Samuels 2010).

Recent research by Fukuda and Boret (2019) has shown that the idea of the tsunami as a trial from God remains the dominant discourse during the annual tsunami commemorations in Aceh. During the eleventh, twelfth, and thirteenth public commemorations in Banda Aceh, every public speaker implied that “the hands of God” were behind the disaster, and that the tsunami was a trial for Acehnese people, with victims referred to as martyrs (Fukuda and Boret 2019: 237). Interestingly, the discourse of the tsunami as punishment (azab) from God, which was prevalent in earlier periods after the tsunami, has been excluded from these annual commemorations. Fukuda and Boret (2019) noted that Islamic leaders giving the talks explicitly rejected the idea that the tsunami was a punishment from Allah.
This exclusion may also be related to the government’s interests, which preferred a discourse that supported the recovery process. In this context, Clarke et al. (2010: 245) have noted that religious interpretations can sometimes hinder recovery efforts, especially when survivors are made to believe that the disaster was a punishment of some kind and that God is angry.

One of the most significant aspects to note here is the politics of naming that emerged in the aftermath of the 2004 tsunami. The disaster was framed as a trial, with the deceased being identified as martyrs. At the mass graves of the tsunami victims, visitors will find an information board referring to it as the “graveyard of the tsunami martyrs” (Figure 1). This naming strategy solidified the meaning of the disaster and impacted people’s behavior (cf. also Lotman 2019: 98) – it encouraged individuals to pray and revere the deceased. Selg and Ventsel (2020: 152) have observed that “through the act of naming, the hegemonic relations are established.”

The dominant interpretation of the 2004 tsunami was formed by selectively choosing from various pre-existing meanings. The tsunami was not viewed as a punishment or a warning, but rather as a trial, and the deceased were not regarded as sinners or victims but as martyrs. Over time, this singular name will serve as “the foundation for the continuity of its identity” (Selg and Ventsel 2020: 157).

Figure 1: An information board at a mass grave of tsunami victims (source: personal documentation).
4.2 The Sharia law and the pious elites

Some anthropological studies suggest that the aftermath of disasters can lead to unanticipated changes in culture, and the paths of such transformations are unpredictable (Oliver-Smith 1996). The explosive moments that follow a disaster are characterized by an influx of information that creates a “completely new, unpredictable and much more complex path” (Lotman 2009: 14). Depending on the scale and impact of the disaster, local, national, or international donors may become involved, bringing with them their own ideas and agendas. Consequently, a range of possibilities emerges, each with an equal probability of occurring, especially with respect to the fundamental question of how to move forward after a disaster. This range includes unconventional trajectories that originate outside of the concrete culture’s semiosphere and are introduced by the peripheral spaces of that semiosphere. These possibilities are either inaccessible or impossible to engage with under normal circumstances. According to Lotman (2013: 65), “Every time history lays probability on the table, we find ourselves at the intersection of several different paths.” This indeterminacy is resolved by selecting one of the various potential paths, which is followed by a foreseeable and gradual development (Lotman 2009). However, the moment of selection itself is fundamentally unpredictable, and each option has an equal chance of being chosen. After the selection has been made, the culture will never be the same as it was before the disaster.

What changes have occurred in Acehnese society since the tsunami? In an interview in June 2019, a local writer noted that while people had changed, he was uncertain about what had changed. However, he provided an interesting insight by stating that the middle class in Aceh has become increasingly Islamic. He stressed that this middle class is now a vital component of the community, comprising educated individuals in their productive age, with a thriving financial basis, and occupying prominent positions in government, law, medicine, and academia. They display a strong enthusiasm for Islamic symbols.

My own observations confirm this conclusion. In 2019, large-scale recitations and dhikr events were held almost weekly in major mosques throughout Banda Aceh, including the Baiturrahman grand mosque, with billboards and banners promoting these events installed prominently along roadsides. Women wearing wide headscarves or veils were also frequently seen in Aceh. During government events that I attended, I noted that many officials were what Schlegel (1979) would describe as “pious technocrats” – individuals who demonstrate their devotion to Islam through regular prayer, attendance at Friday sermons, and appropriate dress according to Islamic teachings. It is my contention that this new Muslim middle class was instrumental in the widespread implementation of Islamic Sharia law in post-
tsunami Aceh. As the Acehnese writer (interview, AA, male, 40s, 8 June 2019) stated, “This new Muslim middle class has transformed the face of Islam in Aceh by ambitiously implementing Islamic symbols and disciplining the religious practices of the people.”

