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Social Representation of Global Climate Change: An Exploratory Study Focusing on Emotions

Lilla Dézma[a], Sára Bigazzi[a], Mauro Sarrica[b], Anna Siegler[a], Sára Serdült[a] and Valentina Rizzoli[b]

[a]Department of Social and Organizational Psychology, University of Pécs, Pécs, Hungary; [b]Department of Communication and Social Research, Sapienza University of Rome, Rome, Italy

ABSTRACT

Climate change is a complex, emerging concept, and emotions seem to play a vital role in its social construction. We aimed to explore social representations of global climate change, especially from the perspective of emotions. We investigated emotions as representational components and, by applying anxiety, as psychological anchors affecting the organization and contents of representations. Free associations to the inductor "global climate change" were collected from 287 Hungarian respondents (Mage = 32.7, SD = 12.1 years). They were submitted to specificities, prototypical and similarity analyses (IRaMuTeQ software). Anxiety was measured with STAI, using the Trait subscale. Results show an integrated representation of natural and human-related aspects. Fear and anxiety were the most frequently mentioned emotions. Fear was a prominent concept, as part of the representation was organized around it. More anxious participants tended to anchor climate change as more ominous and unavoidable. Less anxious participants had a distanced view, while actions were central for participants with medium anxiety. We discuss how these results compare to previous findings and what might be the sources and implications of group differences, especially from a climate communication view.

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Introduction

Climate change is the most prominent risk nowadays, demanding urgent individual and societal responses. The social construction of climate change influences these reactions, and correspondingly, investigating these constructs is critical (Breakwell, 2010). In risk-construction models, the role of emotions traditionally has been overlooked, although emotional reactions, especially negative emotions, seem to influence risk constructions significantly (Breakwell, 2010; Brosch, 2021; Harth, 2021; Ojala et al., 2021). However, the current risk perception field still tends to ignore the interplay of common-sense beliefs and emotions that underpin public reactions to risks (Bouriche, 2022; Joffe & O'Connor, 2013). Our study explores how climate change-related emotions

CONTACT Lilla Dézma dezma.lilla@pte.hu Department of Social and Organizational Psychology, University of Pécs, Ifjúság útja 6, 7624 Pécs, Hungary.

play a role in the social construction of hazards, and we adopt social representation theory as the theoretical framework to address the individual-society nexus (Bouriche, 2022; Breakwell, 2010; Joffe & O'Connor, 2013). Applying this perspective, we aim to explore cognitive and emotional aspects of climate change's social representations and the role of anxiety on the representational field as an anchoring factor.

Emotions and climate change: anxiety

Emotions vary from other affective states such as mood or sensations in their automatic nature, intensity, polarity on pleasantness, suddenness, and short duration. They are indicators of the individual's perception of reality and the channels through which the discontinuity of interaction between the individual and the world is communicated. This characteristic leads to treating emotions as individual dispositions representing the connection of (dis)continuity between people and reality (Bouriche, 2022). Negative emotions such as fear, anger, and sadness seem to be the most important factors in climate-related judgments and behavior (Brosch, 2021; Harth, 2021; Harth et al., 2013). On the one hand, they are related to self-reported pro-environmental behaviors by improving risk perception through careful information processing and increased action motivation (Smith & Leiserowitz, 2014; Wang et al., 2018). On the other hand, a strong sense of threat results in distancing oneself from climate change, which can be a coping mechanism for potentially overwhelming emotions (Caillaud et al., 2016; Norgaard, 2006). Among the positive emotions, constructive hope promotes action by emphasizing the importance of solution-based individual and collective action, while denialist hope relates to doubts and inaction (Brosch, 2021). Böhm and Pfister (2017) have examined perceptions of environmental risks within an appraisal-theoretical model of emotions (Keller et al., 2012). Their finding important for our study is that consequence-focused perceptions seem to be connected with consequence-related emotions such as fear, sadness, or worry, while cause-focused perceptions with morality-based emotions such as anger, outrage, or guilt (Böhm & Pfister, 2017).

Anxiety has also been related to climate change, both as a consequence and as a possible cause for the amplification of climate-related mental health issues (Ojala et al., 2021). In this study, anxiety is conceptualized as a dispositional emotion that is negative and unpleasant and has the underlying appraisal theme of facing uncertain existential threats (Lazarus, 1991; Lerner & Keltner, 2000; Ojala et al., 2021). Individuals with high anxiety have difficulty adapting to novel information and prioritize threatening over non-threatening information (Knowles & Olatunji, 2020). At the same time, anxiety is an adaptive, activating emotion as well: it signals possible, impending danger (Endler & Kocovski, 2001; Ojala et al., 2021; Stanley et al., 2021). Correspondingly, the action tendency associated with anxiety aims to reduce uncertainty by avoiding the threat through action or palliation (Stanley et al., 2021; Stollberg & Jonas, 2021). For instance, Lerner and Keltner (2000) found that anxious individuals make relatively pessimistic, low-risk assessments and risk-averse choices. This could also resonate with the finding that anxiety might be a prerequisite for critical thinking processes, and a first step to addressing societal issues (Ojala et al., 2021) such as climate change.

Social representations and climate change

Far from being exclusively individual risks, complex phenomena such as climate change are objects of social debate and require shifting the focus of analysis from individual perception to the processes involved in the social construction of risk. In this regard, social representation theory has proved to be insightful for exploring what meaning systems appear in society and how individuals and groups form and deploy them in communication (Jaspal et al., 2014). Social representation theory, as a mild form of socio-constructivism, stands at the intersection between individual processes and the social construction of reality. In this perspective, social representations (SRs) are the shared elaboration of a relevant social object by individuals and groups for the goal of communicating and acting (Jaspal et al., 2014; Joffe & O'Connor, 2013; Moscovici 1961/2008).

