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What do people think? Inhabitants' perception of reconstruction in Chilean historic areas affected by earthquakes

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Abstract

Chile has earthquakes on a regular basis. Despite the regularity of earthquakes in Chile, recovery and reconstruction processes are not properly institutionalized. There is no governmental institution evaluating previous reconstruction experiences, at least not at the level of the user. This paper investigates the perception that heritage areas' inhabitants have of their living environments, and how this is reflected at the architectural scale of reconstruction projects. In order to do this, the study analyses the results of a questionnaire used to canvas opinions after the earthquakes that affected those areas, and where applicable, views about the quality of reconstructed and repaired houses. This was part of the fieldwork of the author's current PhD research, which also included the 3D laser scanning and photographic recording of the buildings. Three case studies are presented: *San Lorenzo de Tarapacá*, affected by the 2005 earthquake and already 'reconstructed'; *Zúñiga*, affected by the 2010 earthquake but not intervened by the time of the survey (January 2013); and *Lolol* also affected by the same earthquake, but where reconstruction was an ongoing process. What are the inhabitants' opinions about the reconstruction process? What elements present and missing in the new houses that can link them to their characteristic historic past? The results show that the moment to evaluate the reconstruction process has a direct link on some of the answers; that interior available space of dwellings has been significantly reduced by the effects of earthquakes and reconstructions; that people value their heritage constructions and like traditional architectural elements on the new houses, but only when they make sense to their living habits and improve dwelling's quality and performance. These observations can be relevant to inform an alternative design approach – currently under development in author's PhD research¹ and to inform public policies for housing re-construction in heritage areas.

Keywords: earthquakes, Chile, reconstruction, heritage perception, evaluation.

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Introduction

Earthquakes in Chile are a common experience for the population. According to Madariaga (1998), every ten years an earthquake above eight in magnitude is expected in a different area of the country. Building codes have led to the safer behaviour of constructions in response to earthquakes, especially in urban areas, and have reduced significantly the number of fatalities. However, strong earthquakes continue to cause large scale destruction of the built environment.

The state response after earthquakes in Chile varies in each time, ranging from how the reconstruction is funded up to the authorities in charge. No institutionalised evaluation process is being done about the recipients of a reconstructed or repaired dwelling, which seems to be left to academia, whereas the official reconstruction is measured only in a quantitative way, led mainly by politicians' short term goals. Therefore, this paper will look into the social dimension of the reconstruction from the perspective of the inhabitants in some heritage areas, which are amidst the most vulnerable zones to earthquakes. This is due mainly to the age of its buildings, lack of maintenance and accumulated damage over the years, yet where history and culture are merged together by the use of vernacular building techniques and passive sustainable designs. Housing typologies represent a specific way of living as inhabitants identify with their neighbourhood because of its built heritage. However, state reconstruction approaches for these areas in the past ten years have failed to recover the social identity of such places, offering only a material solution to housing problems with a 'traditional' design –a superficial way of understanding heritage.

The focus is set on the reconstruction carried out by the Ministry of Housing and Urban Development of Chile after the 2005 and the 2010 earthquakes. In both cases, the reconstruction was funded using housing subsidies, which objective is to give access to dwelling to vulnerable population in regular situations. It is a social mechanism that was adapted for the reconstruction to be applied in different cases after earthquakes, i.e. heritage areas (MINVU 2011), but it has not been designed for that purpose, which generates a series of issues, such as difficulty of accessing the benefit in times of emergency. This problem persists in heritage areas, even when exceptions are usually set up for these zones as an attempt to recover as much as possible. After the 2005 earthquake, only subsidies for the construction of new dwellings were possible to use. After the 2010 earthquake, an option only for heritage areas was created, where the amount of funding defined for a new house could be also used to repair the dwelling if applicable. This meant that several damaged houses were repaired using reconstruction subsidies in heritage areas. All of the cases to be presented here have been designated as *Typical Zones*, which is a category assigned by the Council of National Monuments of Chile that recognizes the historical and cultural values of that area, and acts as a regulatory framework for the buildings inside it. In practical terms, that institution regulates demolition, repair and construction, thus sometimes it can be seen as an obstacle rather than a protection by the inhabitants (Devilat 2013).

