

YUNGAY: RECENT TENDENCIES AND SPATIAL PERCEPTIONS
IN AN ANDEAN RISK ZONE*

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ABSTRACT

The following paper focuses on the question, how Andean urban risk zones are urbanized and perceived various years after a disaster. The mortal 1970 debris avalanche from Mount Huascarán buried 5,000 inhabitants in the Peruvian town of Yungay. Four decades later, 9,500 people are living again in the risk zone beside the Yungay memorial. It is shown, that the dangers, produced by the Mount Huascarán, are still perceived. On the other hand, the perception of Yungay's exposure to risk is dramatically decreasing.

Key words: Andean risks zones, Yungay, spatial perception, disaster.

Yungay: tendencias recientes y percepciones espaciales en una zona andina de riesgo

RESUMEN

El siguiente artículo se centra en la reurbanización y percepción de las zonas andinas de riesgo, varios años después de ocurrido un desastre. En 1970, la ciudad peruana de Yungay fue destruida a causa de una avalancha de hielo, nieve y rocas que se desprendió del nevado Huascarán. Murieron 5000 personas, es decir el 95 por ciento de la población urbana. Cuatro décadas después, la zona es habitada por 9500 yungaínos. Se muestra que los peligros que origina el nevado Huascarán todavía se perciben. De otro lado, la percepción de riesgo de la ciudad de Yungay, debido a su ubicación, está disminuyendo dramáticamente en su población.

Palabras clave: zonas andinas de riesgo, Yungay, percepción espacial, desastre.

* This paper is based on research conducted between April 2009 and September 2010 regarding the unpublished master's thesis *Siedlungsdruck und Umweltwahrnehmung in andinen Risikozonen* (Urbanization pressure and environmental perception in Andean risk zones).

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1. INTRODUCTION AND POST-DISASTER SETTLEMENT GENESIS

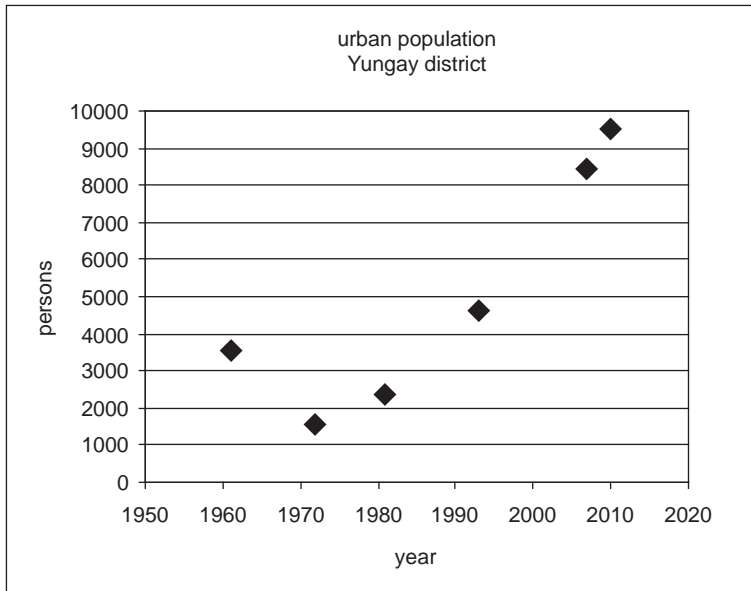
Yungay is a small city of estimated 9,500 inhabitants in the Andes of the Peruvian Ancash region. The provincial capital's central place is situated at 9° 8' 20" southern latitude and 77° 44' 40" western longitude, 2,500 meters above sea level, near the Mount Huascarán glacier. According to Klimeš, Vilímek and Omelka (2009; see also Vilímek, Luyo Zapata and Stemberk 2000) the core-settlement, lying on the orographic right side of the Rio Santa valley, is constructed above prehistoric debris-avalanche depositions from Mount Huascarán. The city's geological position is characterized by the Cordillera Blanca fault, a zone of high tectonic activity (Dalmayrac and Molnar 1981: 474). Due to its situation between the biogeographic regions of *yunga* and *quechua* (Pulgar Vidal 1946), Yungay offers great agricultural opportunities (beneficial climate, fertile soils, sufficient precipitation or glacial meltwater) in its rural surroundings.