The two essential communicative processes involved in the construction of SRs are anchoring and objectification. By anchoring what is new with the ideas already shared, groups and individuals make the alien event imaginable and familiar (through naming, and classifying it). Objectification further translates the novelty, from the abstract into concrete objects, constructing shared metaphors, icons, or tropes (Höijer, 2011; Wagner et al., 1999). Among the different approaches to SRs, the structural approach has deepened the cognitive facets of SRs. From this perspective, SRs can be examined as structured socio-cognitive fields that are organized by a limited number of cognitive elements in a given social group (Abric, 1993; Lo Monaco et al., 2016). The central core includes a limited number of cognitive elements that are deemed fundamental, and that are salient and consensual, thus it provides stability and organization to the entire representation. Peripheral elements are marginally placed in the public discourse, they have a conditional nature and a more flexible and practical character, and serve to adjust the representation to everyday experience (Abric, 1993; Lo Monaco et al., 2016). Therefore, the contents and structure of SRs can be explored by looking at the cognitive elements that are shared within a given group, their salience, and the relationship among them (Rouquette & Rateau, 1998; Wachelke & Wolter, 2011).

Regarding findings of climate change's SR, Höijer (2011) argues that climate change is often anchored to ideologies such as nationalism, death, and illness in the media. It is represented as a part of a broader set of social and environmental issues, such as industrialization, consumption, or over-population (Wolf & Moser, 2011) yet socially defined for the majority by its physical impacts (Moloney et al., 2014). It is objectified as changes in local or global weather, concrete weather phenomena, ice melting, warming, pollution, polar bears, or personified as Al Gore (Höijer, 2011; Leiserowitz, 2005; Lorenzoni et al., 2006; Olausson, 2010; Smith & Joffe, 2013). Antinomies of certainty-uncertainty, global-local, nature-culture, natural-unnatural, and self-other in thinking were identified (Höijer, 2011; Olausson, 2010; Smith & Joffe, 2013). Elements referring to the anthropogenic cause of the change were prevalent (Jaspal et al., 2014) yet respondents associated the causes with other people, countries, or corporations (Smith & Joffe, 2013; Whitmarsh et al., 2011). Baquiano and Mendez (2015) studied the structure of Guam University students' representations. The core of climate change's SR contained associations of weather and warming, while the peripheries associations of impacts on the natural and human world. Gaymard et al. (2015) found differences

in the content of the central core based on weather phenomena characteristic of the living space of the indigenous people from Cameroon, while the peripheries contained mostly elements referring to impacts.

Social representations and emotions

In this study, we approach SRs as cognitive-emotional processes of social knowledge construction, conservation, and transformation (Bouriche, 2022; De-Graft Aikins, 2012). This concept implies that SRs may be thought of as both products and processes of emotional experience. The study of SRs as cognitive-emotional processes can then be approached from two different perspectives (for a review, see Piermattéo, 2021): first, a top-down line of research corresponding to how SRs, as cultural pre-constructs and shared knowledge about a specific reality, potentially influence individual emotions (Bouriche, 2022; Wagner et al., 1996); and second, a bottom-up line of research corresponding to how emotions are involved in SRs' genesis and evolution (Bouriche, 2014; Höijer, 2010; Smith & Joffe, 2013), and in the dynamics of SRs as components of the representational field (Bouriche, 2022; Piermattéo, 2021). Our research affiliates the second line of research. In our study, we explore emotions both as constitutive elements and as psychological anchors of representations.

Indeed, SRs often include emotionally loaded content (Breakwell, 2015; Piermattéo, 2021): for instance, Tavani and Collange (2017) found words such as sadness, anger, and shame in the SR of the Clément Meric case. Curelaru et al. (2012) discovered that fear as a content of the SR of cloning forms part of its internal structure. SRs can further include contents with a strong symbolic value and emotional tone, which may not explicitly refer to specific emotions (Rouquette, 1994). In particular, as regards the SR of hazards, anxiety and fear are regularly an integral part of the representation (Breakwell, 2015). In the SR of climate change, Flores and Amigón (2018) identified fear along with emotions such as indignation, sadness, distrust, impotence, anger, and pessimism.

Emotions could also influence the development and dynamics of SRs by directly impacting anchoring and objectification (Piermattéo, 2021). In the media, Höijer (2011) found that climate change is anchored to emotions such as fear, anxiety, hope, nostalgia (see also Smith & Joffe, 2013), or guilt. At the individual level, emotions challenge knowledge structures by revealing discontinuity between individuals and representational objects first, then encouraging individuals to deploy attentional resources to restore coherence and clarify SRs (Bouriche, 2022). The SR clarification reflects the individual's position and commitment to the SR object, thus, the psychological anchoring (Doise, 1992). Through psychological anchoring, the emotional experience updates SRs and, more broadly, increases and influences knowledge (Bouriche, 2022). In this perspective, two empirical investigations showed the effect of emotions as psychological anchors on the dynamics of an SR: Methivier (2010) concluded that fear influences the components of SRs of work and unemployment. Bouriche (2014) produced results revealing a differential clarification according to the structural status (central or peripheral) of the components of teamwork's SR after emotions experienced in a natural teamwork setting.

Aims of the current study

First, we aim to explore the social representation of global climate change by analyzing the content and organization of SR. Second, as emotions seem to play an essential role in the social construction of risks (Bouriche, 2022; Breakwell, 2010; Brosch, 2021; Joffe & O'Connor, 2013), we aim to examine the role of emotions in climate change's SR (Piermattéo, 2021). To do that, we especially focus on (a) the emotions included among the central and peripheral representational elements (Breakwell, 2015; Flores & Amigón, 2018); and (b) anxiety as a psychological anchor (Bouriche, 2022; Doise, 1992; Ojala et al., 2021). Namely, based on the few previous findings (Bouriche, 2014; Methivier, 2010), we expect that some differences in the contents and organization of the representational field of climate change will be anchored to the diverse anxiety levels of respondents.

Materials and methods

Participants

The data were collected through an online, self-administered, structured questionnaire that was imported to Google Forms. Participants were recruited through convenience sampling, on different social media channels. 287 Hungarian respondents participated in our study, 227 of them were female (79%), 58 were male (20%), and 2 chose a third, "Other" category (1%). The average age of the participants was 32.73 years (SD = 12.1 years, with a minimum of 18 and a maximum of 72 years). Regarding the educational background of respondents, most of them had higher levels of education: 180 had university degrees (63%), 104 had secondary school qualifications (36%), and only 3 had lower levels of education (1%). Participants gave informed, written consent to participate in the research approved by the Hungarian United Ethical Review Committee for Research in Psychology (number: 2022-52).

