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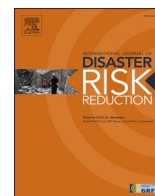
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'No way! I'll stay! Who will get me out of here?' House attachment and staying intentions of homeowners with a damaged dwelling in a rural risk area

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ABSTRACT

Few studies have investigated staying intentions and house attachment of residents who are confronted with physical damage to their dwelling in a risk area. This paper examines whether and how homeowners who are confronted with human-induced risks and the consequences of gas extraction in the Dutch Groningen rural earthquake region are attached to their damaged dwellings and why they stay. A content analysis was performed on 92 published interviews with homeowners of damaged dwellings. Additionally, three semi-structured interviews were held with key journalists and a homeowner. The results show that the homeowners' staying intentions are interrelated with their house attachment; moreover, their awareness of their house attachment arises precisely because of the damage. We identify five subdimensions of physical and social house attachment, related to family history, heritage, (agricultural) business, personal refurbishment, and cohabiting family members, which make homeowners want to stay. The family history is especially mentioned by mid-to-later life homeowners, while some younger homeowners emphasize social house attachment to their children.

We conclude that a homeowner's decision to stay in a damaged dwelling is a continuous cycle of reconsideration and renegotiation, punctuated by potential new risks and damages influencing the house attachment and staying intentions. Based on the found dimensions of house attachment, policymakers in risk areas could apply different approaches to homeowners in case of damage repair, rebuilding, or relocation plans, as homeowners - even those with damaged dwellings - may prefer to stay.

1. Introduction

Studies on adapting to risks and hazards due to climate change and environmental issues are focused on the role of governments and less on the role of the civil society [1,2]. In addition to governments and private sectors, individuals and households also need to adopt strategies to reduce risks and hazards in a risky environment. As a result of climate change and environmental disasters in the world, more and more people will be threatened in their existence in a particular place or home. The social and psychological costs of living with risks have long been underestimated, as have the economic costs of damage and the restoration of property [3]. To gain a

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better insight into residents' motives for staying in or leaving a high-risk situation, it is necessary to explore whether and how individuals and households are attached to a damaged dwelling. Do residents still want to stay in a damaged home after a disaster, or would they rather leave? This paper focuses on house attachment in a rural area with ongoing and recurring human-induced risks and why and how homeowners intend to stay in a damaged dwelling. The aim of this research is to gain a better understanding of why homeowners with a considerable physical risk, by means of a damaged dwelling, stay in an environment at risk for years. Policy makers in risk areas can use the results of such research for their measures in the field of relocation, repair, reinforcement, or rebuilding.

One of the most drastic measures that policymakers and authorities can take in a situation at risk is to order the residents involved to leave their homes, voluntarily or compulsorily, and move out of the hazard area. Especially in the case of a 'voluntary' choice, the decision to move or not, will in any case be influenced by whether the residents feel attached to their dwelling and its specific surroundings [4]. Van Valkengoed and Steg [2] mentioned 'evacuation' or 'migration' as important strategies of individuals to reduce or avoid risks. Instead of focussing on 'evacuation' or 'migration', other research emphasizes residents' staying strategies by studying place attachment related to risk coping or preventive measures regarding the home [5–9]. Apart from hurricane evacuation/stay studies in the US such as Adjei et al. [10] and research of Zander and Garnett [11] into hazards like floods, earthquakes, cyclones, and wildfires, little is known so far about whether residents in risky circumstances decide to move to a safer place or consider staying.

In the scientific literature, there has been considerable attention to place attachment at the spatial level of the neighbourhood or city [12–16]. At the spatial level of the house, in the sense of house attachment, this is less the case [12,14,17,18], particularly where risky or threatening situations are concerned [19–21]. The main objective of our study is to explore 'why' and 'how' homeowners stay in a physically damaged dwelling in a hazardous environment. The reason for research on staying put is that extensive outmigration from an affected area, due to any risk, disaster, or damage, would have consequences for both the residents and the economic perspective of the (rural) area [8]. In addition to the transaction costs of relocation and the loss of local insider advantages for residents, these include a disrupted housing market, unoccupied dwellings, loss of facilities and decline in quality of life [22].

We investigated whether individual homeowners want to stay in a damaged dwelling, including characteristic and listed dwellings, and explored the role of house attachment. In this connection, we focused on the staying behaviour of homeowners with damaged dwellings in a rural, risky area. Our case region is the Groningen earthquake region in the north of the Netherlands, with recurring human-induced earthquakes as a result of long term gas extraction. In this region, many residents have been waiting for years for damage compensation and reinforcement of their dwelling, while the earthquakes are still ongoing [23,24]. While existing studies provide important information about governance and policy, housing markets, health and wellbeing, our study aims to analyse the shared thoughts and experiences of individuals and families living in houses that were damaged due to previous earthquakes. With the help of the person-process-place framework, abbreviated as the PPP framework of Scannell and Gifford [25], we concentrate both on the individual person-place relationship at the spatial level of the house and its surroundings, defined as house attachment, and on the place-process relationship in the sense of staying intentions despite of past and future earthquakes. By focussing on house attachment to a damaged dwelling, and on the multiple dimensions of this attachment to the house, this paper enriches the PPP framework of Scannell and Gifford [25] and other existing studies.

The paper is structured as follows. Section 2 contains an overview of the theoretical background and concepts concerning risks, place attachment, house attachment and staying behaviour in an environment at risk, such as an earthquake-prone environment. Section 3 introduces the used methodology, including the case study, data description and collection, analytical approach, and preparatory interviews. Section 4 presents the results related to existing academic research on house attachment and staying strategies of homeowners in (rural) risky areas. Finally, the paper ends with conclusions (Section 5).

2. Theoretical background

2.1. Physical and social place attachment in risky areas

Most research on attachment related to places with environmental risks and hazards focuses on the spatial level of the neighbourhood and attachment to the environment [3,6,14], although the residents' personal risk and possible damage experience to their own home is also of significance. Residents with significant and multiple damage to their homes rate their health worse and have more mental health symptoms [23,26,27].

The affective bond towards the place of residence has a social but also a physical dimension as was found by Fried [28] in a relocation study in Boston, and later by Hidalgo and Hernandez [12] and Scannell and Gifford [25] in their studies on place attachment in general. Scannell and Gifford [25] have further developed the concept of place attachment in their three-dimensional model, the person-process-place or PPP framework. The person component is translated into the realizations experienced by someone with a place. The process component is linked to feelings for a place (affection) such as love, pride, and happiness; memories and meanings (cognition) and, finally, expressed in behaviour (proximity-maintaining, reconstruction of place). Scannell and Gifford [25] emphasize the functions of place attachment, in terms of survival and security, goal support and self-control, and continuity, while encouraging empirical research into other functions, such as a sense of belonging (see also [14]). Anton and Lawrence [18] argue that the concept of place attachment is being used too broadly and therefore that a distinction should be made between the concepts of place identity as emotional place attachment and place dependence. Place dependence reflects functional ties to a place [17]; p. 672). Seebauer and Winkler [29] report in a study of an Austrian flood-risk area, that place identity, especially for the elderly, is the most decisive factor for staying. A strong place attachment reduces the probability that residents will move out of a risk area, regardless of their risk awareness [9,30]. At a small-scale level, house and neighbourhood attachment implies that respondents report stronger survival intentions in case of hazard events [17]. Stedman [31] concluded that lake property owners with stronger place attachment are more willing to act, protect or defend their place if it is under threat. A 'disruption' to place attachment by a wind energy project, indeed showed that

residents with a stronger place attachment exhibit opposition behaviour and negative attitudes [32].