It is very important to trace back the emergence of this new elite within Aceh society to understand this post-tsunami cultural change. During the 1970s, Schlegel (1979) identified two types of Acehnese government officers. The first type was constituted by the pragmatist and secularist elites who emphasize the materialist developmental agendas without any concern for Islamic teachings, while the second included the typical pious agents who showed better Islamic commitment and practice at the social levels. At that time, the governmental elites of both types did not belong to the Acehnese; they were considered outsiders, as Aceh culture at that time had so much regarded itself as an Islamic society (see also Aspinall 2009: 211–212; Feener 2012: 307–309). From the outside perspective, it seems they were a holistic single Islamic society. However, from the inside view, Aceh society had many variants of Islamic streams, each having its own leaders, institutions, rituals, and mosques. Social bonding and integrity mostly happen at the micro-level of a village or group of villages. Local Islamic leaders, the tengku, played a role as central symbols for these small communities. A local scholar (interview, AA, male, 40s, 8 June 2019) told me that before the tsunami, “the tengku in the meunasah (small mosque) were enough to become priests for all people in the gampong (village). In the past, young people learned Quran and Islam from tengku in the gampong.” Within this cultural semiosphere, the government elites were the outsiders.

During the 1980s, the pious government officer type was first accepted within Aceh society. At first, people accepted the persons, not the ideas they brought about. Such pious technocrats, according to Schlegel (1979: 245), are not “beyond the pale” of the local culture; they can be regarded as a new type within the diversity of Acehnese Islam. Later, in the 1990s, the acceptance was more profound. Feener (2013: 266) observed that in the 1990s, there was a significant convergence of secular and Islamic goals and orientations in Indonesia. As a result, the idea of modernist Islam, how Islam should be compatible with modern developmental discourse, has been integrated as one of the integral parts of Islam Aceh. In 1999, the Indonesian government granted special autonomy to Aceh, which provided fertile ground for establishing an Islamic legal system in the province. The basic idea was to manifest Sharia or Islamic law as the legal system in Aceh. Modernist Muslims were pleased with this new autonomy.

However, the implementation of Sharia law faced several obstacles. As discussed by the local writer and noted by Feener and Daly (2016: 195), one of these obstacles was the rejection by the Gerakan Aceh Merdeka (GAM) of this legal system. The writer explained, “GAM rejects Islamic Sharia. This Islamic Sharia contradicts the
objectives of their government; what is Islamic Sharia for if we can be independent. Later after independence, we can apply anything. Islamic Sharia is a gift from Jakarta” (interview, AA, male, 40s, 5 August 2019). The implementation of Sharia law only made real progress after the 2004 tsunami. According to a local writer, the tsunami marked a turning point in the implementation of Sharia law in Aceh, which entered a “new phase” (Abubakar 2008). Feener (2012, 2013), analyzing Sharia law as social engineering, argued that its success was strongly facilitated by the prevalent discourse of total reconstruction during the post-tsunami recovery and reconstruction processes. Islamic leaders, both in government and non-government sectors, were actively involved in many reconstruction programs, creatively incorporating Sharia law as an integral part of the post-tsunami reconstruction processes.

The aftermath of the tsunami presented an opportunity to observe the process of selection for Aceh’s future vision, which included the Sharia system as one of the contenders during the recovery and reconstruction phase. Another potential option was the reformation of local government, with the principles of modern good governance as the core values, which international donors and aid workers ambitiously advocated for (Daly et al. 2016; Thorburn and Rochelle 2014). While the new pious elites played a significant role in the selection of the Sharia system, the process itself was unpredictable. During the reconstruction phase, all competing visions had an equal chance of being chosen, as they each had strong political support, promoted new ideas for Aceh’s future culture, and had the freedom to create and develop their own media to convey their ideas. The post-tsunami Islamic atmosphere, which involved intense self-reflection on the meaning of the tsunami and the active involvement of Islamic institutions and leaders during the emergency and recovery processes, provided the semiotic ground for the selection process. This atmosphere led to a general belief that the application of Sharia was necessary to ensure the correct path toward achieving a better Islamic society in Aceh’s future.