Questionnaires and Case Studies



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The questionnaires carried out in the three case studies was the first time that someone asked the inhabitants about their thoughts on the repair and reconstruction process, or at least that was what they said.² Because of that, they were keen in collaborating with the answers, even though they were aware that the objective of this study was mainly academic.³ Indeed, only two persons refused to answer the questionnaire from a total of 84. Questionnaires were carried out as much as possible, but only two days per case were defined to do that task, thus it was not possible to get to all of the houses within the heritage area. In addition, some of them were abandoned or closed; others had nobody available during the fieldwork; and others were being under repair or construction, so without inhabitants. However, as in any work of this type, as the questionnaires were done randomly, they are representative sample of the total.

Zúñiga is a heritage village located in central Chile. Its houses grew around a chapel built in 1765 by the priest *Antonio de Zúñiga*. The dwellings have been built using adobe⁴ in the configuration of continuous façade (Council of National Monuments, 2010). Despite the 8.8 magnitude of the 2010 earthquake that affected the area, houses were not severely damaged but were in need of reinforcement. Inhabitants were still occupying their dwellings despite the potential danger in forthcoming quakes as no repairs or reconstruction had been undertaken at the time of the survey (January 2013). The main reconstruction approach in this area was to repair some of the affected houses, process that was due to end at the beginning of 2015. In this case, 34 questionnaires were carried out.

San Lorenzo de Tarapacá is a vernacular settlement located in the north of Chile, composed mainly of dwellings that have been built using traditional building techniques such as adobe and quincha⁵ around the main square and church, dating from the 18th century. An earthquake of 7.9 affected this village in June 2005. The governmental reconstruction following the earthquake only considered the construction of new dwellings that replicated 'traditional' houses, not the reinforcement or retrofit of reparable buildings. Because of that, a number of abandoned and ruined constructions were recorded in the fieldwork done in 2013. This village represents the 'finished' reconstruction case, as the governmental reconstruction after the 2005 earthquake seemed to be ended by then and it is unlikely that any other interventions related to that process will be carried out on that area, as a number of other disasters in different areas of the country

² The author would like to thank to all the residents that collaborated to this study by answering the questionnaire and those who gave her additional insights too.

³ Even though this study might help to inform future reconstruction policies in Chile, only the academic aim was mentioned to the people that participated, in order not to raise their expectations.

⁴ Adobe is a type of masonry made of mud and straw bricks, which are sun dried, obtaining usually thick walls of about 50 to 80 cm. In the best cases, it is built using timber reinforcements.

⁵ Quincha is a wood panel structure that is filled with cane as vertical elements and clay, reaching usually 10 to 15 cm. of thickness.

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had deviated the attention of authorities during recent years, even another earthquake occurred in the region in 2014. In this case, 26 questionnaires were carried out.

Finally, *Lolol* is an area located in the centre of Chile. Its houses are built as continuous facades, but are also characterized by having continuous porticos, which generate a particular spatiality to the public space. The 2010 earthquake also affected this heritage village, but here the reconstruction was in progress when the fieldwork was carried out in 2013. By that time, *Lolol* was the most advanced in the reconstruction process of all affected Chilean historic zones, and was in turn used by the Government as an example to show the progress of the Heritage Reconstruction Programme created in 2010.

