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## **When factors of risk perception are an obstacle to risk representation: earthquakes in Southern France**

## **Quand les facteurs de perception d'un risque constituent un obstacle à la représentation de ce même risque : le risque sismique dans le sud de la France**

Chesterman, A.\*, Lopez, A.\*\* , Rateau, P.\*\*\*, Weiss, K.\*\*\*

\* CRP-CPO Laboratory (E.A. 7273), Picardie Jules Verne University (France)

\*\* Laboratory of Social Psychology (E.A. 849), Aix-Marseille University (France)

\*\*\* CHROME Laboratory (E.A. 7352), Nîmes University (France)

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## **Abstract**

### Introduction

More and more, researchers are turning to social representations to explore social thinking about risks, but this may not always be the best option. In particular, low to moderate risks possess inherent characteristics that can potentially constitute an obstacle to sociorepresentational processes, such as translating as “zero risk” in the eyes of the general public.

### Objective

With this in mind, we conducted a study on the social representation of earthquakes in Southern France in order to better understand if low to moderate risks can be objects of social representation.

### Method

After first exploring data available in the region on risk perception in relation to factors that condition the emergence of a social representation, we analysed the structure of the social representation of earthquakes in Southern France among earthquake-exposed inhabitants ( $N = 94$ ), using three methods designed within the structural approach: prototypical analysis, similitude analysis and the Test of Context Independence.

### Results

We identified an essentially descriptive representation with no practical orientation, leading us to discuss social representations in relation to collective representations.

### Conclusion

We propose a clearer distinction between the two as well as arguments in favour of a standardised technique for verifying the existence of a social representation. We then attempt to situate both concepts within the Architecture of Social Thought model.

Key words: Social representation, collective representation, earthquakes, social thinking, risk perception

## **Résumé**

### **Introduction**

De plus en plus, les chercheurs se tournent vers les représentations sociales pour explorer la pensée sociale à propos des risques, mais ce n'est pas toujours forcément la meilleure option. En particulier, les risques faibles à modérés possèdent des caractéristiques inhérentes qui peuvent potentiellement constituer un obstacle aux processus socioreprésentationnels, comme par exemple se traduire par « risque zéro » aux yeux du grand public.

### **Objectif**

Sur la base de ces considérations, nous avons conduit une étude sur la représentation sociale des séismes dans le sud de la France, dans le but de mieux comprendre si les risques faibles à modérés peuvent être objets de représentation sociale.

### **Méthode**

Après avoir exploré des données disponibles dans la région en lien avec les conditions d'émergence d'une représentation sociale, nous avons analysé la structure de la représentation sociale des tremblements de terre dans le sud de la France auprès d'habitants de zones sismiques ( $N = 94$ ), et cela à l'aide de trois méthodes développées dans le cadre de l'approche structurale : l'analyse prototypique, l'analyse de similitude et le test d'indépendance au contexte.

### **Résultats**

Nous avons identifié une représentation essentiellement descriptive, sans aucune orientation pratique, ce qui nous mène à questionner les représentations sociales en relation avec les représentations collectives.

### **Conclusion**

Nous proposons une distinction plus claire entre ces deux concepts, en essayant de les situer dans le modèle de l'architecture de la pensée sociale.

Mots clés : représentation sociale ; représentation collective, tremblement de terre, pensée sociale, perception des risques

## **1. Introduction**

Certain areas of Metropolitan France are exposed to earthquake risk, not least of which is the Provence-Alpes-Côte d'Azur (PACA) region. In 1909, for example, a 6.2<sup>1</sup> magnitude earthquake hit the small town of Lambesc, killing nearly 50 people, injuring hundreds more and leaving many homeless. Several villages were partially or completely destroyed, making it one of the most destructive earthquakes ever to hit Metropolitan France. Of course, compared to other countries and even some French islands (such as Martinique or Guadeloupe), seismic activity in Metropolitan France is moderate, but preparedness is no less essential in these areas given that earthquakes are unpredictable (Geller, Jackson, Kagan & Mulargia, 1997). Even though low to moderate risks are less dangerous than high risks, they do bring about various psychosocial factors that can blur risk perception, hinder mitigation and hence increase vulnerability.

For example, low to moderate earthquake risk can translate as “no risk” in the eyes of the general public (McClure, Johnston, Henrich, Milfont & Becker, 2015), meaning that the terms used objectively by experts are interpreted subjectively and negatively impact preparedness. Indeed, why would individuals prepare for a hazard if they doubt its very existence? Similarly, low impact tremors, far more common than destructive earthquakes in low to moderate seismic areas, can induce a false sense of security and convince at-risk populations that they are not in danger (Becker, Paton, Johnston & Ronan, 2013; Mileti & O'Brien, 1993). Moreover, perceptible, damaging earthquakes are rare, implying a lack of practice, which in turn hinders preparation (Beck, André-Povaud, Paule-Annick, Chardonnel & Lutoff, 2012).

In light of these observations, we conducted a study to determine if the specificities of low to moderate seismic areas can influence the emergence of a social representation of earthquakes. After exploring available data on the perception of earthquakes in Southern France, particularly in relation to the indicators of a social representation of earthquakes, we conducted a structural study on the social representation of earthquakes in the PACA region.