Measures

Anxiety – Short version of the Spielberger State-Trait Anxiety Inventory: Trait subscale (Spielberger et al., 1970; Zsidó et al., 2020)

The shorter version of the adapted STAI's trait subscale was utilized (Zsidó et al., 2020). It measures self-declared anxiety on a 4-point Likert scale with 5 items (e.g., "I worry too much over something that really doesn't matter"). The scale had a mean of 10.89 (Sum = 20), and good scale reliability (Cronbach $\alpha = 0.79$). To analyze the relationship between anxiety and textual data, anxiety scores were categorized into three groups based on mean and one standard deviation (+/- SD = 3.05). Participants who positioned themselves as having lower levels of anxiety constituted Group 1 ($N = 67$, scores 0-8), those, who positioned themselves as having high levels of anxiety formed Group 3 ($N = 62$, scores 14-20), and Group 2 included those who were between them ($N = 191$, scores 9-13).

Social representation – free association task

Given the exploratory nature of the study, we asked participants to produce spontaneously 5 words or phrases (Wachelke & Wolter, 2011) to the inductor "global climate change" (globális klímaváltozás in Hungarian) in written form, at the beginning of the questionnaire, before the scale. Despite the instruction, the number of responses varied from zero to fifteen, and the average number of associations was six. The frequency and order of spontaneously mentioned words could provide an insight into the contents and structure of SRs shared by the participants, also including emotive and implicit pathways (Joffe & Elsey, 2014; Leiserowitz, 2005; Wagner et al., 1999).

Data analysis process

Free associations were preprocessed: typos were corrected, and in order to obtain a less ambiguous corpus of textual data, lemmatization, and conceptual categorization were applied (Moliner & Lo Monaco, 2017; Sarrica & Contarello, 2004). The different word forms were reduced to their lemma (i.e., the word as found in the dictionary), and different words assimilable from a semantic point of view were reduced to the most frequently used form (e.g., 'uncertain' includes 'uncertainty'). Furthermore, words derived from a foreign language but commonly used were translated into their Hungarian equivalents (e.g., 'ignorant'). Subsequently, the textual corpus was submitted to three exploratory techniques that are common to SRs studies: prototypical, similarity, and specificity analysis.[1]

Prototypical analysis operationalizes some assumptions of the structural approach to SRs about the characteristics of core and peripheral elements. The analysis considers two complementary criteria to classify words evoked by a free association task: the frequency of occurrence (i.e., the level of consensuality) and the rank of appearance (i.e., their relative importance). The frequency and evocation rank criteria are complementary, providing two collective indications to measure a word's salience in a corpus. In this perspective, core elements are more salient than the peripheral ones, i.e., they are relevant to the object and accessible, and they are largely consensual. For each criterion, a cutoff value is calculated in order to distinguish between high- and low- frequency and high- and low-rank associations. In our analyses, the average frequency of occurrence defined the cutoff between high- and low-frequency words (i.e., the total number of words divided by the number of word forms, for example, 1204/90 in the first prototypical analysis). Furthermore, to reduce the noise created by idiosyncratic and very low-frequency associations, we selected a minimum frequency threshold of 6, taking into account the possibility of an ad hoc threshold definition (Alessio et al., 2011). This choice allowed us to encompass most of the words related to emotions. Thus, 74% ($N = 1204$) of the total corpus ($N = 1624$) was processed, while 26% ($N = 420$, including 38 hapaxes,[2] representing 3% of the total) was excluded from the analysis. In our entire sample, the level of shared knowledge concerning global climate change can be characterized as consensual, as indicated by the presence of few hapaxes. The mean evocation rank was used to define low or high-rank associations respectively (i.e., below or above 3.87 in the first analysis).

By crossing the two criteria, it is possible to categorize free associations into four groups, that constitute the prototypical analysis results table (Table 1-4) (Lo Monaco

et al., 2016; Wachelke & Wolter, 2011). Words with high frequency and low evocation rank, i.e., responses given by many participants in the first place, are regarded as constituting the possible central core. The zone of the first periphery includes the responses with high frequency and high evocation rank. They are frequently reported, however as secondary elements of the representation. The third zone, or zone of contrast, has items with a higher degree of significance but a lower frequency. These associations either just complement the first periphery or denote the presence of a

Table 1. Result of the prototypical analysis on the SR.

		Rank	
		<= 3.87	> 3.87
Frequency	>= 13.34	**CENTRAL ELEMENTS**	**FIRST PERIPHERY**
		Warming (50; 2)	Cooperation (35; 4.6)
		Ice melting (38; 3.2)	Future (30; 4.4)
		Catastrophe (29; 3.1)	Species extinction (24; 4.2)
		Extinction (28; 3.3)	Migration (24; 4.9)
		Plastic (24; 3.8)	Water shortage (23; 4)
		Danger (23; 2.6)	Action (22; 4.5)
		Fear (20; 2.9)	Politics (21; 5.2)
		Drought (20; 3.1)	Child (20; 4.2)
		Inertia (20; 3.6)	Animal (17; 4.1)
		Hunger (19; 3.8)	War (17; 4.3)
		Garbage (18; 3.7)	Greta Thunberg (16; 4.7)
		Warm (17; 3)	Zero waste (16; 4.9)
		Carbon dioxide (17; 3.6)	Extreme weather (15; 4.7)
		Forest fire (17; 3.8)	Responsibility (14; 4.5)
		End of world (15; 3.5)	Change (14; 4.6)
		Death (14; 2.4)	
		Decay (14; 2.9)	
		Problem (14; 3)	
	< 13.34	**CONTRAST ZONE**	**SECOND PERIPHERY**
		Famine (13; 3.6)	Fossil energy (11; 4.4)
		Environmental protection (13; 3.3)	Tree (11; 5.2)
		Desert (12; 3.4)	**Anxiety (11; 5.2)**
		Uncertain (12; 2.9)	Sea (10; 3.9)
		Forest (11; 3.2)	Industry (10; 3.9)
		Water (11; 3.3)	Climate (10; 4.2)
		Air pollution (11; 3.5)	Illness (10; 4.7)
		Greenhouse effect (11; 3.7)	Natural disaster (10; 4.7)
		Polar bear (10; 3.1)	Extremity (9; 4)
		Storm (10; 3.7)	Money (9; 4.1)
		Trump (9; 3.4)	Humanity (9; 4.6)
		Urgent (8; 1.8)	**Hope (9; 4.9)**
		Hotness (8; 2.6)	Renewable energy (9; 5.1)
		Flood (8; 2.9)	Consciousness (9; 5.2)
		Sea level rising (8; 3.1)	Ignorant (9; 5.2)
		Unconcerned (8; 3.5)	Make a change (9; 5.2)
		Ozone (8; 3.6)	Will to act (9; 5.6)
		Deforestation (8; 3.6)	Irresponsibility (8; 4)
		Nature (8; 3.8)	**Anger (8; 4.5)**
		Heat (7; 2.9)	Pollution (8; 4.6)
		Environment (7; 3.3)	Demonstration (8; 6.4)
		Worry (6; 1.5)	Temperature (7; 3.9)
		Threat (6; 1.5)	Environmental pollution (7; 4.3)
		Sad (6; 2.5)	Activism (7; 4.7)
		Collective (6; 3.2)	Recycling (7; 5)
		Weather (6; 3.5)	Damage (7; 5.4)