In general, place attachment is often measured by the length of residence and homeownership [15], but according to Bonaiuto et al. [6] we should also keep in mind that a prediction about place attachment based on these variables reflects the economic investments by a resident, which are not necessarily indicative of a resident's psychological relationship with a place.

Variables like homeownership and length of residence for place or house attachment are certainly realistic to account for a strong house attachment [17], also in a threatening situation [6,18]. Jansen [9] found that residents in a rural earthquake area are more likely to stay as they are predominantly strongly attached to and/or were born and raised in the area. Unless this is required due to a mandatory order, Bonaiuto et al. [6] concluded in their review paper on place attachment and risky areas that once a person is attached to a place, it's rather difficult to leave the risky place.

2.2. House attachment in an environment at risk

Hidalgo and Hernandez [12] and Jorgensen and Stedman [33] have drawn attention to physical and social attachment at the spatial scale of the house, referred to as 'house attachment' within the person-place relationship (see also [25]). Research has shown that people report a higher score on attachment to their house than to their neighbourhoods [12,15]. According to Jorgensen and Stedman [33] and Anton and Lawrence [18], this higher level of house attachment could be due to the fact that the human-environment relationship to a home is more clearly defined than one's 'neighbourhood'.

House attachment might be influenced by the type of housing involved [15]. Also, the architectural identity of the environment, in the sense of historic residential housing with old patterns and ornaments, positively influences the attachment of residents [34]. Taçon and Baker [35]; p. 1300 even argue that 'heritage should be used to strengthen the bond between people, places, and identity'.

In the case of external risk factors, they appear to influence the intensity of house and place attachment of residents at different spatial levels. In fact, according to the theory of Relph [36], the residents' connection to their house only emerges at moments of dealing with potential loss or when times are hard. Some studies have been conducted on house attachment in risky and threatening situations. Billig [19] showed that, despite the risk of possible terrorist attacks, Jewish settlers have a strong tendency to stay, partly due to their strong attachment to their house and ideology in respect of the Holy Land. Twigger-Ross and Uzzell [37] also found that attached people are more likely to stay when their physical residential environment changes due to economical, environmental, and social developments and are less prepared to leave their homes, compared to unattached people. Next to the neighbourhood where people live, also their home can be an important factor to stay in an environment at risk, even if these homes are damaged or destroyed [38].

2.3. Staying and coping with risks

In the risk and insurance theory, risk has to do with controlling the future, or the inability to do so, especially where this is related to safety [39]. Thoyts [40]; p.5) defines risk as 'the probability of an uncertain event, causative of economic loss'. The concept of 'risk' is related to hazards or danger. Hazards and the associated risks are assessed differently by individuals, depending on the specific circumstances. This also means that by staying or leaving, individuals cope differently with hazards and risks. We define risk coping as behaviours and actions of people confronted with risks and hazards [6,41]. Stancu et al. [5] conclude that people living in a high-risk area who have strong ties to the place and a high-risk perception were also found to be more likely to experience distress.

From a psychological perspective, there are six categories of behavioral change of individuals and households because of hazards related to institutional, social, cultural, legal, and physical circumstances [2]. These are information seeking, preparative and protective measures, political action, purchasing insurance, and evacuation or migration. Although evacuation or migration of residents seems to be an obvious, relatively fast, and successful strategy in the face of hazards, it overlooks the negative effects afterwards, such as the loss of cultural heritage and people-place relationships [42]. If one stays in the risky place, a positive relationship is generally observed between place attachment and risk coping behaviour in the sense that someone takes action to improve or protect it [6,7]. So, risk coping might include staying in the hazardous area, isolating oneself instead of acting in a panic and/or in anger, or relocating [6]. Other research demonstrates that, despite the risks and damage in the region, most homeowners still stay [8,9,22].

Seebauer and Winkler [4] found diverse risk coping strategies in their relocation study on staying or leaving the 2013 flooding of the Eferding Basin (Austria) like opposition (mistrust of authorities and perceiving procedures as unfair), and escape/avoidance (not talking about the issues). Ruiz & Hernández [43] reduced coping strategies in a case of volcanic activity to three coping styles: analysis, denial, and an active strategy. In a study on earthquakes, Jansen [9] clarifies the staying of residents, including residents with damaged homes, by their strong place attachment and the risk coping strategy of not accepting the situation. Also coping in the sense of housing renovation and gardening activities after disruption(s) is known to strengthen residents' people-place bond with their home and its surroundings; it incites to action and might even restore the people-place bond again [44]. Overall, we can see that the different studies show certain similarities: the staying behaviour of residents is related to place attachment and ways of risk coping [8].

2.4. House attachment and a damaged home: a place to stay or to move?

We expect that a mid-to-later life, long-term homeowner, also in a damaged dwelling, will have a stronger house attachment than a younger one, as determined by homeownership, length of residence and age [14,17]. Logically, on average, a younger homeowner will have a shorter length of residence than a mid-to-later life homeowner. At the same time, older, long-term residents are more likely to develop house attachment as they stayed in their homes longer before it was damaged. Haacke et al. [45] also emphasize that older people are inclined to stay in their familiar place and do not relocate until this is unavoidable, as they are attached to their home and environment (see also [46]). We want to explore whether and how house attachment in the case of a damaged dwelling relates to the intention to stay and what differences are visible. We assume that a mid-to-later life homeowner will be more likely to stay in the

damaged home instead of moving. This hypothesis then leads to our main research focus concerning the relationship of residents with their damaged house and their considerations to stay or to leave the risk area.