## **2. Theory**

In general, understanding and favouring hazard preparation necessarily implies exploring how the hazard in question is perceived (Slovic, 1987). Indeed, risk perception has been linked to preparation in several studies on numerous risks (e.g. McClure, Walkey & Allen, 1999; Becker et al., 2013; Palm & Carrol, 1998 on earthquake risk; Bourque, Regan, Kelley, Wood, Kano & Mileti, 2012 on terrorism; Stein, Buzcu-Guven, Dueñas-Osorio, Subramanian & Kahle, 2013 on hurricanes). Thus, beyond understanding how laypeople *think* about risks, exploring risk perception can provide valuable information for behaviour interventions, or at least for understanding why people so often fail to prepare.

The risk perception approach has been criticised by some theorists for being too focused on “erroneous” risk assessments by laypeople compared to scientific risk assessments by experts (Joffe, 2003). Thus, perceived probability is “often compared with scientific estimates of probability, and the focus has been upon the existence and source of lay error” (p. 57). In other words, the risk perception approach tends to oppose scientific and lay thinking, as if individuals only reason probabilistically. In fact, people do not think about risks probabilistically, “not because the public does not understand the sums, but because many objectives which it cares about have been left out of the risk calculation” (Douglas, 1994, p. 40). Otherwise said, simply demonstrating lay errors can potentially fail to consider psychosocial factors that are just as important for exploring risk perception.

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<sup>1</sup> 6.2/9 on the Richter Scale: A strong earthquake that can cause destruction in a radius up to 180km. Poorly built buildings are likely to be severely damaged. Earthquake resistant structures can be moderately damaged.

An alternative to the risk perception approach lies in Social Representations Theory (SRT, Moscovici, [1961] 2008). This theory “places great emphasis upon factors beyond individual information processing”, and instead of “conceptualising lay readings of risk as deficient, they are viewed as entities that contain the eccentric contents of people’s repositories of knowledge” (Joffe, 2003, p. 60). In other words, SRT fundamentally differentiates between scientific and lay-thinking (Rateau, Moliner, Guimelli, & Abric, 2011), and hence favours integrating non-scientific factors into human reasoning: “while people do not conform to the scientific norm in their everyday reasoning, it is not always because they are incapable of doing so, but rather because some preferences make them think differently” (Rateau, Ernst-Vintila & Delouvé, 2012, p. 54).

Following Moscovici’s seminal work on psychoanalysis (Moscovici, [1961] 2008), numerous authors have sought to offer more precise definitions of a social representation. For Abric (1993, 2001), it is a functional perspective on the world that enables individuals to give meaning to their behaviour and to understand reality with their own reference system (see also Rateau et al., 2011). This highlights the “circular relationship” between social representations and behaviour (Zouhri, Féliot-Rippeault, Michel-Guillou & Weiss, 2015, p. 158), whereby social representations contribute to guiding behaviour and behaviours contribute to structuring a social representation (Abric, 1993, 2001; Guimelli, 1993, 1998; Flament, 2001). In this way, SRT “offers a conceptualisation of human action that is context and culture specific” (Sammut, Andreouli, Gaskell, & Valsiner, 2015, p. 11). Thus, individuals will not produce a behaviour simply by committing to it; the behaviour must also be compatible with their system of values (Abric, 1994). In light of this, several authors have argued in favour of SRT as a valuable approach to behaviour change interventions (e.g. Eyssartier, Joule, & Guimelli, 2007; Jodelet, 2008; Piermattéo, Lo Monaco & Girandola, 2015; Rateau & Weiss, 2011; Souchet & Girandola, 2013; Valencia & Elejabarrieta, 1994; Wagner, 1993; Zbinden, Souchet, Girandola & Bourg, 2011; Zouhri et al., 2015), including in the specific case of risks (Apostolidis & Dany, 2012; Weiss, Girandola & Colbeau-Justin, 2011).

Even though SRT can be a valuable approach to lay thinking about risks, various criteria must be met in order to justify it. A social representation is indeed the representation of an object, but not all objects are socially represented (Moliner, Rateau & Cohen-Scali, 2002). As such, five criteria have been defined as conditioning the emergence of a social representation (Moliner, 1993).

First, an object of social representation must constitute some form of important issue for the group, whether it is negative (*i.e.*, a threat to be controlled or nullified) or positive (*i.e.*, a benefit for the group). This is also described as “sociocognitive salience” (Flament & Rouquette, 2003). The object must also be *polymorphic* in that it belongs to a more general class of objects. Furthermore, given the importance of collective communication for the emergence, sustainability and evolution of a social representation (Moliner et al., 2002), an object can only be socially represented if the group communicates directly or indirectly about it. This is connected to the second group-related criterion defined by Moliner: group dynamics. In other words, an object should provoke some form of interaction within or between groups. An object is socially dynamic if it presents a form of utility or need that is justified through interaction with other groups. Moliner’s fifth and final criterion is the absence of orthodoxy. In an orthodox system, “knowledge is not elaborated collectively because regulatory entities control the dissemination and validity of information about the object” (Moliner et al., 2002, p. 31). Thus, for a representation to be truly social, its object should not be subjected to any kind of authority that regulates or limits lay-thinking about it.