Note. The first number in the brackets indicates the frequency, the second number after the „;„ sign indicates the evocation rank. Words referring to emotions are in bold.

Table 2. Result of the prototypical analysis on the SR of Anxiety Group 1 ($N = 67$).

		Rank	
		<= 3.47	> 3.47
Frequency	>= 4.32	**CENTRAL ELEMENTS**	**FIRST PERIPHERY**
		Ice melting (11; 3.2)	Future (11; 4.5)
		Warming (10; 1.5)	Migration (7; 4.6)
		Drought (8; 2.5)	Sea (5; 4.2)
		Extinction (7; 3.3)	Child (5; 4.6)
		Danger (6; 2.3)	Cooperation (5; 4.8)
		War (5; 2.8)	
	< 4.32	**CONTRAST ZONE**	**SECOND PERIPHERY**
		Hope (4; 3)	Decay (4; 3.5)
		Polar bear (4; 2.8)	Change (4; 3.5)
		Famine (4; 2.5)	Greta Thunberg (4; 4)
		Sad (4; 2)	Carbon dioxide (4; 4.2)
		Catastrophe (3; 1.3)	Plastic (4; 4.5)
		Warm (3; 1.7)	Renewable energy (4; 5)
		Water shortage (3; 2.3)	Extreme weather (4; 5.8)
		Water (3; 2.3)	Zero waste (3; 3.7)
		Ignorant (3; 2.3)	Climate (3; 4.3)
		Uncertain (3; 2.3)	Land (3; 4.7)
		Desert (3; 2.7)	Tree (3; 4.7)
		Garbage (3; 2.7)	Struggle (3; 4.7)
		Extremity (3; 3)	Inaction (3; 5)
		Inertia (3; 3.3)	Development (3; 6.3)
		Animal (3; 3.3)	
		Politics (3; 3.3)	
		Hunger (3; 3.3)	
		Life (3; 3.3)	

Note. The size of the corpus was 267. In the analysis, 49% of corpus ($N = 132$) was included (hapax = 65–24%), the minimum occurence was 3.

subgroup that regularly rates certain elements differently from the majority. The fourth zone, or the second periphery, contains words with a lesser degree of significance and a lower frequency of evocations, that are not salient and less interesting for the structure of the representation (Abric, 1993; Lo Monaco et al., 2016; Wachelke & Wolter, 2011).

The similarity analysis was applied to investigate the organization of SRs' elements and the meanings emerging from their relationships. This technique provides a more dynamic perspective for interpretation by revealing SRs' latent structure. The concept behind this analysis, which is central to the structural approach to SRs, is that meaning arises not from SRs' constituents alone, but from their organization, as well (Roquette & Rateu, 1998). Thus, this method investigates the co-occurrence of words in the corpus, showing which associations have connections, and how strong they are, and allowing us to investigate if they create veritable fields of meaning (Degenne et al., 1973). This approach is based on graph theory (described in Degenne et al., 1973) and allows the graphic representation of the organization of elements in the form of a graph. Graphs display the words associated with the representational object linked by edges. Based on their degree of co-occurrence, the analysis also suggests semantic universes: groups of words that are often connected and that are differentiated from others with which they have a weak association (see Figures 1–4). In our analyses, we used the Jaccard index,[3] which indicates the proportion of connection between two words in comparison with the corpus. It varies between 0 and 1: the closer the indicator is to one, the stronger the connection. A high degree of connectedness can be considered when the Jaccard index is > 0.5 (Kent & Coker, 1992). In the similarity analyses, we applied as the

Table 3. Result of the prototypical analysis on the SR of Anxiety Group 2 ($N = 191$).

		Rank	
		<= 4.09	> 4.09
Frequency	>= 9.28	**CENTRAL ELEMENTS**	**FIRST PERIPHERY**
		Warming (35; 2.1)	Cooperation (26; 4.4)
		Catastrophe (21; 3.1)	Future (18; 4.6)
		Ice melting (21; 3.4)	Action (17; 4.9)
		Fear (15; 3)	Water shortage (16; 4.4)
		Extinction (15; 3.7)	Child (15; 4.1)
		Plastic (14; 3.5)	Species extinction (15; 4.4)
		Danger (13; 2.4)	Migration (14; 4.5)
		Inertia (13; 3.8)	Responsibility (12; 4.7)
		Warm (11; 3.5)	Politics (12; 5.3)
		Environmental protection (11; 3.5)	Animal (10; 4.4)
		Garbage (11; 3.5)	Forest fire (10; 5)
		Drought (10; 3.3)	Greta Thunberg (10; 5.6)
		Carbon dioxide (10; 3.5)	Zero waste (10; 5.8)
	< 9.28	**CONTRAST ZONE**	**SECOND PERIPHERY**
		Decay (9; 2.9)	Land (9; 5.2)
		Storm (9; 3.8)	Money (8; 4.2)
		Hunger (9; 3.8)	Extreme weather (8; 4.6)
		End of world (9; 3.9)	Tree (8; 5.4)
		Greenhouse effect (8; 2.9)	War (7; 4.7)
		Forest (8; 3.5)	Make a change (7; 5.1)
		Industry (8; 3.5)	Consciousness (7; 5.1)
		Problem (8; 3.6)	Change (7; 5.4)
		Air pollution (8; 3.9)	Demonstration (7; 6)
		Uncertain (7; 3.1)	Environmental pollution (6; 4.2)
		Urgent (6; 1.8)	Water (6; 4.2)
		Death (6; 2.2)	Fossil energy (6; 4.3)
		Sea level rising (6; 3)	Famine (6; 4.7)
		Illness (6; 3.8)	Desert (6; 4.7)
		Heat (5; 3)	Consumer society (6; 4.8)
		Flood (5; 3.2)	Natural disaster (6; 5)
		Anger (5; 3.4)	Informed (6; 6.2)
		Temperature (5; 3.4)	Comfort (6; 6.5)
		Hotness (5; 3.6)	Climate (5; 4.2)
		Weather (5; 3.6)	Activism (5; 5.2)
		Polar bear (5; 3.8)	Renewable energy (5; 5.2)
		Pollution (5; 4)	**Anxiety (5; 5.2)**
			Selfish (5; 5.4)
			Ignorant (5; 5.4)
			Greed (5; 6.2)
			Will to act (5; 6.2)
			Hope (5; 6.4)