3. Methods

3.1. Description of the case study of the rural Groningen earthquake region

The consequences of gas extraction in the rural area of Groningen, the north of the Netherlands, were only felt and visible much later in time. Since 1986 the Groningen region has been confronted with earthquakes caused by gas extraction [27,47]. Although residents of the area did report they felt earthquakes and had housing damage after 1986, this damage and cracks to their houses because of the earthquakes was initially dismissed by the gas extraction organisations as ‘subsidence damage’ caused by, in their view, poorly founded and constructed buildings and dwellings. Only since 2012, after the strongest earthquake in the area, in Huizinge, the area has been recognized by the national government as an earthquake area (see Appendix 2). Until 2010, the number of earthquakes was less than 50 per year. From 2011 to 2019, the year of our research, the number fluctuated between 75 and 125 earthquakes per year, with one or two each year in the M (magnitude) 3.0–3.5 category on the Richter scale (KNMI, 2023, see also Appendix 1, Fig. 1). Although the recurring earthquakes in Groningen are classified as ‘minor’ based on their magnitude on the Richter scale (max. 3.6 in 2012), Vlek [47] states that the area is nevertheless a ‘slow-onset disaster’ area because the earthquakes are close to the earth’s surface (less than 3 km) and take place in a soft soil, causing aftershocks [48]. Their effects became more prominent and pervasive over time. These human-induced earthquakes have a considerable impact on dwellings, building structures and residents. As a result, buildings in the region have been physically damaged [24]. In addition to the immediately visible damage to homes and commercial real estate,

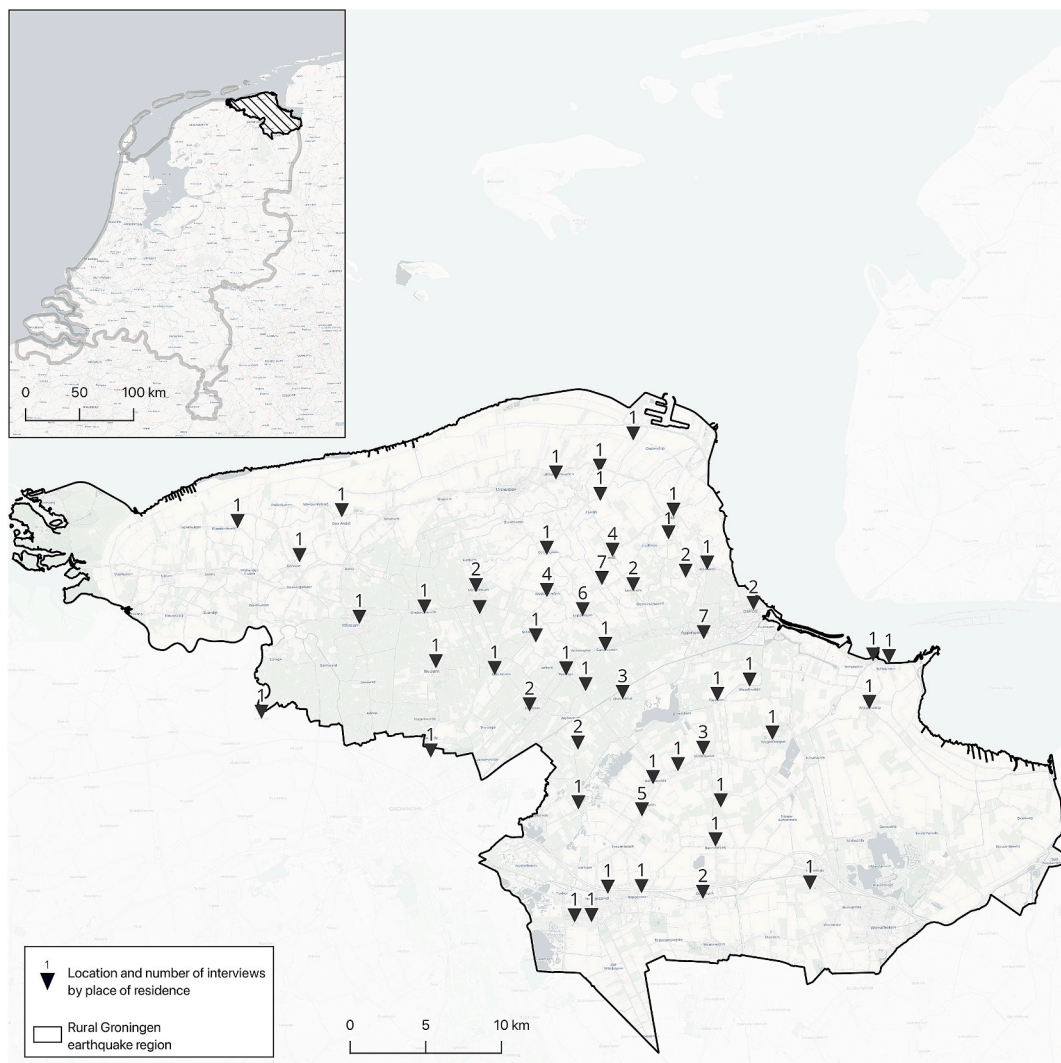


Fig. 1. Distribution of a total of 92 interviews with homeowners of damaged dwellings in the rural Groningen earthquake region in the Netherlands (see inserted country map) by place of residence. (Edited by Geodienst/University of Groningen, 2023).

there were also less visible effects, like health issues, welfare problems and psychosocial consequences for the residents [23,27]. Over 400,000 residents live in the Groningen recognized earthquake area, of which approximately 42.5 % have been personally affected by building damage [47].

According to Zijlstra et al. [27], research has mainly focused on the economic damage and social effects of ‘major’ earthquakes rather than on the ‘minor’ earthquakes, while the latter are much more common in the world and can also be disastrous for people in a situation of continued stress. The human-induced earthquakes in the Netherlands, not only led to damage to dwellings, but also to a reduction in living comfort and an increased risk of (fatal) injuries [23,49]. Despite the impact of earthquakes on the quality of life of residents in the Groningen earthquake area, the willingness to move is low, namely 6 % [50], while in the province of Groningen in general some 15 % of the residents want to move [51].

3.2. Data description and data collection

To gain a better understanding of the specific nature of the individuals’ house attachment, we used semi-structured published interviews. These had been conducted by journalists on location and were published in the regional newspaper ‘Dagblad van het Noorden’ on a daily basis between January 8, 2019 and May 6, 2019. Afterwards they were compiled in a book entitled “‘I’ll Wait’ 101 Reports from the Earthquake Region” (in Dutch ‘Ik wacht’ [52]). In June 2019, in the presence of residents involved, the book was presented in the medieval church of Zeerijp in the earthquake area to the Minister of Economic Affairs and Climate, responsible for the damage compensation scheme and home reinforcement of homeowners since 2012.

We analysed 92 of the 101 interviews with homeowners, published in the book. We had to omit nine interviews as these concerned managers of institutional buildings, such as churches or sports accommodations, or tenants instead of homeowners. We focus on homeowners because Burningham et al. [53] found that homeowners are more risk aware than renters, and Lewicka [14] has shown that home ownership is a coherent predictor of place attachment. The housing market in the Groningen earthquake region consists of 64 % owner-occupied houses [54].

About half of the interviewed homeowners live in a multiple-person household and have been interviewed as a couple or family (49 interviews), and the other half as one-person interview (43). Of the in total 142 interviewed homeowners 70 were females (49.3 %) and 72 were males (50.7 %). All of them were owners of (semi-) detached dwellings, most of them with a surrounding garden or yard. The distribution of the interviews over the Groningen earthquake region is shown in Fig. 1, while characteristics of the household (age and length of residence) and dwelling (construction year) are presented in Tables 1–3.