Adding to Moliner’s criteria, Flament and Rouquette (2003) also defined common practices as a pre-requisite for a social representation. This is related to the object’s importance within

the group, that is, to its social utility. Socially useful objects are more likely to encourage common practices through increased personal involvement (Gruev-Vintila & Rouquette, 2007) and by extension, social dynamics and communication.

By considering these criteria, it becomes clear that their presence is not a given in the case of earthquakes in Metropolitan France. Although earthquake preparation is undeniably important, it remains to be seen if this is recognised by the relevant populations. Furthermore, social dynamics involved in punctual, commemorative events (such as those organised throughout 2009 to commemorate the 1909 Lambesc earthquake) do not necessarily last, indicating that communication within and between groups about earthquakes is not continuous and varies in intensity. Moreover, even though certain aspects of earthquake risk are submitted to orthodoxy (*i.e.*, indicators of intensity and magnitude), others are not (*i.e.*, the public's understanding of said indicators). In fact, a recent research program (REVDU<sup>2</sup>, Marchand et al., 2011) that explored earthquake risk perception in Metropolitan France led to some alarming conclusions. On the basis of 120 semi-structured interviews conducted in four earthquake prone towns (Albertville, Salon-de-Provence, Tarbes, and Mulhouse), at-risk inhabitants lacked knowledge about earthquake preparation, were in denial, and expressed a fatalistic outlook on their ability to reduce their vulnerability. Some would displace the risk, assuring they were safe compared to neighbouring towns, and would not recognise their own homes' vulnerability, described as an "intolerable oxymoron". The interviewees also displayed signs of risk prioritisation; specifically, the PACA region is exposed to high flood risk, which tends to be considered more important and hence prioritised compared to low to moderate earthquake risk.

Another, more recent study, conducted specifically in the PACA region, provided further clues as to the appropriateness of SRT for studying lay-thinking about earthquakes (Lopez, Régner & Schleyer-Lindemann, 2015). Within a more general survey on the perception of various risks (forest fires, nuclear risks, floods, landslides, the transport of dangerous substances, dam failure, and earthquakes) in two towns in the PACA region (N = 143), the authors measured, among others: spontaneous and prompted risk evocation, sources of information about each risk, perceived and actual preparedness knowledge, perceived probability, perceived danger and worry. When considered in relation to the criteria described above, these indicators can shed light on the existence of a structured social representation of earthquakes.

Indeed, a high level of spontaneous evocation of earthquake risk, perceived probability, perceived danger and worry can be considered indicators of the importance attributed to earthquakes. Collective communication should be reflected in the declared sources of information for each risk, particularly with regard to "word-of-mouth". Common practices can be explored through perceived vs. effective preparedness knowledge; if earthquakes involve common practices, levels of perceived and effective preparedness knowledge should be relatively high.

In line with these assumptions, the survey by Lopez, Régner and Schleyer-Lindemann (2015) leads to yet more ambivalent conclusions. In terms of spontaneous evocation, the authors reported large variations depending on the risk. In this sense, 1.4% of participants spontaneously declared that their town is prone to landslides, which is in stark contrast to highly salient nuclear risk that was spontaneously provided by 83.9%. Earthquake risk lies between these two extremes, with a spontaneous evocation rate of 55.6%. Furthermore, a gap

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<sup>2</sup> *REduction de la Vulnérabilité sismique et Développement d'OUtils de sensibilisation/Reduction of seismic vulnerability and creation of tools to raise awareness.* Centre Scientifique et Technique du Bâtiment (CSTB), Laboratoire PACTE (UMR 5194), Laboratoire de Psychologie Sociale (E.A. 849).

was observed between spontaneous risk evocation and declared awareness. For earthquake risk in particular, although 55.6% mentioned it spontaneously, 85.3% recognised it when prompted. This indicates that it is not necessarily salient and is only recognised after an external prompt. Still in terms of sociocognitive salience, earthquakes, along with forest fires and floods, were considered one of the most probable risks in the survey, but neither the most dangerous nor the most worrisome.

Lopez (Lopez et al., 2015) also asked participants to describe what sources of information they typically use for finding information about each risk present in their town, among which they could respond “word-of-mouth”. If earthquakes do involve collective communication, then word-of-mouth should be high on the list of sources of information about earthquakes. For all risks except the transport of dangerous substances, the authors observed that a majority of participants declared they knew about each risk because of the geographic situation. For seismic risk in particular, 40% of the declared sources of information were the geographic situation; 15% official information; 9% word-of-mouth; 12% personal experience; 14% media; 8% through other information seeking behaviours. While these information sources are relatively diverse, a large proportion of respondents declared having deduced the presence of seismic risk from environmental factors rather than “human” sources. This casts doubt on the presence of collective communication about earthquakes in the PACA region.

Last, Lopez (Lopez et al., 2015) measured perceived preparedness knowledge for each of the risks studied. This measure was compared to effective preparedness knowledge, which was determined by comparing perceived preparedness with official recommendation documents available in both towns. The authors observed the highest level of perceived preparedness knowledge in the case of forest fires and floods, followed by seismic risk, nuclear risk and dam failure (on level pegging). This casts doubt on the social dynamics involved with earthquake risk. Not only is perceived preparedness knowledge about earthquakes relatively low, but it is equivalent to nuclear risk and dam failure which have never manifested in the region. That said, the authors also reported the highest level of effective preparedness knowledge for flood, nuclear and seismic risks, which were all statistically equivalent. Thus, in terms of generating common practices, this last indicator seems compatible with the existence of a structured social representation.