In *Zúñiga*, the questionnaire was composed of: condition of the inhabitant (owner, tenant, other); number of years living in the same house or village; profession or activity of the householder; if the house is an old or a new construction; main materiality of the dwelling; number of adults and kids living there; perception of the inhabitants about the denomination of *Typical Zone* and whether it has had a direct benefit for them; space available in their dwelling before and after the earthquake; whether they would prefer to live in an old retrofitted house or a new one; and finally whether they think their house have a higher monetary value because of being part of a *Typical Zone*. (Fig. 1- graphics on the left hand side)

In *San Lorenzo de Tarapacá* and *Lolol*, where reconstruction was already done and in progress respectively, the following questions were added: Is now the village similar to what it used to be after the reconstruction? Do you think it is looking better or worse? Finally, in case they were beneficiaries of the reconstruction subsidy, a couple more questions were added: where was the reconstructed house built; if it has a good or bad quality or thermal behaviour; and if they liked some of the 'characteristic' architectural features in them. (Fig. 1-graphics on the right hand side)

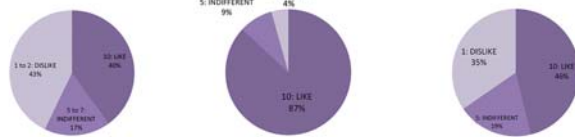
There are some similar answers in all the three cases. Most of the houses are old, or built before the largest earthquake that affected the area, where the predominant building material is adobe. In *Zúñiga* and *Lolol*, the largest earthquake before the 2010 one was in 1985, which had a magnitude of 8.0 Mw in Richter scale. In *San Lorenzo de Tarapacá*, the largest earthquake before the 2005 one was in 1987, which had a magnitude of 7.2 Mw in Richter scale. Any house built before that was considered 'old' for the survey. The lowest number of old houses was in *Zúñiga*, with only 47% of old dwellings and 43% built with adobe.

Most of these houses are owned by their inhabitants or have been given to them by inheritance. This is an important point for the reconstruction subsidies, as this is a requirement to apply to the benefit. If the dwelling was rented by the time of the earthquake, the affected construction may not be eligible for a subsidy, because it depends on the owner, not the tenant. The lowest ownership rate is in *Zúñiga*, corresponding to 56%. In this last case, tenancy is significant with a 19%, which is almost inexistent in the other two cases. This may be related to the fact that *Zúñiga*

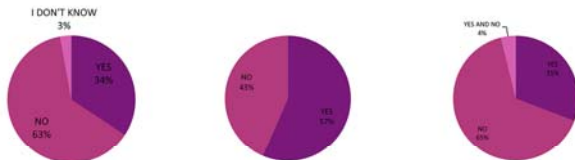
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Perception of inhabitants about the denomination of Typical Zone



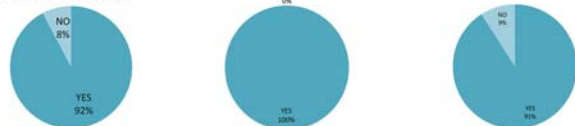
Do you have any benefits because of living within a 'Typical Zone'?



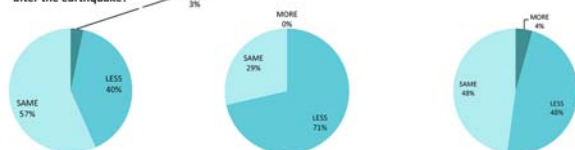
Which ones? (If answered yes)



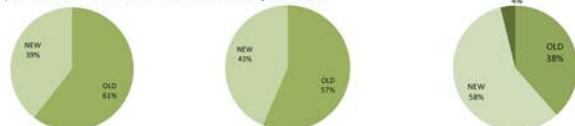
Did you have enough space to live before the earthquake?



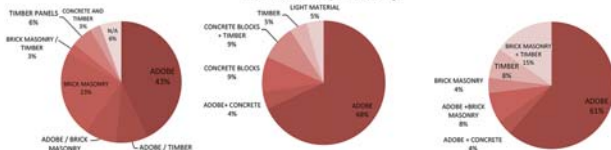
Do you have enough space after the earthquake?