In most cases we knew the length of residence, as the homeowners mentioned their residential history, while in other cases we were able to deduce the minimum length of residence if the interviewee referred to an earthquake year. Based on the data, we estimate that more than three quarters of the interviewed homeowners have lived in their house for more than six years.

Almost two-thirds of the dwellings were built before 1933, while 72.8 % originate from before 1940. The oldest house with a listed or characteristic status dates from 1594.

Although the homeowners have appeared in the newspaper with their names and photos, and therefore anonymisation would not be necessary, we present extracts from the published interviews (in italics and with quotation marks), only stating gender and age group. We translated the statements made in Dutch into English through the services of a qualified translator.

3.3. Analytical approach

At first a content analysis was performed on the 92 published interviews. Although academic research on risks and hazards using media as a data resource is still sparse, it has been recognized that media can play an important role not only in disseminating information but also in collecting information from residents in a risk area [23,55–57,58–60]. The interview question ‘What do these risks and damage mean in your life’ was especially important for our analysis, alongside topics such as the extent of the damage, and how long the interviewee(s) had to wait for damage compensation or damage repairs. We also applied an inductive approach to the content analysis [61]. The advantage of analysing the published interviews this way is that we got an ‘open minded’ view of the residents’ responses to their damaged dwelling. It provides a valuable contribution to exploring the relationship between house attachment and staying or leaving a risky environment. Separating the roles of interviewer and researcher, especially in an environment at risk, is a way of trying to approach the research material more objectively. In an environment of risks and disasters there often exists tension, stress, and sensitivity among the respondents and it can be wise to create distance between data collection and the analysis of the results. The homeowners who were willing to share their experiences did so on a voluntary basis. However, this could also result in self-selection: perhaps only those homeowners wanted to be interviewed whose strategy is ‘action readiness’ and staying [2]. We are aware that hindsight bias may play a role in interviews [62] on interpreting and reflecting on risks. However, this paper does not focus on reflections on (the process) of risks, but on the relation between attachment to a damaged dwelling and intentions to stay in a risk area.

Digital versions of the interviews were downloaded from Nexis Uni. We used ATLAS. ti 22 [63] for open coding of the interviews

Table 1
Distribution of the selected interviews and homeowners by age group.

Age group	20–30 years	30–40 years	40–50 years	50–60 years	60–70 years	70–80 years	80–90 years	Total
Number of interviews* (%)	0 (0 %)	8 (9 %)	23 (25 %)	26 (28 %)	23 (25 %)	10 (11 %)	2 (2 %)	92 (100 %)
Number of homeowners (%)	1 (1 %)	12 (9 %)	37 (26 %)	43 (30 %)	34 (24 %)	12 (9 %)	3 (2 %)	142 (100 %)

(*based on the oldest person in the interview).

Table 2
Distribution of length of residence of the interviewed homeowners with a damaged dwelling.

Length of residence	< 4 years	≥ 4 years	≥ 6 years	≥ 13 years	Unknown	Total
Number of damaged dwellings (%)	4 (4 %)	11 (12 %)	25 (27 %)	45 (49 %)	7 (8 %)	92 (100 %)

Table 3
Distribution of construction year of the dwellings of the interviewed homeowners.

Construction year	<1900	1900–1940	>1940	Unknown	Total
Number (%)	28 (30 %)	39 (42 %)	23 (25 %)	2 (2 %)	92 (100 %)

and to identify experiences, responses, emotions, and opinions. After breaking down the data in the open coding we used axial coding by recombining the originally identified themes. We reduced the codes to code groups of subjects put forward by the homeowners in the interviews (see [Appendix 3, Table A.1](#)). Finally, we selected the overarching and relevant main themes according to our research question. In this phase we focused on the quotes in the interviews about risk coping related to staying or leaving. In the final step we selected the relevant quotes related to physical and social house attachment to further explain and clarify the main themes.

3.4. Preparatory interviews with journalists and homeowner

To gain a better insight into the background and working method of the journalists who conducted the interviews, we followed the suggestion of Evensen et al. [55] and carried out additional semi-structured interviews with the two journalists who relatively conducted and worked out the most interviews (about 30 %). We discussed how respondents were recruited, whether an interview guide was used, how the interview was conducted and how the reports were written out. We also asked the journalists how they perceived the relationship of the interviewees with their homes. These interviews were done in February 2022. In November 2021 we had already organized a semi-structured interview with one of the interviewed homeowners to discuss and check the preparation and aftercare of the journalists' interviews. All three interviews lasted 45 min to an hour and a half. They were transcribed verbatim. The journalists stated that the respondents had come forward themselves or had been recruited through networking and snowballing. They further explained that the interviews were meant to shed light on the question of how the respondents dealt with their homes becoming an unsafe place where the authorities literally are in charge at your own kitchen table. Most interviews with the residents, also took place at the kitchen table. This made it easy for the respondents to show their personality, who they are and how they live.

In order to obtain an accurate picture of the narratives of the homeowners in the 'I Wait' series, mainly the 'open interview' technique was used, meaning that as few as possible leading interview questions were asked, by summarizing and letting the homeowners talk.

Photos of the respondents were all taken inside the house by the same photographer, most often with them sitting at the kitchen table. The journalists stated that they considered the indoor photo as part of the newspaper article, because the main narrative also concerned the house. The fact that the journalists and photographer went to the homeowners' dwelling was greatly appreciated by the residents. A description of what the house looked like was the starting point, after which the people were introduced. The journalists felt that writing the reports was easier because they had been there in person. The method of elaborating the interviews differed between the journalists: some recorded the interview with their smartphone, others made notes on the spot, and there were those who did both. After the interview the report was submitted to the residents to check whether it was accurate. This was confirmed by the interviewed homeowner.

The journalists who participated in the 'I Wait'-series were all employed to the newspaper's editorial board, already worked in the earthquake region, and had completed a journalism education at university level. The journalists also asked homeowners why they still stayed in their homes, despite the damage, bureaucracy, powerlessness, and lack of confidence in damage repairs and damage compensation.

4. Results

In section 4.1. we first provide an overall picture of the homeowners' relationship with and behaviour towards a damaged dwelling. In sections 4.2. and 4.3. we present the homeowners' relationship with their damaged dwelling, the different types of physical and social house attachment and, finally, the homeowners' staying intentions and attachment to the damaged dwelling in the rural, risky area.

