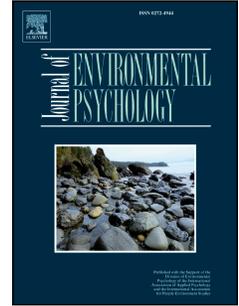


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to place attachment

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ACCEPTED MANUSCRIPT

Abstract

Most studies on natural disasters have focused on physical and psychological health consequences or risk perception, paying little attention to variables associated with bonds to place. In order to study these types of variable, 265 people from different towns on the island of El Hierro (Canary Islands, Spain) were interviewed individually during the volcanic process that took place on the island between September and December 2011. This interview set out to assess the emotions they experienced, the coping strategies they used and the changes in place attachment, place identity and perceived restorativeness. Levels of fear, anger, loss and active confrontation were higher in the town nearest the volcanic process than in other towns on the island. A greater impact on the perceived restorativeness of place and place attachment also occurred in this town. Multiple regression analysis revealed that changes in place attachment are related to feelings of loss.

Key words: place attachment, perceived restorativeness, emotions, coping strategies, natural disaster

Emotions and coping strategies during an episode of volcanic activity and their relations to place attachment

Between September and December 2011, several eruptive episodes took place just off the island of El Hierro (Canary Islands, Spain), resulting in the emergence of a 88 metres depth submarine volcanic cone 2 km in front of the coast of La Restinga, a town in the south of the island known for its marine biodiversity (see Figure 1). During this time the 600 residents of La Restinga were evacuated on several occasions and all fishing, sport and tourism activities were suspended. When initial seismic activity was detected in June 2011 scientists could not anticipate how the situation would evolve, since the previous volcanic process in the Canary Islands had occurred on La Palma in 1971, resulting in a volcanic eruption. The state of uncertainty in El Hierro continued until the submarine eruption was confirmed between 10 and 31 October. When the eruption was declared over, the top of the cone lay 88 metres below the surface of the sea in the Mar de las Calmas, a marine reserve.

<<INSERT FIGURE 1>>

The consequences for the island and its inhabitants were not serious when compared with bigger natural disasters. They did, however, present a change in setting that enabled us to raise several questions of interest from an environmental psychology perspective: which emotions are most intensely felt during unexpected volcanic activity? Which strategies will residents adopt to cope with this unexpected event? Will these events have an impact on the perception and bonds of all the residents of El Hierro towards their island and villages, or will the impact be restricted to those who live closest to the phenomenon?

Some studies have focused on the possible effects of natural disasters on bonds between people and their environments (Brown & Perkins, 1992; Gaillard, 2008;

Mishra, Mazumdar & Suar, 2010), but most research into natural disasters has centred on the consequences for the physical and psychological health, such as post-traumatic stress, and perception of risk, of those affected (Bonnano, Brewn, Kaniasty & La Greca, 2010, Kaniasty, 2011). Furthermore, most literature associated with effects of natural disasters on the perception of the environment published in the last decade has emerged from research disciplines other than Environmental Psychology. We do know, however, that when a place undergoes change, it has an impact on the perception, values and emotions of people towards that place (Lai & Kreuter, 2012). Without adequate resources and coping strategies, environmental changes that alter the bonds that people have developed towards a place may have important psychological consequences (Benight, Wift, Anger, Mith & Zeppelin, 1999; Cox & Perry, 2011; Fried, 2000; Hay, 1998; Smith & Cartlidge, 2011). Therefore, in this study we have focused on changes to bonds to place and perception of the environment throughout the volcanic process, by linking them to the emotions and confrontation styles that arise as a result.

Place attachment is among the bonds to place that have received most attention. Leaving aside the controversy caused by this definition in recent years, most authors accept that place attachment can be interpreted as the emotional bonds established by people with the places where they carry out their daily activities and which provide them with security and confidence (Hidalgo & Hernández, 2001).

Several studies have highlighted the importance of this bond in the face of changes arising from land management and development decisions (Lai & Kreuter, 2012), reconstruction after a tornado (Smith & Cartlidge, 2011), development of a wind energy project (Devine-Wright, 2005) and large civil engineering projects (Lima, 2011). More specifically, Bird, Gísladóttir and Dominey-Howes (2011) analyzed the different reactions of rural and urban residents to the emergency plans for volcanic hazards

caused by Katla volcano (Iceland). They concluded that the rural inhabitants' knowledge of the risks, sense of community and place attachment were central to their higher resilience and lower vulnerability to volcanic hazards. However, these same factors also explained their lower acceptance of the evacuation plans. In most studies, the goal is to determine whether the level of place attachment influences the level of acceptance of changes to the environment. An open question is how such changes modify previously established bonds. A study by Cox and Perry (2011) reveals that the residents of two communities devastated by fire experienced significant feelings of loss when faced with a dramatically changed landscape and that they needed to reconstruct their bond with the place. Climate change studies have also revealed that residents may experience psychological disorders when ecological changes shatter the protective relationship that should be provided by place (Hess, Malilay & Parkinson, 2008).

For an outside observer, the changes that occurred in El Hierro might appear to be minor because they were not visible—the new volcano is submarine. In fact, research into natural disasters has focused on those that have the potential to cause and have caused much loss of life, physical and social harm, and damage and destruction to property (Mishra et al., 2010). This has been to the detriment of more minor environmental phenomena that have less impact on the environment but may have important psycho-environmental effects. Although there may be variability depending on size, history and location, generally speaking, islands are considered to be particularly vulnerable to even the slightest change in their surroundings because they are far more dependent upon the stability of their ecosystems (Hess et al., 2008). Thus, the people of La Restinga, for example, felt their identity to be under threat because they strongly relate to the marine reserve where the volcano appeared. This does not mean that we expect place identity to be affected in the short term, as it is a process by which people describe themselves in

terms of belonging to a specific place through interaction with it (Hernandez, Hidalgo, Salazar-Laplace & Hess, 2007). Place attachment, on the other hand, could be affected in that it is intrinsically bound up with the emotions and feelings that stem from the comfort or safety provided by place on a daily basis (Hidalgo & Hernández, 2001). It does then seem important to maintain the positive characteristics of the environment, and to that end we introduced another variable that we consider of interest in our study: the perception of restorativeness.