5 The concurrence of religious and scientific modeling of the tsunami

The 2004 earthquake and tsunami, considered the worst natural disaster in modern Indonesian history, had a significant impact both at the national and local levels. At the national level, it created a new perception of Indonesia as a country prone to disasters, complicating its existing image as a beautiful and fertile land with other exotic attributes. A few years after the tsunami, the Indonesian government ratified a disaster management act for the first time and established disaster management bodies. At the local level, post-tsunami reconstruction programs included the
establishment of a research body to study tsunamis and other natural disasters in Aceh. One of the most important of such programs was the development of the Tsunami and Disaster Mitigation Research Center (TDMRC), embedded in the local university (Universitas Syiah Kuala). The province also has the Aceh Disaster Management Agency, which actively promotes modern scientific discourse on tsunamis, earthquakes, and other natural disasters. As a result of the intensive dissemination of scientific discourses during the reconstruction processes, scientific knowledge about the tsunami quickly spread and was widely accepted among the locals.

In daily life, it is common for the locals to understand the tsunami as a natural phenomenon. When asked how they perceive the tsunami, a young local woman (interview, AA, female, 20s, 28 July 2019) comfortably provided a natural scientific explanation: “A vertical crack in the plates causes them to collide with other plates, creating big water waves.” A teenaged girl (interview, NR, female, late teens, 28 July 2019) responded similarly: “High sea waves that come toward the mainland and can cause damage. The signs of a tsunami are powerful earthquakes followed by the rapid decrease of seawater.” During fieldwork, almost all local visitors to the Aceh Tsunami Museum and PLTD Apung Monument knew that a tsunami would be preceded by earthquakes and a sudden decrease in the seawater level. Scientific knowledge about the tsunami was widespread among the locals. Some knew basic information about the natural signs preceding the wave and how to respond when such signs are evident, while others demonstrated deeper scientific knowledge.

Interestingly, scientific understanding coexists with religious beliefs about the tsunami in daily life. For example, after scientifically explaining the tsunami, a man in his early 30s (interview, RSP, male, 30s, 28 July 2019) expressed gratitude, saying, “I am very thankful to Allah, as he saved my family and me from the tsunami.” A young man in his early twenties explained that his family follows religious practices such as performing prayers and reciting the Quran, which they believe can protect them from disasters:

> From the tsunami, we can learn that we should thank Allah and try to become better Muslims; we should also increase our awareness and prepare for a tsunami in the future. In order to prevent fatalities in future tsunamis, the government has built escape buildings and tsunami alarms. However, human resources need to be improved to strengthen future disaster mitigation plans. (Interview, IKH, male, 20s, 29 July 2019)

These quotes indicate that following a natural disaster, people can hold multiple interpretations of the event simultaneously, including perspectives grounded in religious beliefs and modern scientific explanations. Although studies indicate that diverse groups within the affected communities may interpret the same disaster differently, it is essential to note that a single person or group may develop more than one interpretation of the disaster. Additionally, people often negotiate manifold co-
existing explanations and coping strategies in an enduring entanglement of secular and religious interpretations of natural hazards and disasters.

Dibben (1999) has proposed the concept of “cognitive dissonance” to describe such parallel interpretations of disaster. According to Leon Festinger, cognitive dissonance occurs when an individual holds two cognitions that are psychologically inconsistent, leading to a negative drive state (Festinger 1957: 13). Dibben (1999) found that cognitive dissonance plays an important role in an individual’s processes for constructing representations of volcanic hazards. However, he also concluded that this cognitive frame might result in difficulties in changing behavior through an individual’s attitudes. Similarly, Chester and Duncan (2010: 90) noted that responses to disasters often represent cognitive dissonance or a psychological inconsistency between beliefs, attitudes, and behavior, in which two apparently incompatible views are held at the same time.