In light of these observations (Lopez et al., 2015; Marchand et al., 2011), the existence of a structured social representation of earthquakes in the PACA region is far from certain. This may explain why Gruev-Vintila and Rouquette (2007), when comparing social representations of earthquakes in Metropolitan France (Caen and Dijon) and Romania, observed an essentially *normative*, rather than *practically oriented*, social representation among individuals with little or no experience of earthquakes and low personal involvement. Considering the conditions for the emergence of a social representation, could it not be that these individuals simply did not have a structured social representation of earthquakes? The fact that the representation of earthquakes among individuals with prior experience and high personal involvement was also richer and more structured lends support to this idea.

Thus, solely relying on previous observations is not sufficient to confirm with certainty that earthquakes in the PACA region are (or are not) the object of a structured social representation. In fact, some aspects of these studies (Marchand et al., 2011; Lopez et al., 2015) lend support to the existence of a social representation, whereas others cast doubt on this very assumption. Given these ambivalent conclusions, we conducted a multi-method field study on the social representation of earthquakes in the PACA region as the most proficient way to determine its existence.

### 3. Method

For this study, conducted in 2014 in the PACA region, we adopted the structural approach to social representations (Abric, 1993, 2001). Within this approach, a social representation is defined as an “organised set of information, opinions, attitudes and beliefs about a given object” (Abric, 2003, p. 59). Through his Central Core Theory, Abric (1993, 2001) accounts for a representation’s structure by defining two types of representational elements: central elements (that form the central core) and peripheral elements (that form the peripheral system). The central core structures the representation in that it generates and organises the entire representational system (Flament, 2001). It is hence stable, resistant to contextual variations and consensual (Brunel et al., 2017). The peripheral system authorises inter-individual differences and adapts the representation to the context of its expression, thus allowing the “integration of everyday experiences” (Abric, 1994, p. 28). In fact, the peripheral system acts as an “interface between the central core and the situation” (Abric, 2003, p. 25), and thus fulfils five roles: *embodiment* (allowing the expression of reality in concrete terms); *regulation* (adaptation to the evolution of society); *defence* (of the central core by acting as a “buffer” between it and context); *behavioural prescriptions* (according to context); and *personalisation* (individual appropriation of the socially represented object).

We applied three methods designed specifically for identifying the content and structure of a social representation: prototypical analysis (Bonnet, Roussiau & Vergès, 2002; Ernst-Vintila, Delouée & Roland-Lévy, 2011; Vergès, 1992), the Test of Context Independence (TCI; Degraeve, Granié, Pravossoudovitch & Lo Monaco, 2015; Lo Monaco, Lheureux & Halimi-Falkowicz, 2008; Lo Monaco, Piermattéo, Rateau & Tavani, 2016; Skandrani-Marzouki, Lo Monaco & Marzouki, 2015) and similitude analysis (Ahn & Jung, 2015; Flament, 1962, 1981; Jung & Pawlowski, 2014; Pawlowski & Jung, 2015; for an English review of these methods, and others, see Lo Monaco, Piermattéo, Rateau & Tavani, 2016).

#### 3.1. Procedure and material

Based on verbal associations, prototypical analysis assumes that a consensual word or expression (*i.e.*, a potentially central element) will appear more frequently than others and will be considered more important (for describing or defining the object) by respondents. Thus, crossing the mean rank of importance (whereby participants rank their verbal associations from the most to the least important for defining or characterising the object; Abric, 2003) and the frequency of each verbal association provides the hypothetical structure of a social representation. This procedure offers four “profiles”: frequent and highly ranked associations can be considered central elements because they are both consensual and considered important. Contrariwise, infrequent and lowly ranked associations potentially belong to the peripheral system as they are neither frequent nor considered important. Between these two “extremes” are frequent but unimportant associations and infrequent but important associations; both configurations supposedly belong to the peripheral system.

Given that central elements are characterised by more than just their high frequency and salience, prototypical analysis only authorises hypothesizing about representational structures; these can only be confirmed by further exploration.

The TCI (Lo Monaco et al., 2008) is a particularly handy confirmatory method when used in conjunction with prototypical analysis. Initially developed as an alternative to the better known methods of the Attribute Challenge Technique (Moliner, 1995, 2002) and the Basic Cognitive Schemes Model (Guimelli, 1998; Gruev-Vintila & Rouquette, 2007; Lo Monaco et al., 2016) that require lengthy questionnaires and complex items, the TCI is based on central

elements' abstract and trans-situational properties (Wagner, Valencia & Elejabarrieta, 1996). Hence, the TCI simply requires respondents to say if each potential central element is *always and in all cases* a characteristic of the object. If participants answer affirmatively and the proportion of affirmative answers is superior to a threshold determined by a Kolmogorov-Smirnov test<sup>3</sup>, then the relevant element is confirmed as belonging to the central core.

Prototypical analysis and the TCI provide centrality estimates based on the non-negotiable, salient and consensual characteristics of a representation's central core, but they fail to take into account its *connectivity*. Thus, another method is required to determine how the elements that constitute a social representation relate to one another, such as similitude analysis (Ahn & Jung, 2015; Flament, 1962, 1981; Jung & Pawlowski, 2014; Pawlowski & Jung, 2015).