The restorative capacity of places is strongly linked to the perception of stress relief associated with place (Ulrich, 1981) or the restoration of cognitive capacity after a work period (Kaplan & Kaplan, 1989). Nature areas with rich vegetation and water figure among most people's preferences (Völker & Kisternann, 2011) and are associated with higher restorative capacities, as they are more likely to have the set of characteristics identified by Korpela and Hartig (1996) as restorative factors: evasion, fascination, complexity, compatibility and extent.

Again, it is reasonable to expect that physical changes in the landscape will have an impact on the perception of the restorative capacity of that place, in the sense that it may now be less fascinating, no longer inviting evasion or escape from reality, may have a different level of complexity or may no longer be compatible with activities carried out there. The emergence of a volcano could definitely affect any of these factors. In the case of this volcano, the idea that it might contaminate the waters could alter the perception of the restorative capacity normally attributed to aquatic environments or "blue space" (Völker & Kisternann, 2011). While modifications to the environment can alter emotions and bonds towards it, individuals are faced with a situation that they perceive as dangerous in varying degrees, entailing different risks and that originates various emotions and reactions. Research on the human response to

natural disasters has shown that risk perception is not only based on physical elements that might be dangerous but on other emotional, social and cultural factors that may affect end perception and alter how people adapt to the demands of the situation (Gaillard, 2008; Lübken & Mauch, 2011; Smith, 2000; Tobin, Whiteford, Jones, Murphy, Garren & Padros, 2011) The characteristics of the environment can change risk perception of the same natural disaster. By way of example, proximity to the phenomenon, closeness to the sea, or the type of opportunities and resources provided by the environment can heighten risk perception (Brody, Zahran, Vedlitz & Grover, 2008).

Residents then adopt coping strategies that they either consider appropriate or that are simply available to them, in order to control the emotions associated with these events (Lazarus & Folkman, 1986). Coping is considered a dynamic process in which different strategies are adopted according to changes in the environment and perception of the situation (Hernández-Fernaud, Hernández, Ruiz & Ruiz, 2009). Therefore, the focus is not on individuals with specific styles of coping, but on coping strategies in stressful events. Unlike the other variables mentioned above, in recent years coping and associated emotions have received considerable attention from researchers seeking to explain the differences in the capacity of inhabitants to adapt to the effects of natural disasters. Many studies have chosen the term “resilience”, defined as “the capability of a community to face a threat, survive and bounce back or, perhaps more accurately, bounce forward into a normalcy newly defined by the disaster related to losses and changes” (Bird et al., 2011; Cox & Perry, 2011). In fact, some studies find that most persons exposed to natural disasters are able to face up to them and carry on with their lives after a certain time (Bonnano et al., 2010).

Emotions are undoubtedly a very important explanatory factor in understanding

responses to natural disasters. Emotions of anger, for instance, are among the most common responses of people coping with a traumatic situation arising from a natural disaster (Warchal & Graham, 2011). Post-traumatic stress disorder has also been the focus of many studies on natural disasters (Bonnano et al., 2010). However, when dealing with such disasters, it is important to realize that there are other emotions connected to the experience of leaving the place to which one is attached, in addition to emotions produced by fear, the perception of risk to personal safety and the loss of interpersonal relations, work and so forth. This feeling of “loss of place” represents for Diaz and Dayal (2008) the most catastrophic impact of natural disasters. When a natural disaster occurs, people suffer because they feel in danger but also because they are afraid of losing what they consider to be their own: place.

Other emotions like pain or anxiety are common when individuals need to be evacuated. Evacuations and separations from place compromise residents' mental health. In fact, residents who are not displaced physically may feel that their sense of place attachment and identity is affected when it changes (Hess et al., 2008). And this brings us back to our initial questions: is place attachment affected by a volcanic episode? Is the change in the level of place attachment higher in persons who experience stronger feelings of loss? What is the influence of coping strategies in these situations? These questions led us to gather data and perform the analysis that is presented below.

Method

Physical context

This study was performed on the island of El Hierro, located in the far southwest of the archipelago of the Canary Islands and the smallest of seven main islands (see map in Figure 1). El Hierro (278.5 km²) has a population of 10,892 and was declared a

Biosphere Reserve by UNESCO in 2000. It is about to become the world's first energy island, obtaining 100% energy from renewable sources. The local economy is based on agriculture, livestock farming, fishing and tourism. The capital, Valverde, is the most populated town and the island's airport and port are close by. Before 2007, there was just one other municipality, La Frontera, considered the agricultural capital of the island. In 2007 the town of El Pinar became an independent municipality, with two areas of interest: El Pinar, the main rural area, and La Restinga, located on the coast, a tourist centre. The waters of La Restinga have been declared a marine reserve and attract diving enthusiasts from around the world. Just 2 km off the coast of La Restinga is where the submarine volcanic cone emerged (see map in Figure 1).

Volcanic eruption

The volcanic eruption at the centre of this work began in July 2011 with low-intensity seismic activity in the area and continued for three months, increasing in strength and frequency, and moving towards the south of the island. In September, the number of earthquakes per week reached 1,000, some measuring 4 on the Richter scale. Finally, on 10 October, magma reached the surface of the seafloor in the Mar de las Calmas, 2 km south of La Restinga, causing significant changes in the area's marine ecosystem (Santana-Casiano, González Dávila, Fraile-Nuez, Domínguez-Yanes & Escanez, 2013). Aside from the biological and physical impact, the eruption also changed the lives of the local people. The residents of La Frontera were evacuated due to the risk of falling rocks, while those of La Restinga were evacuated several times, depending on the strength of submarine tremors, because of the risk of toxic gases released by the volcano. The strength and frequency of the eruption and the associated seismic activity gradually reduced until, on 5 March 2012, the scientific committee declared that the eruption had ended.