However, my fieldwork in Aceh suggests that the survivors’ religious and scientific interpretations and responses to the same natural disasters are complementary and contingent rather than inconsistent and contradictory. The religious interpretation has enabled them to accept and cope with the extraordinary disaster of the past, while the scientific explanation has created a sense of social resilience, as they know how to identify the signs of future tsunamis and how to act when noticing such signs. Therefore, it is important to understand the nuanced and complex relationship between religious and scientific interpretations in the aftermath of natural disasters.

The adoption of scientific explanations for natural disasters can be attributed in part to post-tsunami reconstruction programs. However, with regards to post-tsunami Aceh, it is important to consider the role of religion as a central modeling system in this adoption, which brings forth two key points. Firstly, religion does not provide all the explanations, models, or functions required by society, particularly in regard to disasters. For example, religion does not provide information on how to predict and anticipate future tsunamis, which necessitates the use of a new sign system, where scientific discourse comes into play. This results in a hierarchy of meanings, where religion offers a primary definition of the tsunami as a message from God, while science offers a secondary layer of meaning explaining the tsunami as a natural phenomenon. Moreover, scientific knowledge can strengthen faith by acknowledging human powerlessness before the might of nature, which is representative of a mighty God.

Furthermore, it is worth noting that the imperative to use science to understand natural disasters came from religion itself. As explained by a local scholar, the Islamic concepts of ikhtiar (effort) and tawakkal (surrender) emphasize the need for maximal effort to prevent human casualties in future disasters, including the development of scientific knowledge to better understand and prepare for such
events (interview, AR, male, 40s, 18 May 2019). This scholar also highlighted the importance of comprehensively understanding natural disasters from both a scientific and religious perspective, as both the Quran and the universe serve as sources of knowledge for humans. Yusny Saby, an Islamic studies professor from the Islamic State University Ar Raniry, emphasized the importance of understanding natural disasters comprehensively from both a scientific and religious perspective (Saby 2018). According to him, the command to think thoroughly comes from the teachings of Islam itself: “Allah sent down two revelations to humans, namely written revelation (Qauliyah – Quran) and unwritten revelation (Qauniyah), or the universe. Allah sent down prophets to teach humans qauliyah revelation; Allah also sent down the intellect to read natural phenomena. All sides require knowledge” (my translation) (Saby 2018: 165). Another local scholar, Lembong Misbah, voiced the same idea: “We need to do exploration and research on various natural disasters that occurred. Do not let the human mind not be used to think about natural phenomena from a disaster. The Quran has given us guidance to study science in this world” (my translation) (Aceh Journal National Network 2018).

Secondly, I argue that the adoption of science to interpret natural disasters in Aceh may have been influenced by a shift in the center and periphery of Acehnese culture after the tsunami. The new Muslim middle class, which has become the dominant force in local culture, is an educated group with a modernist perspective of Islam, viewing it as compatible with modernization. Many university lecturers are among this middle class, and they do not view science and Islam as contradictory. Instead, they encourage the integration of Islamic scholarship with modern sciences.

This spirit of integration can be traced back to the 1980s, when a new model of Islamic education called the Sekolah Islam Terpadu (Integrated Islamic School) emerged and rapidly developed in larger Indonesian cities. The use of the integrated label aimed to differentiate these schools from existing Islamic education systems, such as pesantren (traditional) or madrasa (modern) (see Steenbrink 1986). These integrated schools campaigned for an ambitious integration of Islam and science, not only in the form of teaching Islamic and general subjects in their curriculum, but also by advancing the integration of science and technology with Islamic scholarship. This was often inspired by the concept of the “Islamization of science” proposed by Ismail al-Faruqi (Lubis 2018; Suyatno 2015).

One of the institutions that pioneered the Integrated Islamic School model in Aceh was the Dayah Terpadu Inshafuddin, which was founded in 1974. Through close collaborations with the provincial government, this school initiated the integration of general and religious subjects in its curricula in 1998 (Feener 2013: 79). These integrated schools have rapidly developed, with some being new institutions and others being upgraded schools that existed before the tsunami (Feener 2013). More recently, the integration of knowledge has also occurred in elite high schools that do not
necessarily identify as Islamic (Muhaini 2019). Nowadays, Acehnese parents, especially those who belong to the upper-middle class and have a solid financial basis, prefer to send their children to these new Islamic schools. According to a local writer, “It is a good school with good religious education, but also business lessons” (interview, AA, male, 40s, 8 June 2019). Therefore, in the sociohistorical context of integrating science and Islam, we can easily understand how the use of science to interpret natural disasters is connected to a religious understanding of natural disasters.