Note. The size of the corpus was 988. In the analysis, 68% of corpus ($N = 675$) was included (hapax = 42, 4%), the minimum occurence was 5.

minimum threshold of occurrence a frequency equal to 9. In this way, we could gain a clearer view of the organization by keeping only the most frequent words. Thus, 57% ($N = 903$) of the total corpus was processed. Regarding the anxiety groups, we indicate the minimum occurrence when discussing the relevant section.

Third, we examined whether groups of respondents characterized by different levels of anxiety associated peculiar contents to climate change. To this purpose, we applied the specificity analysis. Similarly to chi-square, the analysis compares the frequency of words within a given subcorpus with the ones observed in the remaining part of the textual corpus. Iramuteq provides a specificity indicator based on the hypergeometric distribution model.[4] The closer the indicator is to zero, the more generic its distribution is. A value equal to or above |2| (corresponding to a p-value

Table 4. Result of the prototypical analysis on the SR of Anxiety Group 3 ($N = 62$).

		Rank	
		<= 3.75	> 3.75
Frequency	>= 4.15	**CENTRAL ELEMENTS** Ice melting (7; 2.7) Extinction (6; 2.5) Death (6; 2.7) Forest fire (5; 1.4) Warming (5; 2.2) End of world (5; 3.2)	**FIRST PERIPHERY** Hunger (7; 4.1) Plastic (6; 3.8) Species extinction (6; 4.2) Politics (6; 5.8) Catastophe (5; 4.2) War (5; 5.2)
	< 4.15	**CONTRAST ZONE** Problem (4; 2.2) Land (4; 2.8) Inertia (4; 3) Deforestation (4; 3) Danger (4; 3.5) Desert (3; 1.7) Warm (3; 2.3) Unavoidable (3; 2.3) **Fear (3; 3)** Famine (3; 3) Carbon dioxide (3; 3) Extreme weather (3; 3.3) Zero waste (3; 3.3) Action (3; 3.3) Fossil energy (3; 3.3) Irresponsibility (3; 3.7)	**SECOND PERIPHERY** Animal (4; 3.8) Water shortage (4; 3.8) Trump (4; 4.5) Garbage (4; 4.5) Nature (4; 5) Cooperation (4; 5.5) **Anxiety (4; 6.5)** Change (3; 4.3) Humanity (3; 6.3) Illness (3; 6.7) Migration (3; 7.7)

Note. The size of the corpus was 287. In the analysis, 56% of corpus ($N = 162$) was included (hapax = 69, 24%), the minimum occurence was 3.

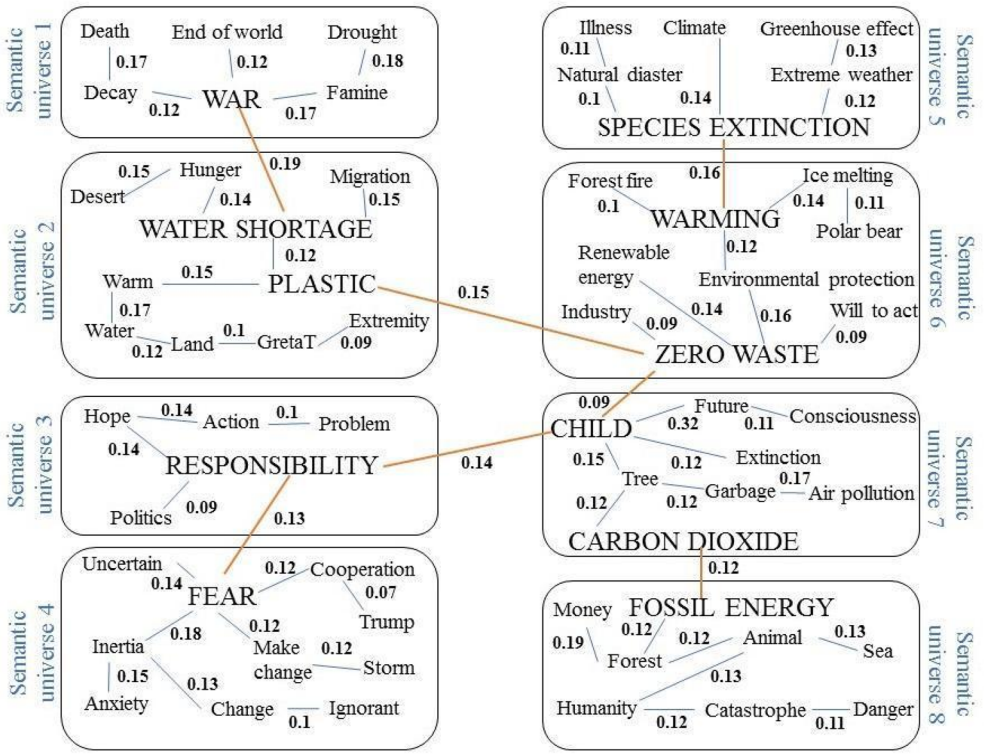

Figure 1. Result of the similarity analysis on the SR.
Note. Words in uppercase indicate those associations which are involved in making connections with other universes.