Participants

To perform this research, we adopted a quota sampling approach based on age, place of residence and time of residence. The sample size was 265 participants; 47.5% were men, with an average age of 45.43 years and an average of 30.58 years' residence on the island. Table 1 shows distribution according to places of residence. As shown, the sample is distributed proportionally between the three municipalities of Valverde, Frontera and El Pinar; El Pinar includes the two small towns of El Pinar and La Restinga.

<<INSERT TABLE 1>>

The sample comprised 41% of married persons. Seven percent of interviewees had no studies, 40% had basic studies, 26% secondary studies, 14% specialised vocational training and 13% were university graduates. At the time of interview, 22% of participants were unemployed, 42% were working, 18% retired and the remainder were students or housewives.

Instruments

A specific questionnaire was developed for this study in order to conduct structured interviews and obtain quantitative data on a wide range of variables of interest, as outlined in the Introduction section. In this paper we describe the results in relation to the following aspects:

1. Socio-demographic data (social and work profile of interviewees).
2. Bonds to and perception of place of residence. The reduced scales of Place Attachment (5 items) and Place Identity (3 items) validated in Ruiz, Hernández and Hidalgo (2011) based on the original (Hernández et al., 2007) and the reduced scale of Perceived Restoration (5 items) (Berto, 2005) were used.

Participants were asked to evaluate each item twice, from 0 to 10, corresponding

to the current moment and to the situation prior to volcanic activity. Given that one of the measurements was retrospective, participants were urged to concentrate on each specific moment in time when responding. Moreover, other scales were inserted between each evaluation: in half the interviews, evaluations of the current situation appeared first, while in the other half, evaluations of the situation prior to volcanic eruption appeared first.

3. Emotions experienced. Participants estimated the degree to which they experienced 20 different emotions, ranging from 0 to 10. Some emotions were extracted from the Spanish version of PANAS scale (Briones, Tabernero & Arenas, 2007; Sandín, Chorot, Lostao, Joiner, Santed & Valiente, 1999) and others related to interaction with the environment (overcrowding, lack of privacy).
4. Coping strategies. Participants estimated on a scale of 0 to 10 the degree to which they made use of different coping strategies, extracted from López-Vázquez and Marván (2004).

Procedure

Questionnaires were administered on-site by a team of nine interviewers at various towns in El Hierro from 3-6 December 2011. Before undertaking this task, the interviewers attended a 2-hour briefing session on how to administer the questionnaire and were informed of the study objectives and profile of the target population. Once the meaning of each item was clear and any doubts had been dispelled, interviewers were briefed on strategies for approaching potential participants and the profile of the sample, detailing quotas per age, place of residence and time of residence, as described below. Participants were classified into four groups according to their age: 16 to 30, 31 to 45, 46 to 60 and over 60. For place of residence, participants were grouped according to

municipality (La Frontera, Valverde, El Pinar). Although La Restinga belongs administratively to El Pinar, the residents of La Restinga were grouped separately, as their town was closest to the location of the new volcano. Consequently, four areas were defined to outline the quota sample. For length of residence, participants were required to have resided for at least six years in one of the above-mentioned municipalities, in order to ensure that bonds to place had been developed, as reported in previous studies (Hay 1998; Ruiz et al., 2011; Smith & Cartlidge 2011).

Each interviewer administered between 15 and 35 questionnaires: 265 in total, average duration 25 minutes. Each participant was informed of the general objectives of the study and the estimated time to complete the questionnaire, and given instructions on how to correctly evaluate the items in each scale. Participants were informed that their responses would be used for research purpose only and assured confidentiality. In order to enhance understanding of the evaluation system, participants were provided with visual support in the form of a card containing the ranges of the responses. Once the data gathering process was complete, the interviewers' work was supervised telephonically (30% of the interviews carried out by each interviewer were supervised). The supervision process consisted in asking the participant to confirm the following data: duration of the interview, age, place of residence, time of residence and values of several randomly-selected items.

Results

The T-Test found no significant differences in the variables studied when comparing the two orders of appearance of the scales of Place Attachment, Place Identity and Perceived Restoration in the questionnaires (see point 2 in Instruments section).

Below, we present the results organized in three subsections, corresponding to

the questions formulated in the Introduction of this paper: were the emotions experienced during the volcanic activity different among residents of the four areas of the island? Were the coping strategies of the residents of the four areas different? Were there changes in the bonds to place or in the perception of place of residence during the period of volcanic activity? Is there a relation between the type of coping strategy and the level of place attachment conserved?

Emotions experienced during the volcanic process

A factorial analysis using varimax rotation was performed for the 20 emotions. We obtained a 5-factor solution and discarded the fifth factor, as it was formed by only one emotion. Another emotion was eliminated because none of the factors had a factorial weight above .30. The remaining four factors explain 60% of the variance. This analysis allowed us to reunify 18 of the emotions into four sub-scales: three summarized negative and one positive emotions, distributed as shown in Table 2. All reliability indexes reached the desired minimum level (Table 2).

<<INSERT TABLE 2>>

For each participant, a score was calculated for the different sub-scales and a Split-plot ANOVA was performed using the four emotion values as the within-subject variable and the place of residence as the between-subject variable. Results show a significant interaction ($F(9, 783) = 5.63, p < .001, \eta^2 = .06$), which is depicted in Figure 2. The vertical axis of the figure shows the mean of the four emotional factors on the horizontal axis, for each of the four places of residence analysed, represented by different lines. La Restinga, which is closest to the volcanic process, presents a profile that is clearly differentiated from the other three places.