On May 31, 1970, an earthquake with a magnitude of 7,7 on the Richter scale (Erickson and Fernández 1970: 4) caused a debris avalanche from Mount Huascarán. The mass movement, consisting of snow, ice and rocks, buried the city of Yungay and killed its 5000 inhabitants. Just a few 300 survived (Evans et al. 2009: 115). As reported by Oliver-Smith and Goldman (1988: 110), first aid programs (e.g. providing food, shelter and health services) attracted earthquake affected rural migrants, which together with the few survivors of the Mount Huascarán debris-avalanche resisted the central government's intention of urban relocation to the 15 kilometers far away Tinguá. After having suffered the natural hazard, people interpreted the relocation plans as another top-down attack (Carey 2008: 233-234). The province's rural population supported the urban resistance to resettlement, as for many peasants the proposed new site seemed inappropriate to function as a central market place because of its remoteness. Hence, the governmental actors yielded to the local inhabitants' pressure, and the settlement was reconstructed just 1500 meters away from the buried city's *plaza mayor*, in a supposed safer zone (Oliver-Smith 1979: 48). New Yungay recovered rapidly, functioning as central place of the entire province. Basic services like schools, a hospital, the church and most of all, the market place, acted as pull factors for more and more rural migrants. A rapid population growth was initiated (see Figure 1).

During the last decades, Yungay's urban area has expanded significantly, incorporating parts of the 1970 debris-avalanche depositions in 2009. In 2007 the city had a population of approximately 8,500 (INEI 2007: s. p.). If the average annual population growth rate for 1993-2007 is presumed for 2007-2010, an actual population of 9,500 could be estimated using the equation $P_{t+n} = P_t * (1+r)^n$. The variable P_t stands for the population number at a definite time, n refers to an additional period of time, and r denominates the growth rate.

Acknowledging the prehistoric debris-avalanche demonstrated by Klimeš, Vilímek and Omelka (2009), nearly the entire urban population is exposed to the risk of debris-avalanche hazards.

Figure 1. Urban population development in the Yungay district



Source: INEI 1961-2007 and own projection 2010

2. RESEARCH INTEREST AND METHODOLOGY

According to Knopp and Bruder (1982; see also Córdova Aguilar 1997: 17-20; 2002: 25), environmental perception takes an important role in land-use decision making. In order to manage disaster risk of urban populations, it seems necessary to take into account the different spatial cognitions. Otherwise, the experts' space could significantly differ from the territory perceived by the pretended persons at risk. As a result, two principal questions guided the research process. First, what are the recent tendencies of settlement dynamics and which perceptions induce them? Second, are there different environmental perceptions between the survivor generation and the younger Yungay population? Does gender matter?

To answer the first question, settlement mapping based on aerial images (from 1996) and high resolution satellite images (from 2003) was applied. Regarding to the second question, a standardized questionnaire was designed. Using semantic differentials, the population's perceptions of Yungay and the Mount Huascarán could be determined. Additionally, participatory mapping allowed analyzing the perceived exposure of Yungay, regarding to mass movements. Due to three reasons, non-random quota sampling was preferred for interviewee selection:

- The population's number and relevant structure (gender, age groups) are known.
- There is no complete list of all possible interviewees, needed for random sampling.
- Quota sampling is cost extensive, practice oriented and empirically provides satisfying results (Noelle-Neumann and Petersen 2005: 258-263).

It was supposed that children do not make location decisions, hence interviewees elder than 14 were interviewed. Certain insecurity was related to Quechua speakers without any Spanish knowledge. Census data did not provide information about them, as only the mother tongue is ascertained. All interviews were held in Spanish. Thus, if the latter monolingual group existed, they have not been included in the following results. Finally, the quota plan based on 2007 census data, read as follows:

- 60 percent of informants within the age group of 15-39 years (born after the 1970 disaster),
- 40 percent elder than 39 years,
- 50 percent male and female in each group.