Inspired by graph theory, similitude analysis highlights the more or less strong relations between elements of a social representation, that is, relations of "proximity, resemblance, similitude, or even antagonism" (Moliner et al., 2002, p. 146). By administering a characterisation questionnaire based on previously collected verbal associations (whereby participants evaluate blocks of items in terms of their importance for characterising or defining the object), similitude analysis enables the calculation of a *distance index* between each pair of elements (ranging from -1 to +1). These relations are represented in a non-cyclic connected graph, where each vertex represents a verbal association and each edge the proximity between two associations. Central core elements should hold more and stronger connections than peripheral elements.

Prototypical analysis and the TCI were deployed in one questionnaire; participants had to provide the first five words or expressions that came to mind when thinking about "earthquakes in the PACA region". They then had to rank their five verbal associations from 1 (the most important for describing or defining the object) to 5 (the least important). Last, they answered the TCI for each of the five associations provided.

A second sample in the PACA region was required to answer a characterisation questionnaire in order to perform similitude analysis. The 20 most frequent and important verbal associations identified in the previous phase were presented in 5 blocks of 4 items. Participants had to first choose the 4 items that, according to them, best define earthquakes in the PACA region (coded +2), then the 4 least characteristic (coded -2). They then had to do the same again among the 12 remaining items (coded +1 then -1), and finally, the four remaining, unchosen items were coded 0.

### **3.2. Population**

Prototypical analysis and the TCI were performed on 94 inhabitants (61.05% females/38.95% males) of low to moderate earthquake prone areas in the PACA region ( $M_{age}=47.04$ ,  $SD_{age}=16$ ). Similitude analysis was performed on 55 inhabitants of the same region ( $M_{age}=32.47$ ,  $SD_{age}=16.76$ ), of which 74.5% were females and 25.5% were males.

## **4. Results**

### **4.1. Prototypical analysis**

Before performing prototypical analysis on verbal associations, Flament and Rouquette (2003) recommend simultaneously considering diversity and rarity indexes as exploratory indicators of the existence of a structured social representation. The diversity index is obtained by dividing the number of *different* associations by the *total* number of associations.

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<sup>3</sup>  $D_{max} = 100 \left(1 - \frac{1.36}{\sqrt{N}}\right)$

The rarity index is the percentage of hapaxes in the overall corpus (*i.e.*, associations that only appear once). In our case, the diversity index is .19 and the proportion of hapaxes is 49.45%.

Following Flament and Rouquette’s guidelines (2003), these indexes must be considered simultaneously. Although they did not define a specific cut-off, they did express the necessity for both indexes to be relatively low (*i.e.*, low diversity and a low hapax occurrence rate, indicating similar, shared verbal associations in the sample). In this way, they do not provide certainty as to the existence of a structured social representation of earthquakes in the PACA region: the corpus is not too diverse, but does contain a relatively high hapax occurrence rate (nearly 50%).

Prototypical analysis involves crossing the frequency and rank of the response categories in order to distribute them in a table according to their relative importance and consensuality, thus providing a hypothetical representational structure. To achieve this, cut-off points must first be defined based on the median rank of importance and the intermediary frequency.

The intermediary frequency is calculated by first classifying the verbal association categories according to frequency in order to retain the 70% most frequent. The intermediary frequency is calculated by dividing the total number of associations (331) by the number of different categories within these 70% (19). The result is rounded to the nearest whole number, giving us an intermediary frequency of 17 in this study. The median mean rank within the 70% threshold is 2.96.

#### INSERT TABLE 1

Prototypical analysis (Table 1) revealed a potential central core composed of the elements “trembling Earth”, “shaking/tremor/vibration” and “death/loss/deadly”. These elements are mostly descriptive in nature and not locally anchored, leading us to question the “local availability” of earthquake risk. In this sense, the first periphery (high frequency, low importance) is also mostly comprised of descriptive elements that refer to the most extreme, but not necessarily local, consequences of an earthquake (*i.e.*, catastrophe/disaster, tsunami/sea/wave, etc.). The second periphery (low frequency, high importance) follows a similar pattern, but also includes references to the emotional consequences of earthquakes (*i.e.*, fear, panic etc.). It also contains the most orthodox aspects of earthquakes (*i.e.*, Richter/magnitude/amplitude, epicentre/shockwave). Finally, the third periphery (low frequency, low importance) is relatively diverse. It is composed of elements related to the consequences of earthquakes on human lives (*i.e.*, victim/injured, help/firemen/aid), to flood risk and to earthquakes in Asia.

#### **4.2. Test of Context Independence**

As explained above, the TCI relies on the non-negotiable nature of core elements in order to identify them. By asking individuals if *X* potential core element is *always and in all cases* a defining characteristic of the studied object, the TCI is a pertinent confirmatory technique to complement prototypical analysis. This technique focuses on the proportion of affirmative answers for each potential core element (a high proportion of affirmative answers being considered an indicator of non-negotiability), which is compared to a  $D_{max}^4$  expressed in percent (here,  $D_{max} = 86\%$ ). In this way, any potential core element that does not exceed the  $D_{max}$  threshold is not confirmed as belonging to the central core.