<<INSERT FIGURE 2>>

Post-hoc analyses using Hochberg's correction reveal significant differences between La Restinga and the other three areas in relation to the emotion of Loss (compared with La Frontera: $t(84)=-5.2, p<.001, \eta^2=.25$; compared with Valverde: $t(74)=-5.78, p<.001, \eta^2=.30$; compared with El Pinar: $t(85)=-5.81, p<.001, \eta^2=.28$). Significant differences also appear in relation to Fear when comparing La Restinga with Valverde ($t(106)=3.17, p<.05, \eta^2=.08$) and with El Pinar ($t(82)=3.15, p<.05, \eta^2=.10$), as well as to Anger between La Frontera and La Restinga ($t(98)=-3.77, p<.01, \eta^2=.12$) and between Valverde and La Restinga ($t(108)=-3.69, p<.01, \eta^2=.11$). No difference appears between the different areas in relation to Interest. Another curious result is that we found no significant differences between the mean values of each of the four emotions in La Restinga, the residents feel them all equally. However, the other three places of residence reveal differences between the four emotions. The contrasting emotions in all three populations are shown in Table 3.

<<INSERT TABLE 3>>

In El Pinar there is no significant difference between Fear, Interest and Anger, but there is when all three are compared with Loss. In La Frontera, Interest and Fear are the predominant emotions, with no significant difference between their mean values. However, they are significantly different from Anger and Loss. Interest was the strongest emotion, which differs significantly from the rest.

Coping strategies used during the volcanic eruption

First, a factorial analysis using varimax rotation was performed for the 16 coping strategies. A 5-factor solution was obtained, but we kept only the first three (action, information, emotion), which explain 50% of the variance and are close to the original proposal of the authors of the original scale (Esparbes, Sordes-Ader & Tap, 1994, taken from López-Vázquez & Margán, 2004). This exploratory analysis allowed us to group

the coping strategies into three coping styles: Analysis, Denial and Active Coping. Table 4 presents the items that are part of each factor and the corresponding reliability indexes.

<<INSERT TABLE 4>>

The mean values calculated for each coping style were used as the repeated measure of the Split-plot ANOVA that was performed, again using place of residence as the between-subject factor. Results reveal a significant interaction between place of residence and coping style ($F(6, 522)=9.10, p<.001, \eta^2=.09$), as shown in Figure 3. The vertical axis of this figure shows the mean values for the three coping styles represented by different lines, for each place of residence on the horizontal axis.

<<INSERT FIGURE 3>>

Post-hoc analyses using Hochberg's correction reveal significant differences in the use of the Active Coping strategy, La Restinga being the place where it was most adopted, compared to La Frontera ($t(101)=-4.83, p<.001, \eta^2=.18$), Valverde ($t(112)=-4.54, p<.001, \eta^2=.15$) and El Pinar ($t(73)=-2.99, p<.05, \eta^2=.10$). On the other hand, Denial was used significantly less by residents of La Restinga than by those of La Frontera ($t(103)=4.38, p<.001, \eta^2=.15$) or those of Valverde ($t(109)=3.39, p<.01, \eta^2=.09$). Finally, for the Analysis strategy we only found significant differences between La Frontera and La Restinga ($t(105)=-3.22, p<.05, \eta^2=.09$). As for the differences inside each place of residence, our data indicate that, while in La Restinga the adoption of Active Coping and Analysis strategies are clearly higher than Denial, the situation is precisely the opposite in La Frontera and Valverde. In El Pinar, the three strategies are used equally.

Changes in bonds to and perception of place

The reliability of the scales of Place Attachment (before and after), Place

Identity (before and after) and Perceived Restorativeness (before and after) was over .80 in all cases. Consequently, mean values in each of the six scales were calculated per participant. In order to analyze whether the mean value of the bonds and perceived restorativeness had been affected during the period of volcanic activity, for each of the places studied, we performed three Split-plot ANOVA, using each of the three pairs of variables (attachment before-after, perceived restorativeness before-after and identity before-after) as the within-subject variables and place of residence (Frontera, Valverde, El Pinar and La Restinga) as the between-subject variable. Results for the place attachment variable reveal an $(F(3, 261)=2.27, p<.08)$ in the interaction between within- and between-subject variables, which, although not significant, indicates some changes in the measures. Figure 4 gives the mean scores for Place Attachment before and after the volcanic process in each place of residence; as shown, changes only occurred in La Restinga.

<<INSERT FIGURE 4>>

Contrasts for each pair indicate differences between areas in relation to the before-after measures. We observe a decrease in the level of place attachment in the residents of La Restinga, the area closest to the new volcano, while that level remains unchanged for the residents of the other areas, as depicted in Figure 4. Moreover, the difference in place attachment that existed before the volcanic activity between the residents of Valverde and La Restinga ($t(133)=-3.55, p<.01, \eta^2=0.086$) disappears after the activity, precisely because of the reduction in the level of attachment experienced by the residents of La Restinga.

Regarding the Identity variable, ANOVA results show that no significant changes occurred during the volcanic activity. However, for the Perceived Restorativeness variable we do obtain significant data. The interaction between

perceived restorativeness and place of residence is significant ($F(3, 261) = 5.91, p < .001, \eta^2 = .004$). Figure 5 gives mean scores for Perceived Restorativeness before and after the volcanic process in each place of residence.

<<INSERT FIGURE 5>>

Carrying out post-hoc analyses in order to identify the places of residence where the difference appears, we find that the positive perception of the environment decreases in all places, although the only places where those differences are significant using Hochberg's correction are El Pinar ($t(37) = 2.56, p < .05, \eta^2 = 0.151$) and La Restinga ($t(52) = 2.91, p < .05, \eta^2 = 0.14$).

Contribution of emotions and coping strategies to changes in attachment to and perception of places

A regression analysis was performed in order to verify the extent to which the emotions experienced and the coping strategies adopted during the volcanic activity can predict change in Perceived Restorativeness and Attachment. The analysis was carried out for the residents of La Restinga, where the values of both variables decreased. The four emotions and three coping strategies were used as predictors, and the difference between Restorativeness-before and Restorativeness-after, as well as Attachment-before and Attachment-after, as criteria variables. After the step-by-step analysis, only Loss remains in the regression equation for Attachment, with a beta of .35 and a 13% of explained variance for the reduction in Attachment; this variance was statistically significant ($F(1,49) = 7.08, p < .01$) and implies a medium effect size (Cohen, 1988). However, in the case of Restoration, the variables used did not exhibit any predictive value. Changes in the perception of restorative capacity must not be attributed to emotions or coping strategies, but to physical changes in the environment.