If you have the choice, would you prefer living in a new construction, even when it implies less space? Or in an old retrofitted house? Both would be earthquake resistant



Main materiality of dwellings



FINISHED AND IN PROGRESS RECONSTRUCTION

San Lorenzo de Tarapacá Lolol

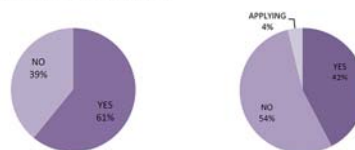
Do you think that the village returned to what it used to be before the earthquake with the reconstruction?



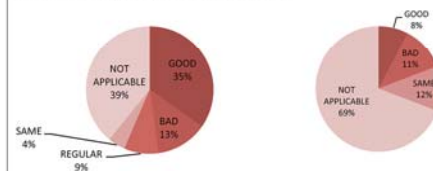
Do you think the village is looking better or worse?



Have you been a beneficiary of one of the subsidies for the reconstruction?



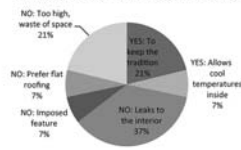
What do you think about the ambiental quality of the new house, is it better or worse than the previous one?



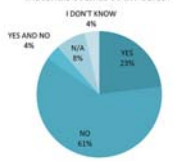
Do you like that new houses have the gable roofing?



Why do you prefer or not the gable roofing?



Do you like that new houses have porticos?



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Figure 1: Main questions asked to the inhabitants of the three case studies in January 2013.



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was the latest case study on obtaining the denomination of *Typical Zone*, thus permission for building and intervening in the area only started in 2005 –the year of its declaration (Council of National Monuments, 2010). Also, *Zúñiga* is the closest village to the capital of the country – *Santiago*, so there is a real state market for building and renting dwellings –both for living and for leisure–, which has produced several new constructions on the village and a more dynamic flux of properties than in the other two cases. Indeed, half of the interviewed had been living in *Zúñiga* for less than twenty years, while this category does not exceed the 25% in the other two cases.⁶

An important common characteristic is that inhabitants considered that they had enough space to live before the earthquake affected each area, which changed after it. The most radical change occurred in *San Lorenzo de Tarapacá*, where all the participants considered that they used to have enough space to live before the earthquake, but only 29% continue with that opinion when referring to the situation after the earthquake –and after the reconstruction– and 71% considered that they have less space. This is because in that case, the reconstructed houses have 33m² of interior space whereas previous dwellings used to have between 120 m² and 150m² in average before the 2005 earthquake, and no retrofitting strategy was put in place back then.

The moment of the evaluation is extremely relevant, because it seems to determine some answers. For example, both *Zúñiga* and *Lolol* were designated *Typical Zones* within recent years –2005 and 2005 respectively– process that should have the approval of their inhabitants. However, as mentioned in previous studies (Devilat 2013), earthquake's destruction changes this approval, as people has to face permissions and bureaucracy to repair and build, thus producing that the majority would dislike the denomination of *Typical Zone*. Indeed, in *Zúñiga* and *Lolol*, the dislike percentage rises up to 43% and 35% respectively, especially because in *Zúñiga* by the time of the survey no works had begun yet –three years after the earthquake–. This point can be reinforced with the question about the benefits of being part of a *Typical Zone*. In these two cases the majority of the inhabitants cannot identify any benefits of being part of it, in opposition to the answers obtained in *San Lorenzo de Tarapacá* where the reconstruction process was finished. From the third of the inhabitants of *Zúñiga* and *Lolol* that were able to identify some benefits, it is possible to extrapolate that the time of the survey also affected their answers, because in *Lolol* –the only heritage area under reconstruction when the questionnaire was carried out– 55% of the people identified the subsidies as the main benefit, whereas in *Zúñiga* (with no reconstruction yet) and in *San Lorenzo de Tarapacá* (with a finished reconstruction) subsidies are only identified as a benefit by 14% and 7% respectively.

Related to these last two points, retrofitting a damaged house is cheaper than building a new one from scratch when the funding tool is the reconstruction subsidy, as the same amount of money

⁶ Another interesting common aspect is the occupation of the person who supports the family, which in all cases is not only related to farming but where other activities are predominant, which is a shift in the economy of these places since their foundation.