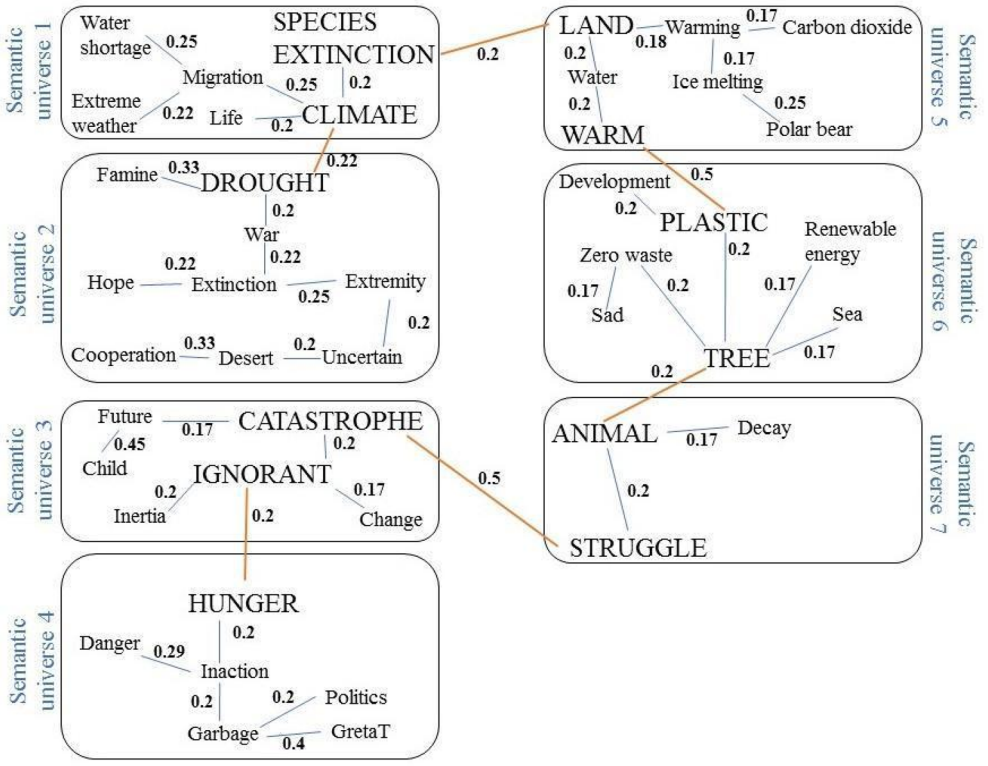

Figure 2. Result of the similarity analysis on the SR of Anxiety Group 1.

less than or equal to 0.01[5]) indicates an overrepresentation or underrepresentation (positive or negative values, respectively) in the distribution of lexical form as a function of the categorical variable under consideration (Sousa, 2021). In our case, we applied specificity analysis to compare the subcorpus of free associations evoked by groups of respondents defined by anxiety levels. The analysis thus identifies the words that show a statistically significant probability of being over- or under-associated with climate change by respondents with low, intermediate, and high levels of anxiety. Finally, in order to deepen the role of emotions in the anchoring process, prototypical and similarity analyses were applied separately to each of the three groups of respondents characterized by low, intermediate, and high levels of anxiety.

Results

First, the SR of the entire population is characterized based on the results of the prototypical and then of the similarity analysis.

Prototypical analysis: SR of global climate change

Central to the population's understanding (Table 1) are elements that refer to proximal and distal natural consequences (e.g., warming, ice melting), also consequences on

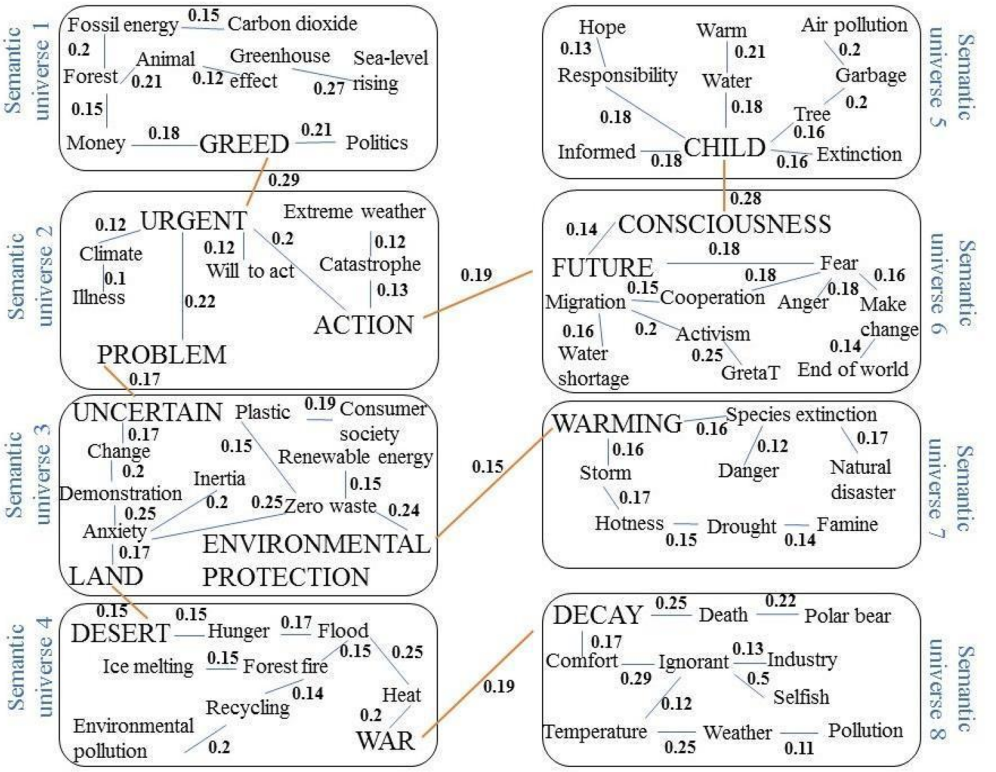

Figure 3. Result of the similarity analysis on the SR of Anxiety Group 2.