Discussion

Our results indicate that the environmental changes that took place in El Hierro had an effect on the residents that is inversely proportional to the distance to the place nearest the eruption. The eruption affected emotions, coping, perceived restorativeness and place attachment, listed in decreasing order by the magnitude of the effect. In the four populations analyzed, coping strategies and emotions were activated in connection with the volcanic process. However, changes in perceived restorativeness and place attachment were only found in population centres closest to the eruption. In no case were changes in place identity detected. The temporary nature and situational dependence of these processes may explain such differences.

Emotions are momentary reactions that are frequently triggered by a specific experience and depend on the context and interpretation of those experiences by the individuals affected (Davidson, 2012). Likewise, coping strategies are activated depending on the changes in the environment and the perception of the situation (Hernández-Fernaud et al., 2009). The restorative capacity of a place is largely determined by individuals' perception of the potential to reduce daily stress in that place (Ulrich, 1981) or to recover their cognitive abilities after a period of work (Kaplan & Kaplan, 1989). Therefore, this perception can be affected by changes in the natural environment. Place attachment, on the other hand, is a bond that develops from continued experiences with the environment and from daily interaction with place (Hidalgo & Hernández, 2001) and is usually maintained over time, even when individuals are temporarily forced to leave the place in question. However, it has been observed that changes to place can reduce place attachment, resulting in the individual not wishing to return to that place, as occurred with several evacuees after the Matupi eruption (Epstein, 1988). In our study, a small change in the environment caused a change, albeit only temporary, in place attachment. This result supports the idea that

changes in place attachment will occur when changes in the environment are produced. A follow-up interview would be needed to discover whether that was indeed the case. Finally, place identity is the part of social identity that derives from belonging to a specific place and slowly develops during the time spent there. It depends on complex cognitive processes of memory, categorization and identification (Proshansky, Fabian & Kaminoff, 1983), and is therefore far more stable and more difficult to modify.

The kind of emotions experienced depending on proximity to place also throw up interesting results in relation to the significance that place may have on individuals' everyday lives. The emotional experiences of the inhabitants of El Hierro increased and intensified the nearer they found themselves to the volcanic process, despite the small size of the island (see the map in Figure 1) and the repercussions arising from the appearance of a terrestrial volcano on the image of the island as a whole. The differences in two of the emotional factors analyzed, Interest and Loss, provide a better understanding of how and why the eruptive process was experienced in centres of population around the island.

Seismic and volcanic activity raised the same degree of interest in all the island's residents and the fact that the process drew the attention of scientists from all over the world was a source of pride and enthusiasm. Even the residents of La Restinga, despite experiencing negative emotions, scored high in interest. At the same time, the overall mean value for the fear factor, which groups emotions of shock, nervousness, worry, tension, alarm, anxiety and uncertainty, does not exceed the average point. According to this information, we could say that the residents of El Hierro did not experience the process at the levels of alarm, worry and fear reported by some news agencies and the media. This was a common complaint expressed by participants during the interviews. The contrast between the emotions of the individuals who endure natural disasters and

those reflected in the media could be the object of further studies, which could help clarify the process of social amplification of such phenomena.

The feeling of loss associated with overcrowding and privacy was only experienced in La Restinga, which was invaded by experts, journalists, government agencies and spectators. In this sense, although there was an obvious increase in population density, other key factors in the feeling of overcrowding (Baum & Paulus, 1987) were present: loss of control of the space that people consider theirs and of the resources that provided their daily sustenance (fishing and diving), and changes in the physical and social environments (emissions, sea contamination, strangers in the area). When people feel that they are losing control over place, attachment to that place can be affected and changes may be less well accepted (Devine-Wright, 2014). Three situational factors may have led to the residents of La Restinga perceiving less control over their environment. First of all, the change to the physical environment prevented them from taking decisions about routines associated with sea-based activities. Secondly, experts and authorities decided which residents should remain at home and which should be evacuated. Finally, droves of journalists and bystanders reduced their privacy and restricted their movements.

However, coping, also an important factor in the model of overcrowding, was more active in the areas nearest the eruption. According to Baum and Paulus' (1987) model, when coping is active and perceived as effective, the level of overcrowding is lower. People assess change to the environment and activate coping, which enables them to act accordingly (Devine-Wright, 2009). In our case, this mechanism could explain why the mean value of loss in La Restinga, though higher than in the other areas, was not excessively high. Passive coping strategies were more frequent in areas further away from the volcano where the people-environment interaction that

contributed to the emotion of loss was absent and people must not suffer a place disruption. As found in other studies, people do not tend to get involved when the changes are not “in their own back yard” (Devine-Wright, 2009).

Another important result of this work is that the values of place attachment after the volcanic activity only decreased for the residents of La Restinga, while the mean value of perceived restorativeness decreased only in El Pinar and La Restinga. Feelings of calm and safety, essential for sustaining attachment and perceptions of restorativeness, diminished during the volcanic activity. This fact was verified when emotions were measured and suggested that both variables could be affected. In the regression, the emotion of Loss explains a significant percentage of the variance in the decrease of attachment in La Restinga. Although the percentage explained is only 13%, it is important to bear in mind that what it predicts are changes to bond. This result indicates that changes in place attachment are associated with emotions directly deriving from interaction with place, such as privacy or overcrowding, and therefore with factors leading to those emotions: lack of control over the territory, arrival of strangers in a place the residents considered theirs and deterioration of the physical environment. On the other hand, the changes in perceived restorativeness were not explained by any of the emotions. Restoration capacity depends on the assessment of experiences that can be provided by the environment. Such an assessment is cognitive and related to the informational variables associated with the environment (Kaplan & Kaplan, 1989). Consequently, it does not depend on previously experienced but on anticipated emotions.