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was defined for both scenarios in heritage areas. Because of this, more interior space can be recovered by repairing than building. The minimum space required to comply with subsidies regulations is 50 m², with specific measurements per room, whereas up to 100 m² was possible to obtain if the dwelling is retrofitted.⁷ This is why in the questionnaires people were asked whether they would prefer living in a new or an old retrofitted construction, both earthquake resistant, considering the new one would imply having less space than before. The answers were divided, although a higher percentage in favour of old retrofitted dwellings was identified in *Zúñiga* and *San Lorenzo de Tarapacá*. It is interesting than in *Lolol*, actually the only place where retrofitting was carried out by the time of survey, had only 38% of approval for that choice, whereas neither *Zúñiga* nor *San Lorenzo de Tarapacá* had have any retrofitting strategy as part of governmental reconstruction yet by then.

In relation to the inclusion of 'traditional' architectural elements in the reconstructed houses, such as the gable roofing in *San Lorenzo de Tarapacá* or the porticos in *Lolol*, most of the inhabitants are in favour of them, reaching a stunning 100% in favour of the porticos in *Lolol*. However, when these elements are not that 'traditional' or even useful, such as the gable roofing in *San Lorenzo de Tarapacá* –characteristic of only 6% of dwellings before the 2005 earthquake–, the opinions are divided. 60% were in favour of them for the new dwellings, but several people complaint that this type of roof was 'a waste of space' (21%) and that 'it leaked to the interior' (37%). This can also be seen in the answers about whether the village was returning to what it used to be before the earthquake, where 83% of *San Lorenzo de Tarapacá*'s inhabitants said that it has not and the majority of them think it is actually looking worse than before. On the contrary, in *Lolol*, 77% of inhabitants said that the village is returning to what it was, and also half of them think that it is even looking better than the earthquake.

Conclusions

The results show that the moment to evaluate the reconstruction process has a direct link on some of the answers. Then, the best time to carry out an evaluation of the reconstruction process should be after the process has ended and after beneficiaries have spent a time inhabiting the new dwellings. Thus, the most reliable data of the three presented in this study is *San Lorenzo de Tarapacá*, as people were not expecting anything else and were honest with their answers because they knew they would not imply any change in the process.

It is possible to say that people value their heritage constructions, although they do not like when regulations, styles and building techniques are imposed to them. This is because even when they are divided in opinions about whether they like or not the denomination of *Typical Zone*, most of

⁷ The author has obtained this information after working at the Heritage Reconstruction programme of the Ministry of Housing and Urban Development from 2010 to 2011.

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them would prefer living in an old retrofitted house rather than a new one, and because they agree with traditional architectural elements that they consider part of their identity.

There is a strong need to improve new buildings' design and performance in the reconstruction process. For these new dwellings, the challenge is still to improve the thermal performance and sustainability, so they can be as good as the old houses used to be. In addition, to recover the amount of interior available space of existing constructions is also an important aspect to have in mind for future design strategies. Although this is strongly related with the budget available, alternatives such as progressive construction can help.

Finally, the role of evaluation for the design of future reconstruction projects and programmes is key. This information is needed in order not to repeat the problems that have been identified and to improve strategies in such a way that they can trigger additional resources and improve inhabitant's participation. Evaluation –considering correct timing and inhabitants inclusion– should be an integral part of future Chilean reconstruction programmes.

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Author's Biography



Bernadette Devilat is a trained Architect and MArch from the Pontifical Catholic University of Chile. She has been studying reconstruction after earthquakes in Chilean heritage areas since the 2005 earthquake, when she co-founded Tarapacá Project. She taught Architectural Design at that university from 2009 to 2010 and worked subsequently in the re-construction process after the 2010 earthquake at the Ministry of Housing and Urban Development of Chile. She is currently a PhD candidate at The Bartlett School of Architecture, University College London.