4.1. The relationship of homeowners with a damaged dwelling

The interviewed homeowners initially discussed topics related to the damage to their home, giving descriptions of the damage, the repair process, whether (or not) the damage is recognized as earthquake damage and the (dis)agreement about the amount of financial compensation. It is clear that the interviewees involved do not simply 'accept the situation', which is in line with the outcomes of Jansen [9]. They all consented to an interview and to have their photographs published in the regional newspaper to come forward in a purposeful way. They blame the government and the companies involved in gas extraction for the damage to their dwelling (see [Appendix 3, Table A.2](#)). Seebauer and Winkler [4] describe these expressions as 'opposition' in the sense of a distrust of authorities and perceiving procedures as unfair. The interviewed homeowners feel powerless, anxious, unsafe, and angry about the effects of

human-induced earthquakes on their living conditions, including the damage to their homes caused by external parties.

He finds himself getting angry again. Then things start bubbling up and I can feel my emotions rising. I also start talking louder and faster. I don't want that at all. I made the conscious decision not to think about it too much anymore.... Ah, you can worry about it, but that won't help. (male, 60–70 years)

Possibly, due to a stronger place attachment, homeowners are more willing to engage in 'place-protective behaviour' which is also shown in the studies of Anton and Lawrence [18] and Stedman [31]. Yet there are also owner-occupiers who say they can handle it well and have a fighting spirit:

The uncertainty of what will happen to his house is annoying. It shouldn't take too long because I'm already approaching seventy. But I see it as a project, a challenge. That's my anchor. Sometimes I am angry when things go wrong or when there is another delay. But I won't let it destroy me. Fortunately, I'm good at putting things in perspective well. I am definitely not a victim. I won't let that happen. (male, 60–70 years)

The damage was often described in great detail: the interviewees stated the number of cracks and their exact locations in the house. A comparison was often made with the situations before and after the earthquakes or after a specific earthquake and sometimes before and after a repair process. The respondents indicated that the damage puts a blemish on their home; it annoys them that their house is no longer as perfect as it was, and they speak with melancholy and pride about how their house used to be before the earthquakes.

I haven't done anything about my house for years [after the found damage]. And that really bothers me. I'm actually a perfectionist. Everything must be right. That is no longer the case. Have you seen the window frames? They [the damage assessment authorities] might tell me: 'You should have painted those window frames. Whereas, a few years ago, I was told not to do anything about the house for the time being, in anticipation of possible demolition or reinforcement.' (male, 40–50 years)

Here we recognize the place-process approach of Scannell and Gifford [25]: the affection in the sense of pride and love for the house and the memories associated with the house before the earthquakes (cognition). It is reminiscent of the concept of 'nostalgia' as described by Savage [64]; p.116 as one of the main narratives of belonging to place: '... one's place of residence appears to have lost its magic'.

4.2. Physical and social house attachment

In general, the staying behaviour of the studied homeowners in the risk area seems to be related to a physical and social attachment to their house, even though it is damaged. We observed that, due to the risk situation that arose, people became aware of their house attachment and as a result are less inclined to leave their homes [12,18,19,65].

We identified five subdimensions of house attachment (or a combination of these) related to the question why owner-occupiers will stay in their damaged dwelling: (1) family history with the house and its surroundings; (2) physical attachment to a listed or characteristic heritage dwelling; (3) physical attachment to (agricultural) business dwellings; (4) physical attachment to personally refurbished dwellings after the purchase or along the life stage of its occupants; (5) social house attachment concerning the co-residents. These subdimensions will be further discussed in sections 4.2.1 to 4.2.5.

4.2.1. A family history with the dwelling and physical house attachment

Especially mid-to-later life long-term homeowners indicated that they are attached to the house and its surroundings, because they grew up or were born there. This attachment to a house and ground (of birth) can be quite strong or far-reaching [66]. If the damaged dwelling has to be repaired or even demolished, and the long-term residents concerned have to live somewhere else temporarily, they often state that they absolutely do not want this. Instead, they only want to live in a temporary housing unit on the exact spot of their current house and grounds of birth or place of growing up:

The place where the family has lived for four generations is literally off limits [house declared uninhabitable due to the earthquake damage]. A few belongings they could take to their portacabin [temporary portable living unit at the same residential location]. 'From one day to the next, you are taken out of your familiar home. That's what you turned ninety for ... They [the authorities] had already booked the hotel. But I said: I won't do that. I've lived here all my life; I'm not just going to leave here.' (male, 90 years)

Another mid-to-later life long-term homeowner also emphasized the importance he attaches to his current native home and ground. Should his damaged house have to be demolished, then he wants it to be rebuilt on exactly the same residential site.

He grew up in the detached working-class house and moved back in together with his young family when his mum died suddenly in 1978. The couple continued to live there with great pleasure. Until the earthquake misery struck. The reinforcement plan for their home opened the couple's eyes: their house is due for demolition. Better to demolish and build new. 'But I won't leave the yard. A [temporary] change of residence to elsewhere? I don't trust anyone anymore. Let them put up a shack here [on the site] to live in temporarily.' (male, 60–70 years)

As argued by Seebauer and Winkler [29], these mid-to-later life residents who still live in their birth houses, are so attached to their home and grounds that they do not want to leave it. In the Scannell & Gifford framework [25], we recognize this as the 'proximity-maintaining behaviour' or the behaviour of staying as close as possible to a specific place.

The strong house attachment of mid-to-later life homeowners that is related to their family history may also be enhanced by length of residence. This connection with the native home and ground seems to indicate 'embodied place attachment', not just to the house

but also to the specific grounds where it is located, the situation in relation to the garden, the grounds, the land, everything else known [14,67]. Meijering et al. [68]; p. 36) emphasize the importance of place attachment at the level of the body and the home in the sense of ‘home-making as an embodied process: people experience the home through their bodies’. This ‘embodiment’ becomes important as a person gets older; as people get older and organize fewer outside activities perhaps due to increasing disabilities, they also become more integrated with their home because that is where they experience their daily activities, social relationships, emotions, and memories [67,68]. We did not find such an ‘embodied’ attachment to a birth house or grounds among the younger homeowners. When they are confronted with damage to their birth house, they do not mention house attachment in relation to family history. Instead, they are more concerned with other themes, such as the care for listed buildings, the (self) refurbished dwelling or damaged business dwelling and the resulting difficulties in connection with developing entrepreneurial activities.

4.2.2. Heritage and physical house attachment

Both younger and older homeowners proudly mentioned the historic value of their dwellings. Several stated that they attach importance to preserving listed and heritage properties for themselves and for the area. Most of the residents interviewed are owners of an authentic or characteristic dwelling (see Table 3). The attachment to characteristic or listed ground-floor dwellings in this rural earthquake area is reflected in the following quotes:

The couple’s stately home can no longer be saved. The house, built in 1924 by grandfather, has too many cracks. ‘It is distressing what is happening to the historical heritage in our beautiful Groningen.’ (male, 80–90 years)

‘This is not just a hut you know. The oldest part of the house is over two hundred years old, built in the eighteenth century from monastic bricks.’ (male, 80–90 years)

The couple bought the large farmhouse with garden gallery in 2006 and a major renovation followed. [...] In 2014, the first cracks appeared in the building with heritage designation. [...] The weighty tympanum on the facade, walls and rafters were reinforced. New cracks emerged in 2017. In the meantime, the damage is worsening, and that goes to the heart of the couple. Says the husband: ‘This is our life’s work. We would like to preserve this heritage.’ (male, 40–50 years)

Some homeowners also intend to apply for a listed status for their own damaged dwelling to prevent the dwelling from being demolished.