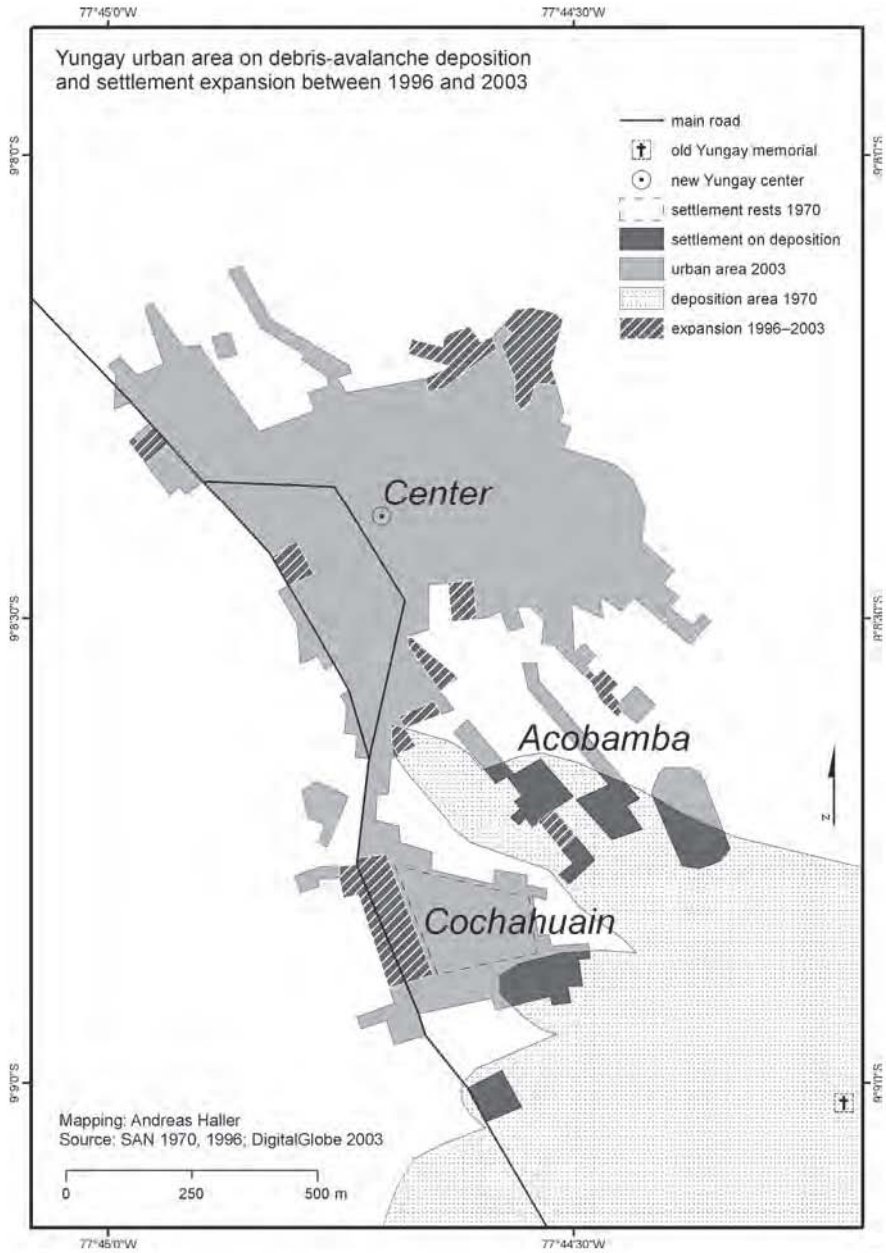
3. RECENT STRUCTURES AND RISK-ZONE PERCEPTION

New urbanizations between 1996 and 2003 have been built all around the city, with certain focus on the southern urban margin. Rests of the old town (named Cochahuain), which escaped the destructive 1970 mass movement, are actually functioning as a connection point between the new center and the unused areas around the memorial. The mapping results (see Figure 2) show the settlement expansion along few lanes of the Acobamba (Quechua for «sandy field») sector, which connect the Yungay memorial and the actual center. Significant parts of the reconstructed town are situated on the 1970 debris-avalanche deposition. Acobamba's consolidation as well as Cochahuain's expansion is expected to increase significantly within the following years.

Calculations carried out by the National Institute of Civil Defence (Indeci 2005: 190) indicate a medium and high vulnerability level for the mentioned areas of Acobamba and Cochahuain. If it is assumed that the population density of the Acobamba and Cochahuain zone (51 inhabitants per hectare) can climb the urban center's density level (101 inhabitants per hectare), the population of the mentioned areas would reach 2,700 persons. Hence, the damage potential could be reduplicated.