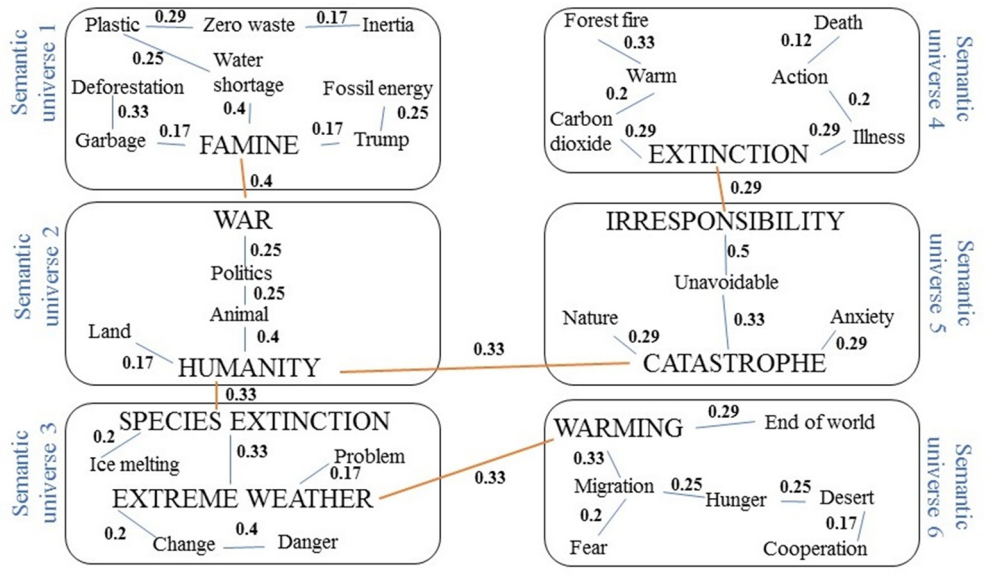

Figure 4. Result of the similarity analysis on SR of Anxiety Group 3.

the human world (e.g., death, hunger), and associations of anthropogenic causes such as carbon dioxide. Words indicating the anchoring process appeared as well, such as catastrophe, danger, or problem, which could underlie the appearance of fear in this part, as climate change is a fearful issue. Associations of the contrast zone referred mainly to local (e.g., weather, storm) and global (e.g., sea-level rising) natural consequences. The polar bear symbol was included here, and associating Trump might be an attempt at personification, as well as defining a possible position to the concern. Words referring to defining climate change (e.g., uncertain, threat), causes (e.g., deforestation), emotions (worry, sadness), and action (environmental protection) also appeared, but in less frequent numbers. The first periphery quadrant did not contain elements referring to emotions, causes, or definitions, although most words referred to the aspects of the human world: consequences (e.g., future, migration), actions (e.g., zero waste, cooperation), and positions (e.g., politics, responsibility). The second periphery quadrant contained elements referring to mainly natural consequences (e.g., sea, natural disaster), actions (e.g., will to act, demonstration), positions (e.g., humanity, ignorant), and causes (e.g., fossil energy, pollution). Emotions such as anxiety, anger, and hope were positioned here. Various, negative and positive emotions were evoked, but less frequently compared to other expressions. The most frequent among them were fear, anxiety, and hope, while worry, sadness, and fear appeared more salient.

Similarity analysis: SR of global climate change

Eight semantic universes emerged in the SR (Figure 1), in which elements were connected weakly as the Jaccard indexes tended to be closer to zero. The strongest relationship was between child and future (0.32). The seventh and the sixth semantic universes seemed to occupy a central space in the organization because they were related to each other and two other fields (3, 8, and 2, 5). The sixth universe referred to warming-related problems (e.g., ice melting) and actions against them (e.g., environmental protection). It was connected to the seventh universe that seemed to represent individual-level consequences (e.g., child) and personal contribution to the issue (e.g., carbon dioxide). This last part then connected to the eighth universe, in which the effects of one's contributions to the environment appeared (e.g., forest). The sixth universe was related through warming to the fifth universe, which represented natural consequences affecting the human world (e.g., extreme weather). The second semantic universe was connected to the sixth, in which associations around a cause (plastic) and water-related consequences (e.g., water shortage) were organized together. This last part leads to the first universe, which exclusively dealt with consequences impacting the human world (e.g., famine and death). The seventh universe was connected to the third one, which emphasized the perceived responsibility in addressing the problem and the hope and need for action. In the fourth universe, fear seemed to have a constituting role because every other association was organized around it. These associations can represent both elements that could induce (e.g., uncertain, inertia) or reduce (e.g., cooperation) fear, or both at the same time (e.g., make a change—as change might be fearful sometimes). Anxiety was positioned here as well, connected to inertia.

In the next section, we examine the representations created by anxiety as a psychological anchor. The three representational fields are first compared on the basis of the specificity analysis. Second, we characterize them separately based on the results of the prototypical and then of similarity analysis.

Specificities analysis: representational content of the anxiety groups[6]

The least anxious group's typical associations presented a seemingly distant position from the object which might be connected to the future (future, 1.57), distant locations (sea, 1.47), and consequences (sad, 1.76), while actions and negative evaluations were associated the least (make a change, −0.89, catastrophe, −0.88, action, −0.84, end of the world, −0.79). The medium anxious group's typical associations might inform us about a responsible and conscious approach to climate change (responsibility, 1.23, consumer society, 1.22, comfort, 1.22, informed, 1.22), while the least typical ones suggest that it might be represented as somewhat controllable (hopeless, −1.72, sad, −1.53, time, −1.29, war, −1.24). The most anxious group's typical associations might represent the issue as unavoidable for humans and nature as well (death, 1.69, hunger, 1.51, nature, 1.49, deforestation, 1.49), while the least typical ones propose not thinking in perspectives (child, −1.63, future, −1.59, responsibility, −1.14, warming, −0.92). At the same time, it is important to emphasize that none of the words reached the value of |2|, so we cannot say that the groups have a specific vocabulary.