In our study, the potential core elements tested were “trembling Earth”, “shaking/tremor/vibration” and “death/loss/deadly”. Respectively, they reached a proportion

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<sup>4</sup>  $D_{max} = 100 \left( \frac{1.36}{\sqrt{N}} \right) = 100 \left( \frac{1.36}{\sqrt{94}} \right) = 100 \left( \frac{1.36}{9.7} \right) = 100(1 - .14) = 86\%$

of affirmative TCI answers of 87.5%, 91.43% and 40%, hence only the latter is not a confirmed central element.

### **4.3. Similitude analysis**

Following the characterisation questionnaire procedure described above, we calculated a distance index between each pair of elements of the social representation of earthquakes. The distance indexes were then entered into a similitude matrix (for which a detailed methodology is available elsewhere, e.g. Degenne & Vergès, 1973; Flament & Rouquette, 2003; Pawlowski & Jung, 2015). The similitude matrix was presented as an acyclic connected graph, where each vertex is an element of the social representation and each edge represents the strength and valence of the relationship between pairs of elements.

FIGURE 1 HERE

In terms of similitude, the term “catastrophe” clearly occupies a central position. To varying degrees, nearly all elements of the social representation are either directly or indirectly related to this term. Specifically, it holds the strongest similitude with the terms “tectonic” (.94), “fault” (.94), “damage” (.92), “destruction” (.91) and “tremor” (.91). These terms are descriptive and/or refer to earthquakes on a global rather than local scale. Indeed, earthquakes are considered catastrophic and highly destructive, which does not necessarily reflect local earthquake reality, and reveals a more general conception of earthquakes anchored in global, media accounts.

Furthermore, we observed an antagonistic relationship between floods and earthquakes (-.54), where the former, as opposed to the latter, was related to the concept of “protection”. This, coupled with the global rather than local portrayal of earthquakes, leads us to question the very existence of earthquake risk in the eyes of the studied population. On the one hand, the most salient terms used to characterise earthquakes in the PACA region (with the exception of highly descriptive, technical terms) refer to earthquakes on a catastrophic scale, wreaking havoc and causing destruction. On the other hand, as opposed to floods, earthquakes in the PACA region were not viewed as something to be protected from.

This paradoxical observation (a catastrophic portrayal of earthquakes that do not require protection) casts doubt on the existence of a localised social representation of earthquakes, as respondents appear to “displace” the risk. In this sense, even though participants were questioned specifically about earthquakes *in the PACA region*, no local references were made to earthquakes. Thus, earthquakes were portrayed in such a way that reflects earthquakes as they occur on a global scale and as they are portrayed by the media. In other words, for inhabitants of seismic areas in the PACA region, earthquakes are highly dangerous, catastrophic, destructive phenomena that have deleterious consequences all over the world, but not in the PACA region, so they do not require protection.

## **5. Discussion**

Our main aim was to determine if a social representation of earthquakes can emerge in regions where earthquake risk perception is low. We first considered data available on earthquake risk perception in the PACA region (Marchand et al., 2011; Lopez, Régner & Schleyer-Lindenmann, 2015) in relation to criteria defined as conditioning the emergence of a social representation (Moliner, 1993; Flament & Rouquette, 2003). This led to ambivalent conclusions as some factors supported the existence of a social representation (*i.e.*, sociocognitive salience, common practices), while others did not (*i.e.*, social dynamics, collective communication). In light of this, we deployed three methods designed within the structural approach to gain further insight into the existence of a social representation of earthquakes.

We identified an essentially descriptive social representation that included references to extreme earthquakes as they are portrayed globally. In this sense, similitude analysis showed that virtually all elements of the social representation were strongly related to the term “catastrophe”, which occupies a central position (Figure 1). Thus, both the content and organisational structure of the social representation led to the conclusion that social thinking about earthquakes in the PACA region is not locally oriented, but rather rooted in dramatic media accounts of disastrous earthquakes. References to Asia in the peripheral system support this idea. This is compatible with the literature on social representations, in that they are formed in part by information obtained from the media (Brunel et al., 2017).

Similitude analysis also revealed an antagonistic relationship between earthquakes and floods; the latter, as opposed to the former, were associated to the notion of “protection”. This term is arguably the only truly “practically oriented” element in the social representation, and its association with flood risk rather than seismic risk leads us to two conclusions: 1) the social representation of earthquakes lacks any practical orientation, potentially casting doubts on its existence with regard to the above criteria; 2) it is compatible with the existence of a social representation of floods in the studied population.

The nature and content of a social representation can provide clues as to the group’s relation to the object. For example, Gruev-Vintila and Rouquette (2007) found that earthquake experience and strong personal involvement correlated with a more structured, richer social representation, with both normative and practical components. We argue that if an object of social representation necessarily implies practice, then a purely *descriptive* rather than *practically oriented* social representation could be indicative of its inexistence in the studied population. In other words, anyone can describe an earthquake, regardless of their seismic exposure, but not everyone is involved enough to integrate aspects of social thought that are fundamental for the emergence of a social representation (*i.e.*, practice, perceived importance, etc.).