She lives in the oldest house in the village. The facade reads 1663. A white-painted farmhouse with a fruit orchard. She fell for the spot completely in 1994 and bought the house. ‘It was uninhabitable, you could see out through the roof, there was no sewage system, it was very, very old. I saw it as an old lady that needed to be refurbished’. Meanwhile, [because of the earthquakes] the house has been patched up many times in recent years. Cracks have been repaired, walls plastered and painted. ‘First damage repair, then reinforcement’. Lately, she hasn’t felt unsafe anymore. However, she does live in fear that her house will eventually have to be demolished. That is why she is trying to get her house on the list of characteristic buildings. Then it will be protected against demolition. ‘I don’t actually understand why it’s not on it.’ (female, 40–50 years)

What is interesting about this quote is that this homeowner perceives her house as a person (‘an old lady’) that needs to be taken care of with love. Scannell & Gifford’s framework [25] classifies this ‘love for an object or home’ under the ‘affect’ dimension of the psychological process of place attachment. By applying for a ‘listed status’, a house seems safeguarded from demolition. However, this does not mean it is free from the risk of earthquake damage. Nevertheless, the engaged owners of characteristic or listed houses want to stay in the dwelling and want to preserve its authentic atmosphere.

4.2.3. Business dwelling and physical house attachment

In general, both younger and mid-to-later life entrepreneurs as owners of a business dwelling, show a more business-like approach towards their house. They consider it self-evident that they will stay in the business dwelling and therefore also choose to repair the damage or reinforce it rather than to move out. Some of the homeowners indirectly point out that they are linked to their house anyway because it also serves as a business dwelling or farmhouse. This last observation is linked to ‘place dependence’ or functional attachment [18].

‘What makes it even more complicated: our company must continue to operate during the approach [of damage repairs and reinforcement]. We have a wonderful family business [in business dwelling] that has existed here for 90 years. We don’t want to be the ones to close it down.’ (female, 50–60 years)

In the interviews, the entrepreneurs are more focused on the financial settlement of the damage to the business dwelling and show less direct house attachment. Of course, this also depends on the type of business. For example, the owner of a Bed & Breakfast shows that she is attached to her dwelling, also because it is an important aspect of her business:

She has chosen to reinforce her Bed & Breakfast house, built in 1905, a property with oak floors, an Art Nouveau ceiling in the hallway, stained-glass windows: a house that she had refurbished with so much love and money. ‘Such a house should be reinforced, not broken down, are you crazy?’ (female, 60–70 years)

Another business owner attaches great value to the physical appearance and representativeness of the couple’s business dwelling and therefore does not want the house to be propped up on the outside due to the damage:

After the 2014 quake, they have damage. Much to their surprise, one day an expert and several men with aerial platforms and beams appeared in their yard. They came to prop up the facade. We assumed it would be resolved, in other words: repaired. But not: propped up. They don't want all those beams against their facade. We have a business. All those struts are not representative and express insecurity. I do not want that. (male, 40–50 years)

4.2.4. Personally refurbished homes and physical attachment

The interviews clearly show that there is a group of homeowners who have extensively refurbished their house themselves or had it refurbished after purchase before the earthquakes damaged the building. They are strongly attached to their house, and some have literally grown into it over time: a room has been added or refurbished with each newborn child. We might describe the personal refurbishment or extension of the dwelling due to additions to the family as personal residential history with the dwelling. A mid-to-later life couple puts it like this:

They have been living in their 100-year-old farmhouse in the village for thirty years. Their four children grew up here. They have refurbished, decorated, and furnished every room themselves. We pretty much built an extra bedroom for each child. Now they see their home slowly collapsing. In 2007 the property was appraised by a real estate agent. Then it was in tip-top shape. Now? There are cracks everywhere (female, 50–60 years). *It will probably have to be demolished* he says (male, 60–70 years). *But the couple does not want a new house at all. This house fits me like a glove,* she says. (female, 50–60 years)

'Personal residential history with the dwelling' then refers to the history individuals have with a home within a generation, in contrast to family history (see dimension 1, section 4.2.1), which involves a residential history with the dwelling that spans several generations.

A younger couple of homeowners with damage to their dwelling gradually made their house their own:

Inside, it is clear to see that the family loves their house. The living room with purple accents is neatly finished. This is a home, albeit a home with cracks in the bedrooms, basement, and scullery. The couple knows [from their relatives] that the damage could have been much worse. But we also work hard for it. We refurbished the house room by room. It was our nest-egg, she says. (female, 40–50 years)

Others say they know their house 'inside out' and even mention that the house is their life's work. The fact that their self-refurbished houses have been damaged by the earthquakes beyond their capacity and thus through no fault of their own, makes them feel powerless, sad, and angry. This is especially the case if the dwellings physically have been damaged several times in recent years. It pains the residents that their self-refurbished houses they are so attached to have been damaged.

4.2.5. Social house attachment by homeowners

Younger homeowners pay more attention to the co-residents they are attached to. Hidalgo and Hernandez [12] labelled this as 'social house attachment'. This is reflected in situations in which children are not able to sleep safely in their bedroom and have to move to another part of the house:

The biggest annoyance for me is that my daughter, who has a very nice bedroom upstairs, has been sleeping in the back-room with me for a year now, a space that actually serves as a laundry room. It's a precautionary step. We are not sure the top floor won't come down if there is a severe earthquake. (female, 30–40 years)

Or that, according to the parent(s), the children can no longer stay or play safely in certain parts of the house:

What you do when you see in a video [during an information session] what could happen to her house in the event of a severe earthquake? A video showing that your house is about to collapse? We moved the children's beds away from the window. Look, I'm not here all day [in the house]. My work is elsewhere. But my children ... My youngest still goes to school here. (female, 40–50 years)

For instance, one of her daughters wanted to have a sleepover party. She wanted it in the front of the farmhouse, which is the most unsafe part of the house. Then [as a mother] you give it some extra thought. (female, 40–50 years)

4.3. Staying intentions and attachment to a damaged dwelling

The majority of the interviewed homeowners reported that they intend to stay in the damaged dwelling, even if it has been damaged multiple times (Appendix 3, Table A.3). Some raised the possibility of selling the house and are thus maybe indirectly expressing an intention to move. Other owner-occupiers indicated that they absolutely want to stay in their damaged dwelling or on the same site in case of rebuilding. Homeowners of a residential farmhouse built in 1900 stated that, unfortunately, their dwelling cannot be repaired, but they appear to have a strong house attachment. They want to stay and prefer the same house to be built back on the same spot:

She and her husband have lived in the quiet little neighbourhood for 30 years. Amidst the farmlands just outside the village, they had created their own paradise. It was great living here until 2013. The institutions have tried to buy them out, they have been offered another house, but they don't want to leave. This is our home. We want to rebuild the same house. (female, 50–60 years)

In a study by Brondi et al. [69] on two earthquake communities in Italy, interviewees with a strong bond to their place of residence also stated that they did not want to leave the place despite the seismic risks. However, in our case, a homeowner expressed that staying

in the damaged dwelling comes with doubts, and the process of staying is also an ongoing weighing up of the pros and cons.