Even the central government seems to have driven this tendency, as a national school («Santo Domingo de Guzmán») has been built clearly within the 1970 debris-avalanche deposition zone (see Figure 3). This authority behaviour possibly conveys the impression of a secure, protected location.

Figure 2. Yungay urban area on debris-avalanche deposition and settlement expansion 1996-2003



(Source: A. Haller)

Mental mapping, also known as cognitive mapping, represents a powerful participatory method for analysing human perceptions of geographic space. On a prepared map of the Yungay and Mount Huascarán area (including location symbols for Yungay, Campo santo and Ranrahirca, road and river signatures), interviewees had to delimit the potential affected area in the case of a repeated mass movement from Mount Huascarán. Afterwards, the Yungay symbol's topology was compared with the potential hazard zones mapped. The result reads as follows (see Figure 4): about 22 percent of the elder informants (more than 39 years) did not include Yungay into their potential hazard zone (75 percent of them were female), whereas three quarters recognized the given damage potential of Yungay. Within the mentioned group a clear gender difference can be attested. In regard to the younger interviewees (15 to 39 years), the number of cases which did not include Yungay into the perceived hazard zone was reduplicated (45 percent). At the same time, the gender difference almost disappeared. From this point of view, it is interesting to determine the younger group's semantic space of Yungay and Mount Huascarán. Is the decreased exposure perception of Yungay accompanied by a decreasing hazard perception regarding Peru's highest mountain?

Figure 3. National school constructed on debris-avalanche depositions



(Source: A. Haller)

Figure 4. Topology analysis of mental mapping results; n=47

	Topology		Total
	Inside hazard zone	Outside hazard zone	
Male	18	6	24
Female	12	11	23
Total	30	17	47
15 to 39 years	16	5 (male) + 8 (female)	29
Over 39 years	14	1 (male) + 3 (female)	18
Total	30	17	47

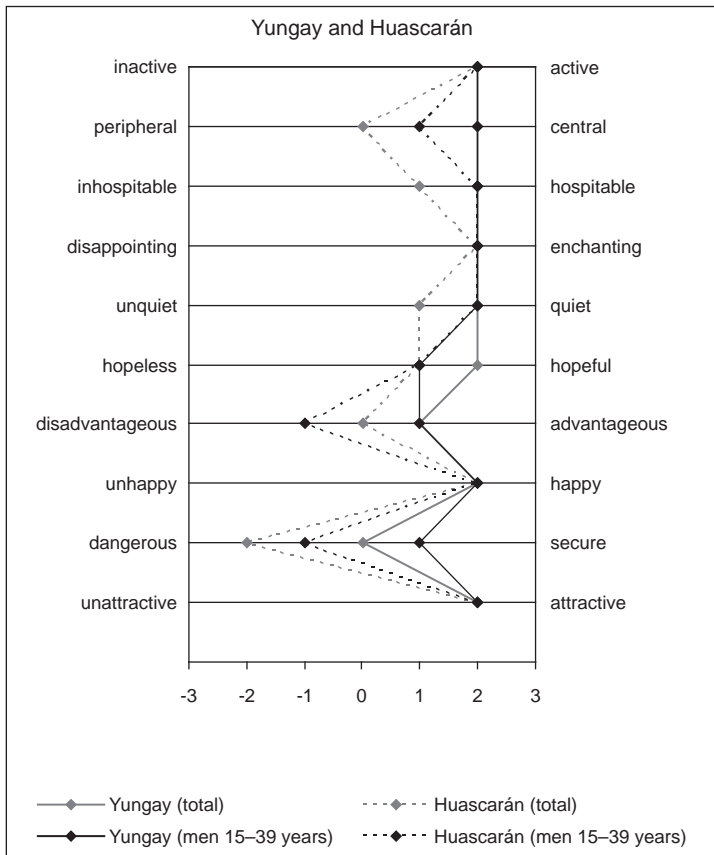
(Source: A. Haller)

Figure 5. Rock from Mount Huascarán as part of the enclosure



(Source: A. Haller)