Place identity was not affected in any of the cases nor in any of the areas during the eruption. The fact that place attachment was somewhat affected in the area closest to the volcano provides additional support for the distinction between identity and

attachment that has been defended in several previous studies (Hernández et al., 2007; Knez, 2005; Lewicka, 2011; Ruiz, et al., 2011; Scannell and Gifford 2010). Once again place attachment appears in connection with daily experiences of the environment and the ensuing interactions and emotions. For this reason, it could develop faster than place identity but could also alter more easily. People develop an identity with the places where they remain that becomes an important part of their self-concept and social image. According to the data gathered in this study, we could consider that, once established, place identity is difficult to alter, even in the event of negative change, thereby coinciding with the conclusions drawn by Casakin, Ruiz and Hernández (2013) in a study of cities in Israel.

We realize that these results have certain limitations because of the procedure used to collect the before-after measurements. Questioning participants about their feelings before the eruption, when the process has already concluded, may bias the answers. For future research, it might be useful to employ other methodological strategies for gathering information, such as narrative interviews, discourse analysis or photo-based methods (Manzo & Devine-Wright, 2014). However, we believe that some of our results endorse the validity of these data. Moreover, the fact that there is no difference between the responses according to the order of presentation of the scales indicates the absence of transfer of one moment in time to another. Furthermore, the before-after differences found are coherent with the theory. As commented earlier in this discussion, changes occur mostly in variables that are more sensitive to changes in the environment. And we should also consider that, given the unpredictable nature of a volcanic eruption, it is not easy to carry out before-after comparisons in an orthodox way. Nevertheless, many research initiatives use event recall and the activation of past emotions and memories to study different processes, such as coping, resilience and

bonds to place, following important change (Benight et al., 1999; Cox & Perry, 2011; Hay, 1998; Knez, 2006; Lewicka, 2014; Smith & Cartlidge, 2011).

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Table 1
Sample distribution by place of residence

	Frecuency	Percentage
Frontera	90	34,0
Valverde	84	31,7
Pinar	38	14,3
Restinga	53	20,0
Total	265	100,0

Table 2
Emotions subscales from the results of factor analysis

Subscale	Variables	Reliability
Fear	fright, nervousness, fear, tension, alarm, uneasiness, uncertainty	.93
Interest	interest, mood, activation, enthusiasm, pride	.73
Anger	irritation, shame, disgust, anger	.73
Loss	crowding, loss of privacy	.70

Table 3

Contrasts peer to peer between the four emotions in Valverde, Frontera and Pinar

Contrast	Valverde	Frontera	Pinar
Fear -Interest	t(83)=3.73, p<.01, $\eta^2=.14$	n.s.	n.s.
Fear -Anger	t(83)=-4.21, p<.001, $\eta^2=.17$	t(89)=-5.56, p<.001, $\eta^2=.26$	n.s.
Fear -Loss	t(83)=8.03, p<.001, $\eta^2=.43$	t(89)=9.59, p<.001, $\eta^2=.50$	t(37)=5.78, p<.001, $\eta^2=.47$
Interest -Anger	t(83)=-7.26, p<.001, $\eta^2=.38$	t(89)=-5.20, p<.001, $\eta^2=.23$	n.s.
Interest -Loss	t(83)=12.85, p<.001, $\eta^2=.66$	t(89)=8.66, p<.001, $\eta^2=.45$	t(37)=7.51, p<.001, $\eta^2=.60$
Anger -Loss	t(83)=4.88, p<.001, $\eta^2=.22$	t(89)=4.84, p<.001, $\eta^2=.20$	t(37)=6.93, p<.001, $\eta^2=.56$

Note. Hochberg correction has been used to determine the significance.

Table 4
Coping subscales developed from the results of factor analysis

Subscale	Strategies	Reliability
Analysis	Analyze the circumstances for what to do, search for information in people who know about, inquire about the problem to professionals	.78
Denial	Reject the idea that this is severe, try not to think about the problem, acting as if the danger did not exist	.64
Active	Make changes in my environment to avoid disaster, walking for escape, speak with your family to share emotions, coping directly with the situation, establish their own prevention plan and get it running, follow what others are doing	.70