Theoretically, the parallels that can be drawn between Rouquette’s model of personal involvement (Ernst-Vintila, Delouvé, & Roland-Lévy, 2011; Gruev-Vintila & Rouquette, 2007) and the criteria for the formation of a social representation open the door to a more standardized method for exploring the appropriateness of SRT. As a reminder, Rouquette defined personal involvement according to three independent dimensions: “the value placed on an issue [...], perceived personal exposure, and the perceived capacity to act” upon the object (Ernst-Vintila et al., 2011, p. 6). To varying degrees, these dimensions echo some of the criteria previously identified for the emergence of a social representation. Indeed, the value placed on the issue equates with the sociocognitive salience of a socially represented object (*i.e.*, how important it is for the individual/group); perceived personal exposure can be linked to the level of object-related practice (*i.e.*, the more a person is exposed to an object, the more he/she develops practices related to it); and perceived capacity to act can be related to social dynamics and collective communication (*i.e.*, the more an object is socially dynamic, the more it encourages people to act upon it). As such, Rouquette’s model of personal involvement could be a pertinent starting point for developing techniques to verify the existence of a social representation before deploying costlier methods, or at least for providing better understanding of the population-object relationship (Gurrieri, Wolter & Sorribas, 2007). An object that is not considered important, that individuals do not feel concerned with and that leaves them feeling powerless to act is unlikely to be socially represented. Social representations are indeed generated collectively through interaction (Moscovici, [1961] 2008), therefore, “how could we imagine individuals interacting about an object of representation without feeling involved in one way or another?” (Guimelli & Abric, 2007, p. 49). Previous research has indeed demonstrated the important role played by personal

involvement in the social representations of various risks (Baggio & Rouquette, 2006; Baggio & Colliard, 2007; Ernst-Vintila, 2009; Ernst-Vintila, Delouvé & Roland-Lévy, 2011). In general, these studies highlight the link between low personal involvement and less rich, more normative (descriptive) social representations. In other words, the less individuals feel involved with a risk, the less their social representation of it is practically oriented. If practice is a prerequisite for the development of a social representation (Flament & Rouquette, 2003), we argue that a purely descriptive representation may in fact not be *social* at all, but that it is no less *collective*.

This leads to an important question: if a purely descriptive representation is not *social*, then what is it? Durkheim's *collective* representations (Durkheim, 1898) may provide an initial answer, but they also raise a conceptual issue that must be addressed. In his seminal work, Moscovici never explicitly distinguished between durkheimian, *collective* representations and his own, *social* representations. They even appear synonymous in some of his writings. When explaining Durkheim's position, for example, he states that "in his [Durkheim's] mind, social representations were a very general class of psychic phenomenon (...)" (Moscovici, [1961] 2008, p. 40), even though the concept of *social* representation did not exist at the time and Durkheim never used the term. Later, Jodelet (1984) clarified this distinction (or lack thereof): "the concept of social representation – or rather, collective – appeared in sociology but was eclipsed for a long time. Its theory took shape in social psychology (Moscovici, [1961] 2008), but not without making a detour through child psychology (Piaget, [1926] 1929)" (Jodelet, 1984, p. 357). Thus, any attempt to distinguish between collective and social representations must first provide better definitions of their contours. This could prove tricky, because "collective representations are to the subject what social representations are to the group, and their respective functions do not distinguish between them" (Trognon, 1989, p. 17). However, if we situate collective and social representations within the Architecture of Social Thought model (Rouquette, 2009; Rateau, Ernst-Vintila, & Delouvé, 2012), we understand that this may not be the case. As opposed to *individual* representations that are personal, collective representations are held by general communities and thus ensure their cohesion; they refer "to sets of opinions and collective knowledge grouped into vast mental forms (religions, myths, rites, traditions, sciences...) that are the work of a global community" (Salès-Wuillemin, 2007, p. 19). Social representations can be positioned between the two, in that "they are both the product of individual and collective outlooks, and take shape through social interactions" (p. 19). This is particularly visible within the structural approach, as core elements are consensual, non-negotiable and resistant to contextual changes, and peripheral elements can reflect inter-individual differences. Despite this proposed distinction, if collective and social representations do have similar functions, they should be able to be approached using the same methods.

With this distinction in mind, we hypothesize that the representation of earthquakes in the PACA region, given its highly descriptive and general nature (*i.e.*, it could apply to any seismic zone on the planet), is a collective, rather than social representation. Thus, SRT may not be the best approach, especially for encouraging seismic preparation behaviours. Indeed, if social representations truly are a guide for behaviour (Abric, 1994), we must first ensure that the risk in question is definitely an object of social representation. Without this preliminary verification, any link established between a social representation and risk preparedness behaviour is tenuous at best. In other words, a *collective* representation must first integrate individual components such as experience and (perceived) exposure before becoming a *social* representation. This implies, almost paradoxically, that what makes a representation *social* is not its collective, shared components, but rather how those shared components are appropriated and understood through an individual's singularity.

In our view, three research perspectives arise from this hypothesis. First, more sociorepresentational studies on low to moderate risks should be conducted in order to replicate our results, perhaps using more in-depth methods. Next, we must better explore and define the concept of collective representation, how it relates to that of social representation, and the place it occupies within the Architecture of Social Thought model. To finish, we must develop a standardised, simple method to explore the appropriateness of SRT, perhaps using personal involvement as a starting point.