6 Conclusion

This paper demonstrates that in the context of Aceh, Islam serves as a central modeling system that performs two crucial interrelated post-disaster functions: explanatory and instructive. The explanatory function provides explanations for inexplicable disasters, while the instructive function offers guidance for subsequent actions and behavior. However, the disaster also resulted in changes to the form and structure of religious society, leading to an explosive transformation within Aceh culture.

Monotheistic religions, including Islam, place God at the center of their modeling system, creating a tension between two meanings: God as the central symbol is situated at the heart of the cultural semiosphere, yet simultaneously is the source of any ultimate cultural indeterminacy. This tension compels the culture to engage in constant self-reflection, which enables it to communicate with and adapt to external semiotic spaces, including the hazards and risks posed by the natural environment. Consequently, religion, as a modeling system, plays a pivotal role in the communication between the interior and exterior of the semiosphere, characterized by dynamic tensions between predictability and unpredictability.

This central role of religion in explaining the unexplainable, which is not clearly visible during regular times, becomes prominently foregrounded during the crisis periods following a disaster. In post-tsunami Aceh, these modeling functions were manifested in three interrelated Islam-based post-disaster coping mechanisms. The first mechanism includes the diverse Islamic interpretations of the tsunami, which are always anchored to Allah as the supreme cause of the tsunami. The second concerns conducting and modifying Islamic worship as a special set of rituals to accelerate sociopsychological recovery. The third encompasses the active roles of Islamic institutions, groups, and leaders during the post-tsunami emergency and recovery steps.

The tsunami and its subsequent crisis periods were explosive moments for Aceh culture, represented by the rise of certain fundamental questions relating to the meaning of and reasons for the tsunami and future trajectories of the society, with a
variety of possible answers initially present. Such cultural indeterminacy is usually concluded with the act of selection: actualizing one path from the existing various possible trajectories of interpretations and development. In post-tsunami Aceh, we may find two important and interrelated choices made in the post-tsunami conditions. The first was the selection of the dominant meaning of the tsunami from the diverse existing interpretations: the tsunami was a trial from Allah, and the dead were Islamic martyrs. The second was the choice to implement the Sharia system as one of the proposed visions for Aceh’s future which existed during the post-tsunami reconstruction processes. The intensive Islam-based self-reflections on the tsunami, the active roles of Islamic institutions and leaders during the post-tsunami crisis, and the decisive actions of the new pious middle class have become the semiotic ground of these selection processes, creating a common belief that the implementation of Sharia was unavoidable in developing a better Islamic society.

Religion as a central modeling system is not necessarily a totalistic, closed system, and it is supplemented by other modeling systems in the given culture. This study has provided an example of how religion and science as two modeling systems supplement one another in post-tsunami conditions. For example, religion does not offer a model to recognize the signs of natural disasters, which is a function a scientific modeling system can carry out. In the context of Aceh, this imperative to comprehensively understand natural disasters through religious and scientific explanations came from the religious institutions and interpretations themselves. It was actively promoted by Islamic leaders and grounded in the school curriculum as well. The descriptions of the tsunami in natural scientific terms were also not seen as contradicting religious interpretations, as God may send his message through or in natural phenomena.

This article has argued that religious interpretations of a natural disaster and scientific explanations for the same disaster event can coexist in society. They do not contradict each other; they even complement one another, as they have different social functions. Therefore, instead of contrasting the difference between religious interpretation and scientific explanation, for disaster management to be most effective, it may have to take into account both interpretations in certain societies.

In the case of Aceh, religion played a central role in providing comfort and hope to those affected by the tsunami, while science provided a framework for understanding the physical and natural causes of the disaster. By integrating both religious and scientific models, a more holistic approach to disaster response and prevention can be developed which takes into account both the spiritual and physical dimensions of such events. Overall, this study highlights the importance of recognizing the complementary nature of different modeling systems in a given culture, and the value of integrating these systems to develop a more comprehensive understanding of complex events such as natural disasters.
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