Waiting is a no-man's land, a vacuum between extremes. One moment I'm thinking: I'll take my loss, I'll leave. The next week I'm thinking: no way, I'll stay! Who will get me out of here?' (female, 50–60 years)

Hjälms [70] emphasizes that also in a non-risky situation, the decision to stay is never final but is continuously renegotiated. The staying decision process is particularly dynamic in a risk area: in addition to life events [71], new disasters and possible housing damage also influence that decision.

Another explanation for immobility in a risk area might be that the homeowners have no choice in location and have to stay in their damaged dwelling as they are (financially) 'stuck' [72,73]. However, other studies [18,19,65] concluded that house attachment including attachment to physical and social surroundings, can even in stressful and threatening situations contribute to (intentions to) stay instead of moving. For our study, these observations might mean that both physical and social house attachment possibly motivate homeowners to cope with the risks of the earthquakes, resulting in their staying in a damaged home.

4.4. Limitations and future research directions

This study was a first attempt to analyse house attachment and staying intentions of homeowners of a visibly damaged dwelling in a seismic area in a context of daily recurring earthquakes. The homeowners who were willing to share their experiences did so on a voluntary basis and as a result, there may be a self-selection bias in the response to participate. Another limitation of the study is that we are unable to provide a representative picture of the experiences of all residents with damage to their property in the area.

Our data source does not provide full insight into all characteristics of the homeowners that could be of interest when researching their relationship with their dwelling. Also, other details on socio-demographic variables like attained level of education, income, whether or not originating from the earthquake region, and actual length of residence of the homeowner(s) would have been a useful addition to the analysis and hold possibilities for further research.

The interviewed homeowners still live in the earthquake area and predominantly indicate they intend to stay in their damaged dwelling. Additional research focussing on homeowners of damaged homes that did leave their damaged dwelling or moved out of the earthquake area entirely, would be interesting and valuable. Therefore, further research is needed to understand the personal challenges that people face in a visibly damaged dwelling. The trade-offs that homeowners in their specific household situation make between house attachment, risk perception, prior risk experience, property protection and the decision to stay or leave -if this decision has not been imposed by the government or other authorities-should be further investigated.

5. Conclusions

This paper examined the role house attachment plays in the 'why' and 'how' of staying intentions of homeowners with physically damaged dwellings in a rural risk area with human-induced earthquakes. We therefore explored whether and how the homeowners are attached to their damaged dwellings. The contribution of this paper to existing literature is that our emphasis is on the dimensions of house attachment rather than place attachment of homeowners with damaged dwellings in a rural area due to recurring human-induced earthquakes. To our knowledge, this has not yet been investigated. This study enriches the PPP framework of Scannell and Gifford [25] in the sense that it explores the multidimensionality of house attachment of homeowners and their staying intentions in a situation of visible inside and outside physical damaged dwellings in the context of a rural environment at earthquake risk for years. The results show that the staying of the studied homeowners turned out to be interrelated with their house attachment, even though their dwelling is damaged. Precisely because of the damage to their dwellings, they have become aware of their house attachment. In a threatening situation regarding the house, people are becoming aware of their house attachment and therefore want to stay despite the risks [18,19,32]. Ruiz and Hernandez [43] describe this awareness in the face of disaster, as fear of 'loss of place'.

We have identified five subdimensions of house attachment which make homeowners want to stay. The physical house attachment to the damaged dwelling is related to (1) the family history with the dwelling and its surroundings; (2) the (own) listed or characteristic heritage dwellings; (3) (agricultural) business dwellings; (4) the personal refurbishment after the purchase and/or along with the life stage of its occupants; 'each child its own room'; and (5) social house attachment in relation to other family members or children living at home. We also found that these subdimensions can be interrelated and may enhance each other. For example, house attachment to characteristic or listed dwellings may be closely connected to the family history or because of its physical appearance and representativeness as a business dwelling.

We observe that mid-to-later life homeowners refer to the family history with the dwelling, while some of the younger homeowners emphasize social house attachment in connection with their cohabiting children. This last outcome is in line with Hidalgo and Hernandez [12] who also found that young people score significantly higher on social house attachment compared to mid-to-later life residents. House attachment by means of fusing with the dwelling, referred to as 'embodied place attachment', is also seen in our study among mid-to-later life homeowners [29,67,68]. Precisely the strength of the emotional bond to a house, which may be measured by length of residence, could explain these differences.

In order to retain their house attachment, homeowners want quick measures for damage repairs or the reinforcement of their dwelling. The desire to 'reconstruct the place' as quickly as possible, return to 'everyday life' and regain pride in the home corresponds with the PPP framework of Scannell & Gifford [25].

The interviewed homeowners seem to be action-oriented, angry and frustrated with the authorities about what happened to their dwellings, which is also identified in other research [4,6,9,43]. This action-orientation and struggle to preserve and restore the dwelling in terms of place-protective behaviour is also reflected in the fact that these homeowners are willing to share their narrative in

the newspaper [20,31].

Based on the results of our study we conclude that the homeowners' awareness of house attachment motivates them to stay and cope with their damaged dwelling [18,65,74]. Despite or precisely because of the damage to their dwelling, the awareness of and interaction between the felt physical and social house attachment might clarify the staying intentions of homeowners in a rural, risky area.

We further conclude that the homeowners' decision to stay in a damaged dwelling is a continuous cycle of reconsideration and renegotiation on staying, punctuated by potential new risks and damages influencing house attachment. Staying is a dynamic process: it starts with disaster(s) and risks (earthquakes), leading to a damaged dwelling and then to awareness of house attachment, which motivates the residents to stay. With each new earthquake, the cycle of reconsideration of and renegotiation on staying starts again [70,71].

In the specific case of the Groningen earthquake area, we observe that after several years, damage settlement and compensation is still not smoothly arranged and some residents are forced to stay ('stuckness') [8,72]. External authorities still decide on gas extraction and production, while the accompanying earthquakes, risks and damage for residents continue. Without control, it is difficult for individual homeowners to influence these decisions and anticipate on it regarding the construction and condition of their dwellings.