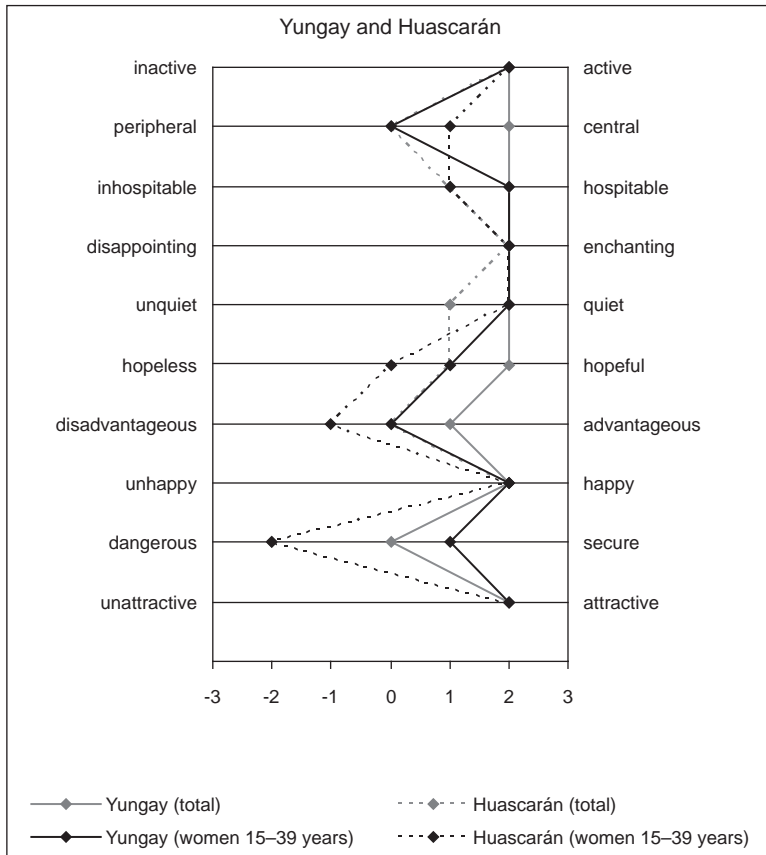
Figure 6. Semantic space of Yungay and Huascarán by 15-39 year old men; n=47



(Source: A. Haller)

If both results, from mental mapping as well as from semantic differential analysis, are put into context, the following interpretation regarding the risk-zone perception can be given: While participatory mapping by two different age groups (15 to 39 years, more than 39 years) indicate a general risk-perception decrease regarding the location of Yungay, the more detailed view on the younger group provides a more differentiated outcome. It shows that Mount Huascarán is already seen as a potential source of hazards! Although the areas of risk are resettled again (Cochahuain, Acobamba), as settlers perceive Yungay as a resistant commercial and agricultural village. In summary it is necessary to distinguish the perception of the potential sources of hazard and the possible objects of damage—a fact that have to be considered in land-use planning and local development strategies, if vulnerability reduction concerning natural hazards is seen as a principal goal.

Figure 7. Semantic space of Yungay and Huascarán by 15-39 year old women; n=47



(Source: A. Haller)

4. DISCUSSION

Yungay has recovered rapidly from the 1970 hazard—it is the central place of an entire province, and in part it even possesses regional importance (e. g. as center for northern Peru’s police education or as site of Peru’s unique mountain rescue entity). As shown, the new Yungay settlement area is actually expanding on deposits of the 1970 debris avalanche. This tendency is partially driven by governmental actors, which allow the colonisation and even construct schools in the mentioned risk zone. The more people are living on the 1970 deposits, the safer the area seems to be perceived. Spatial perceptions of the Yungay and Huascarán zone are diverse—especially in the case of people born after the 1970 event. The mentioned group has never personally experienced damages like the 1970 disaster—nevertheless the hazard potential is well

known. However, living in the risk zone is perceived as a possible strategy to overcome poverty (e. g. lacks of nutrition, education or income) by the local population.

The present findings suggest that settlement activities in the hazard zone are not a result of an absence of knowledge regarding potential natural hazards from Mount Huascarán. It is rather a consequence of perceived inconsistent experts' and authorities' opinions on the one hand, and basic needs that can be fulfilled by inhabiting exposed areas on the other hand.

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