## **6. Conclusion**

Risk research through the scope of SRT is becoming more and more popular among researchers (Weiss et al., 2011). Recently, numerous studies on a diversity of risk-related topics have relied heavily on SRT to explore social thinking about risks (Baggio & Colliard, 2007; Baggio & Rouquette, 2006; Breakwell, 2001; Ernst-Vintila, 2009; Gruev-Vintila & Rouquette, 2007). To our knowledge, very few, if any of these studies has sought to verify beforehand that SRT is truly the most pertinent approach. On the surface, SRT offers a valuable and attractive paradigm, relying not on the objective factors of risks to encourage preparation, but on the perception of those very factors. SRT indeed presents numerous advantages compared to “cognitively-driven risk psychology” (Joffe, 2003, p. 68). Unfortunately, those advantages do not guarantee that every risk, in every context and for every population, is indeed an object of social representation. In this sense, the pertinence of SRT is not always a given and depends strongly on group- and object-related criteria (Moliner et al., 2002). Unfortunately, this issue is not often explored by theorists, but perhaps with good reason: there is currently no standardised method for doing so.

In our view, better clarifying the distinction between social and collective representations and providing a standardised technique for initial verifications would prove valuable in helping researchers explore the population-object relationship in order to choose the best approach. In this sense, we encourage future studies to explore personal involvement, not as a mediator of the content and structure of a social representation, but as a pre-requisite for the very existence of a social representation. To conclude, SRT is a pertinent and valuable approach to risks, but we must not consider all risks as objects of social representation.

## **7. Conflict of interest**

None.

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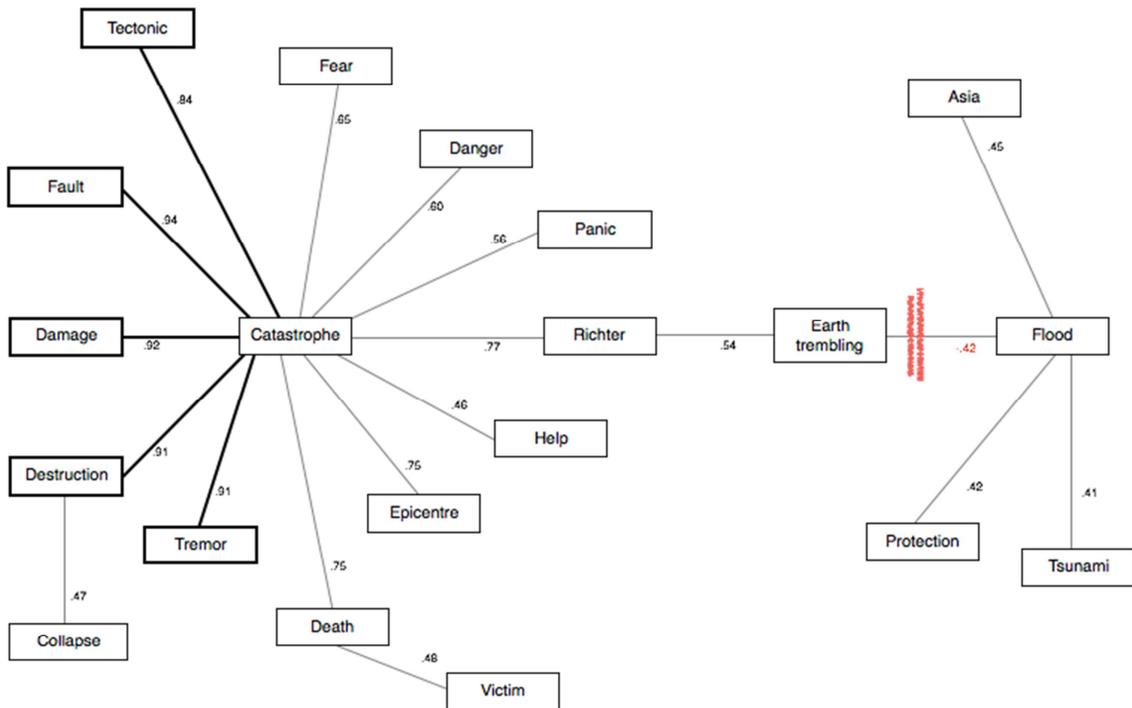


Figure 1: Similitude analysis of the social representation of earthquakes in the PACA region

Table 1 : Prototypical analysis of the social representation of earthquakes in the PACA region (N = 94)

		RANK	
		< 2.96	≥ 2.96
FREQUENCY	≥ 17	Earth trembling (40; 2.05) Shaking/tremor/vibration (35; 2.31) Death/loss/deadly (25; 2.84)	Catastrophe/disaster (30; 3.10) Tsunami/sea/wave (26; 3.58) Destruction/ruin/breakage/wiped from the map (24; 2.96) Damage (17; 3.59) Collapse/landslide/falling debris/burial (21; 3.29)
	< 17	Richter/magnitude/amplitude (15 ; 2.73) Danger (13 ; 2.77) Fault/crevice/fracture/fissure (13 ; 2.69) Fear/fright/terror/trauma (11; 2.82) Panic/chaos/shock/stress (11; 2.73) Epicentre/shockwave (7; 2.43)	Victim/injured (11; 3.45) Tectonic/plate/subduction (10; 3.30) Help/firemen/aid (8; 3.63) Asia/Thailand/Japan (7; 3.29) Flood (7; 4.29)
NB. In brackets (frequency; mean rank of importance)			