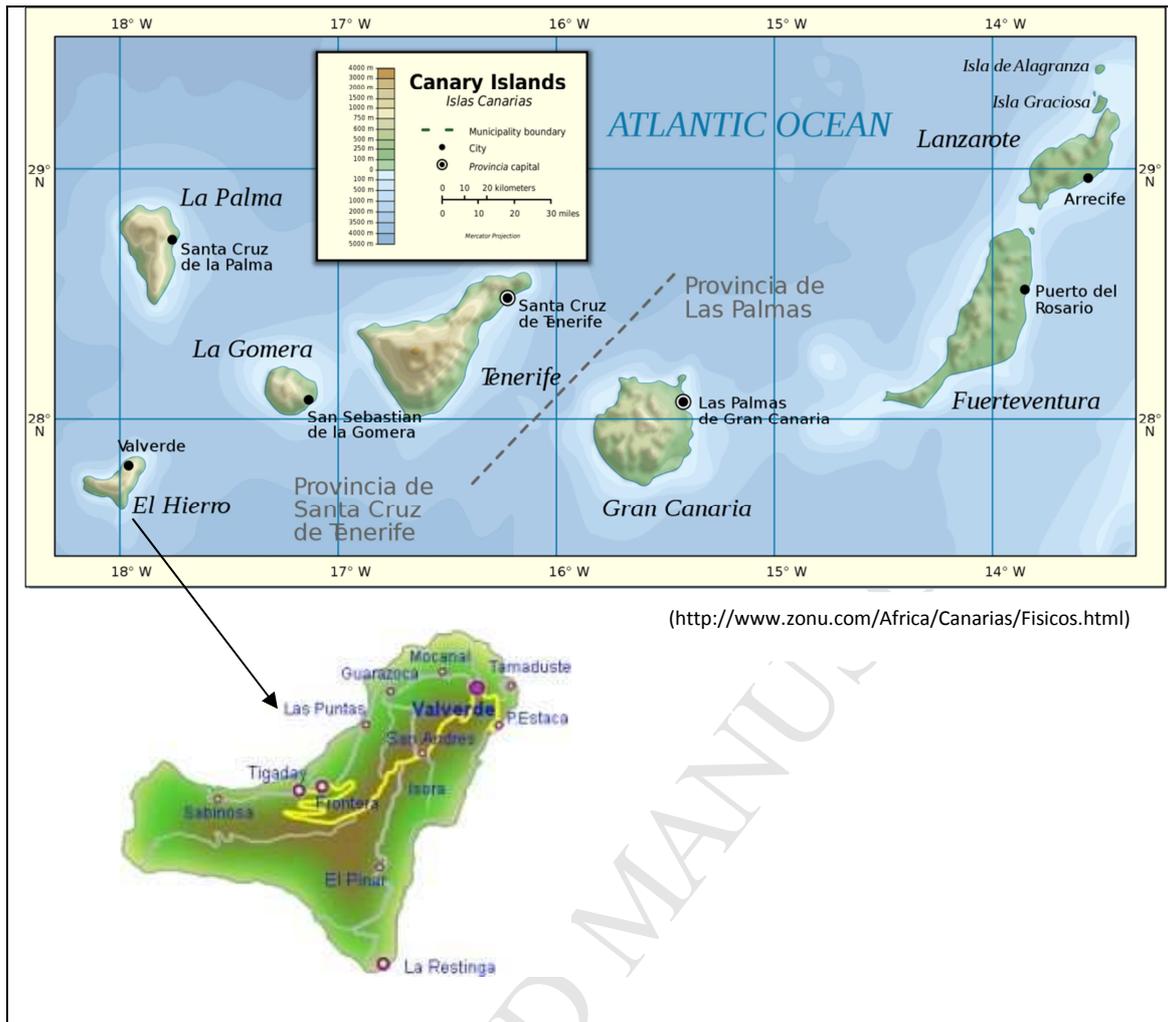


Figure 1. Canary Islands and El Hierro maps.

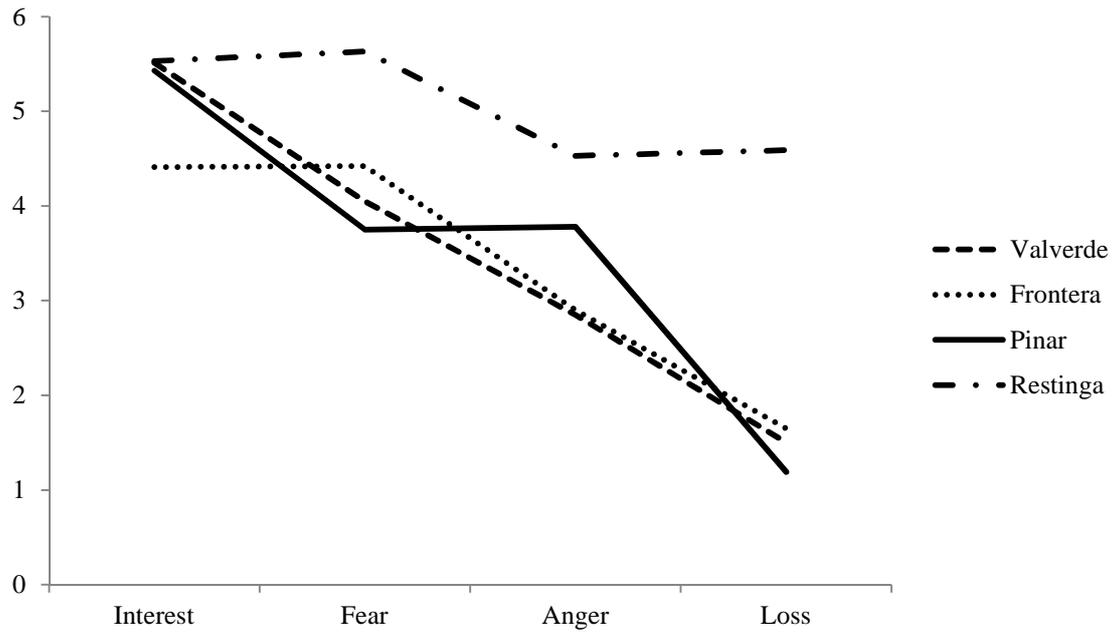


Figure 2. Means in the emotions experienced in each place of residence.

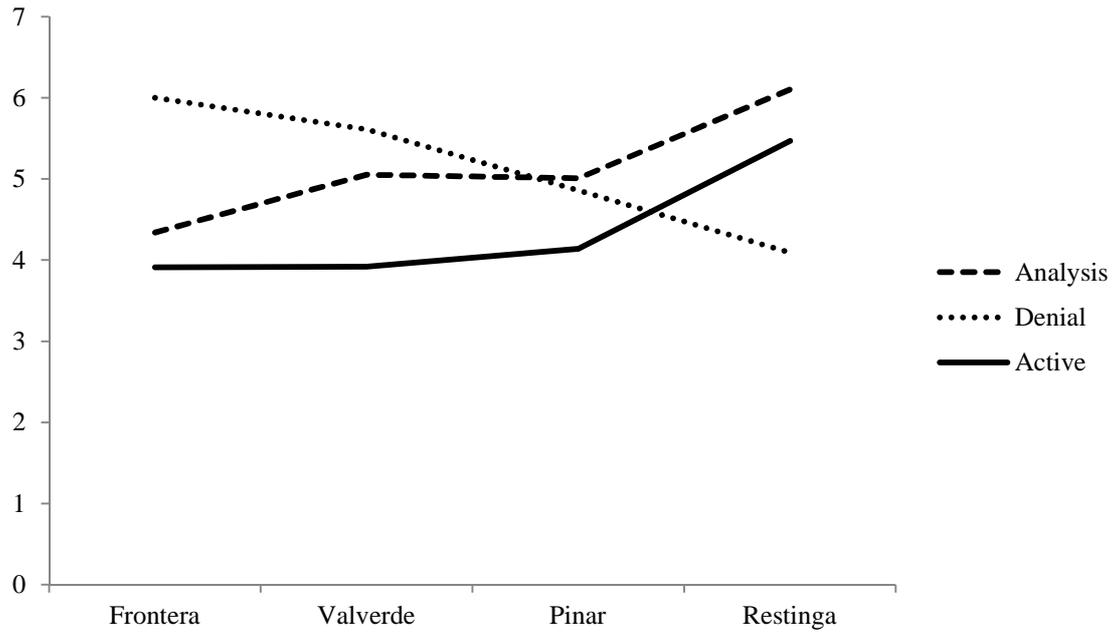


Figure 3. Means in coping strategies in each place of residence.