We may expect that due to climate change more people in the world will have to cope with damage to their dwellings and surroundings in the future. Policymakers in risk areas should pay attention to house attachment when approaching homeowners for damage repair, rebuild or relocation plans. By considering the different subdimensions of house attachment, adaptive measures of private individuals and households can be taken more smoothly [2]. For instance, it could be made easier for young people to stay if they were offered a financial allowance or insurance, as they are more willing or able to manage or repair the damaged dwellings themselves. Mid-to-later life people are more likely to feel powerless, frustrated, and angry with institutions and might be supported with a rebuilding programme organized by the government.

Governments preparing for a possible relocation of homeowners in a rural risk area should be aware that homeowners regarding their house attachment - even those with damaged dwellings - may not be willing to simply leave their homes and surroundings but prefer to stay.

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CRedit authorship contribution statement

Hieke T. van der Kloet: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Validation, Writing - original draft, Writing - review & editing. **Elles A.M. Bulder:** Conceptualization, Formal analysis, Investigation, Methodology, Resources, Supervision, Validation, Writing - review & editing. **Peter D. Groote:** Investigation, Methodology, Supervision, Validation, Writing - review & editing. **Tialda Haartsen:** Conceptualization, Formal analysis, Investigation, Methodology, Resources, Supervision, Validation, Writing - review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix 1

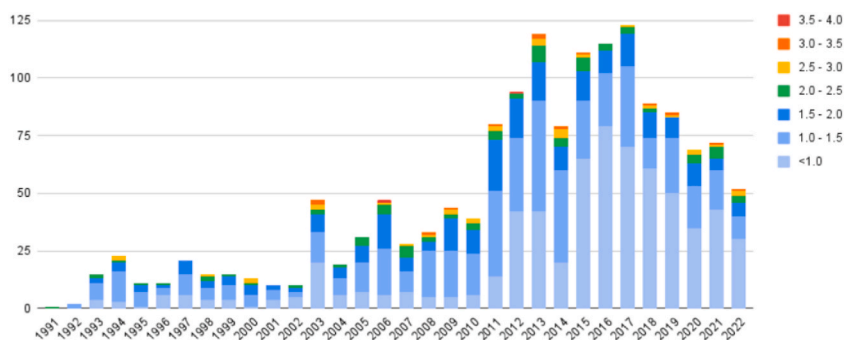


Fig. 1. Annual total number of earthquakes in the Groningen gas field by year and Richter scale category (Source: KNMI, 2023, www.knmi.nl/over-het-knmi/nieuws/jaaroverzicht-aardbevingen-2022 retrieved on September 28, 2023).

Appendix 2. Description of the recognized municipalities concerning the Groningen earthquake region

Initially the 'Value Decrease Scheme' has been applied to homes in the eight recognized earthquake municipalities, namely Appingedam, Bedum, Delfzijl, Eemsum, Loppersum, Slochteren, Ten Boer and Winsum. Afterwards, the municipality of De Marne has been added as the ninth earthquake municipality, just like the municipality of Midden-Groningen (after a merging of the municipalities of Slochteren, Menterwolde and Hoogezand-Sappemeer) and, since 2018, also the municipality of Oldambt (NCG, 2020, Nationaal Coördinator Groningen. Plan van Aanpak, Versterkingsopgave 2020 Gemeente Oldambt).

Appendix 3

Table A.1

Codegroups of subjects found in the interviews by content analysis (2019, N = 92)

Earthquake risk and perception
Description housing history
Age/Mid-to-later life age
Coping strategy
Behaviour/future strategy/perspective
Emotional bonding/family history/birth region or birth house
House attachment/cultural heritage/pride/embodied house attachment
Place attachment
Social/interpersonal attachment
Buying/habitation motives
Originating from
Staying motives
Real estate strategy (damage repair/reinforcement/rebuilding)
Calimero-feeling ('Randstad-city-rural area)
Feelings of insecurity, frustration/powerlessness
Damage description
Damage repair or settelement, negotiation process or procedure
Health problems
Responsibility to children, customers, staff
Strategy of comparing with others
Financial aspects (depreciation in housing value-damage compensation)
Multiple damage
Description of feelings towards gas extraction authorities
Description in (direct) (non)verbal aggression
Description feeling towards government and politics
Description earthquake experience(s)
Residents as experts
Self-direction and self-control
Actions and action readiness
Renovation issues
Feelings of misapprehension/disregard of housing damage
Feelings of fear, concern
Living and housing with earthquakes
Pain to say goodbye to the house
Bureaucracy and Kafka
Description of feelings against the Dutch government/rules of law
Length of residence
(Financially) Stuck

Table A.2

Frequency of reported risk coping by younger and mid-to-later life homeowners to stay in a damaged home in the Groningen earthquake region*. (2019, N = 92)

Reported risk coping to stay in the damaged dwelling	Mid-to-later life Homeowners \geq 50 years (N= 61, (66,3 %))	Younger homeowners <50 years (N= 31, (33,7 %))	Total
Reinforcement (intention to) (Partial) Demolition/New building/Rebuilding (intention to)	33 (67 %)	16 (33 %)	49 (100 %)
Damage recovery (intention to)	40 (68 %)	19 (32 %)	59 (100 %)
Denying situation (mention diverse ways of consciously take a distance to the subject e.g. no communication)	8 (57 %)	6 (43 %)	14 (100 %)
Blaming government/politics/legal system and other institutions or companies involved in the gas extraction (distrust)	38 (75 %)	13 (25 %)	51 (100 %)
Seeking information/becoming, being or engaging an expert	28 (70 %)	12 (30 %)	40 (100 %)
Self-management or self (co-)repair of damage	16 (57 %)	12 (43 %)	28 (100 %)
Becoming physically or mentally sick, tired, angry, aggressive, or frustrated	23 (74 %)	8 (26 %)	31 (100 %)
Stuck (financially, despair or due to combination of residential and business property)	14 (82 %)	3 (18 %)	17 (100 %)

(continued on next page)

Table A.2 (continued)

Reported risk coping to stay in the damaged dwelling	Mid-to-later life Homeowners ≥ 50 years (N= 61, (66,3 %))	Younger homeowners <50 years (N= 31, (33,7 %))	Total
Future perspective (positivity)	5 (50 %)	5 (50 %)	10 (100 %)
Action strategy (Incite action, self acting, protest, keep fighting, combative, willingness to take action)	26 (77 %)	8 (23 %)	34 (100 %)

(* respondents might have mentioned more strategies).

Table A.3

Staying or moving of interviewed homeowners with a damaged home in the Groningen earthquake region (2019, N = 92).

	Mid-to-later life homeowners ≥ 50 years (n = 61)	Younger homeowners <50 years (n = 31)	Total
I. Staying (on the same site)	52 (85 %)	29 (94 %)	81 (88 %)
II. Self-reported intention to move elsewhere	8 (13 %)	2 (6 %)	10 (11 %)
III. Move elsewhere	1 (2 %)	0 (0 %)	1 (1 %)
Total	61 (100 %)	31 (100 %)	92 (100 %)

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