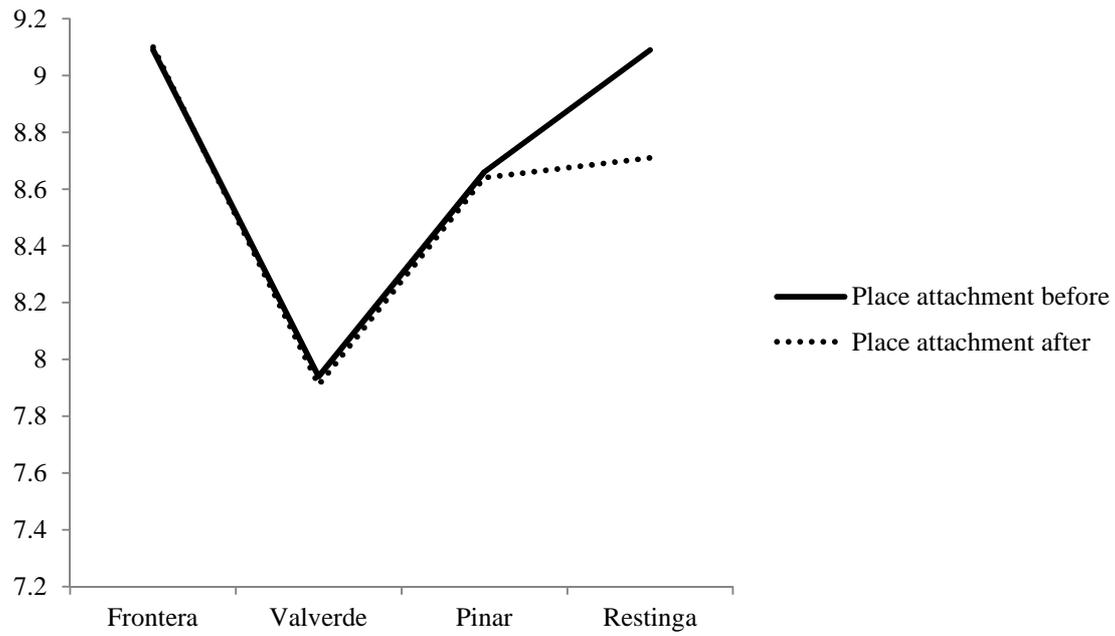


Figure 4. Means in place attachment before and after the eruption process in each place of residence.

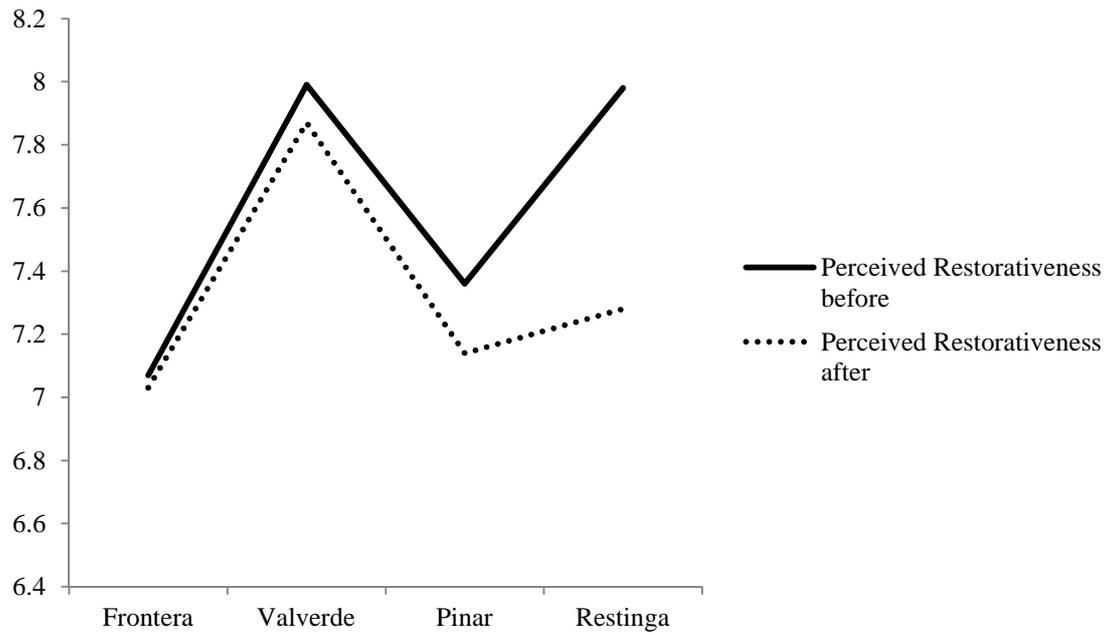


Figure 5. Means in the Perceived Restorativeness before and after the eruption process in each place of residence.

- We analysed the reactions to a volcanic process in El Hierro, a Canary Island.
- Place attachment diminished in the residents nearest the volcanic process.
- Residents near of the volcanic process perceived changes in place restorativeness.
- Coping strategies used were more active in the areas nearest the volcanic eruption.
- The feeling of loss predicted the 13% of variance of changes in place attachment.