Representation of anxiety group 1: prototypical and similarity analysis

The least anxious group anchored climate change as a danger, defining it as uncertain (Table 2). Biophysical impacts such as warming, ice melting, drought, and war as an impact on the human world positioned centrally. Associations of the contrast zone included emotions, which were positioned along with words referring to natural consequences of climate change (e.g., warm, polar bear), to impacts on the human world (e.g., water shortage, famine), and also to mainly passive human positions (e.g., inertia, ignorant). The first periphery represented mostly consequences related to humanity (future, migration, child) and the action of cooperation. The second periphery mainly included human-related aspects: consequences and possible actions (e.g., renewable energy, zero waste), in less frequent numbers, causes (e.g., plastic), and human positions (e.g., inaction).

Seven semantic universes emerged in the SR (Figure 2), in which elements were connected a little stronger, as most Jaccard indexes tended to be above 0.2. The strongest relationships were between warm and plastic, struggle and catastrophe (0.5) but there was no semantic universe that occupied a central space. In the sixth semantic universe, the possible main cause (plastic) was represented by the impacted fields (sea, tree) and the actions (e.g., zero waste) that might reduce the damages. Through these impacts this universe was connected to the seventh one, the main word of which, struggle, could be an evaluation of wasted efforts that leads to negative outcomes represented in the third semantic universe (e.g., catastrophe). The third universe moreover contained human positions, through which the fourth universe containing

the impact of hunger was connected. The sixth universe was also connected to the fifth one, which contained words referring to warming and related concepts, connecting to natural consequences disrupting human systems. The second universe represented drought's impact and its consequences on the human world. Words referring to emotions did not play constitutive roles in this representational field. Hope was connected to extinction in the second semantic universe, while sadness was related to zero waste in the sixth semantic universe.

Representation of anxiety group 2: prototypical and similarity analysis

Potential central elements of the medium anxious group referred to biophysical consequences (e.g., warming, ice melting), anthropogenic causes (e.g., plastic, carbon dioxide), and the human position of inertia, and environmental protection as possible action (Table 3). Climate change was anchored as a catastrophe, a danger, which is problematic, uncertain, and urgent. Associations of the contrast zone mostly included natural and human-related consequences (e.g., storm, hunger) and anthropogenic causes (e.g., industry, pollution). The peripheries contained both individual and public actions (e.g., cooperation, zero waste, demonstration), beneficial and detrimental human positions (e.g., responsibility, consciousness, selfish, ignorant), and anthropogenic causes and consequences (e.g., environmental pollution, migration). More words referring to emotions appeared in this representational field: fear was central, anxiety and hope peripheral, and anger in the contrast zone.

In the eight semantic universes (Figure 3), elements were rather weakly connected, as most Jaccard indexes tended to be closer to zero. The strongest relationship was between ignorant and selfish (0.5). The second and third semantic universes seemed to occupy a central space because they were related to each other and two other fields (1, 6, and 4, 7). These fields contained associations that referred to the nature of the issue (e.g., urgent, problem, uncertain) and outcomes (e.g., extreme weather) but also to the need for actions (e.g., action, change, demonstration). The second universe was connected to the first one, in which the human position of greed, its roots (e.g., money, politics), and effects (e.g., forest, animal) were represented. It was also related to the sixth one, which could symbolize a different kind of perspective. This universe is organized around the possible future, which could be fearful (e.g., fear, migration) but motivating to act as well (e.g., cooperation, making a change). Through consciousness, the sixth universe is connected to the fifth, in which impacts were placed closer to the individual level (child) containing words that can prevent (e.g., informed, responsibility) and worsen the situation (e.g., extinction, air pollution). The third universe was connected to the fourth and seventh ones through the main impacts of desert and warming, these contain mostly natural and human-related consequences (e.g., storm, famine, flood, hunger). The eighth universe was similar to the first one, it represented the roots (e.g., comfort) and effects of ignorance on the environment (e.g., weather). Fear seemed to play a central role in the sixth semantic field because most of the associations were connected to it, even anger. Hope was connected to responsibility in the fifth semantic universe, while anxiety was positioned in the third, on the one hand, connected to inertia and on the other, connected to two types of actions.

Representation of anxiety group 3: prototypical and similarity analysis

The most anxious group anchored climate change as the end of the world, which is moreover problematic, dangerous, and unavoidable (Table 4). Possible central elements of the SR referred to natural (ice melting, forest fire, warming) and human-related consequences (death, extinction). In the contrast zone consequences were mainly represented (e.g., desert, famine), but less frequently causes (e.g., deforestation), actions (e.g., zero waste), and human positions (e.g., irresponsibility) were also present along with fear. The first and second peripheries consisted mainly of words referring to human aspects (e.g., hunger, plastic) and anxiety was positioned peripherally as well.

Elements in six semantic universes were connected a bit stronger, as the majority of Jaccard indexes tended to be above 0.2 (Figure 4). The strongest relationship was between irresponsibility and unavoidable (0.5). The second semantic universe occupied a central space because it was related to three other fields (1, 3, and 5). In this field, humanity was positioned centrally, which was connected, on the one hand, to the first universe representing consequences affecting the human world, causes, and actions, and on the other, to the third universe containing associations of natural consequences. This last universe was related to the sixth one, which represented the impact of warming along with its effects on the human world. The second universe was connected to the fifth one through the impact of catastrophe possibly rooted in irresponsibility. This word creates a connection with the fourth universe, in which associations refer to impacts on the human world and a cause as well. Anxiety was positioned in the fifth semantic universe, while fear was in the sixth semantic universe, but did not play constitutive roles in the organization of this representational field.

Discussion

Overall, this study presents ideas about the interaction of common sense beliefs and emotions engaging in the social construction of risks (Bouriche, 2022; Joffe & O'Connor, 2013). We explored the SR of global climate change and particularly focused on emotions that appear as components of the representational field, and examined the effects of anxiety as a psychological anchor. Climate change has been anchored as a danger, problem, that is uncertain, urgent, and threatening and that could result in catastrophe or death (Breakwell, 2010; Höijer, 2011; Smith & Joffe, 2013). As a possible result, attention has been deployed to negative consequences as associations have referred to them mainly, consistent with previous findings (Baquiano & Mendez, 2015; Böhm & Pfister, 2017; Gaymard et al., 2015; Moloney et al., 2014). Most frequently, biophysical processes have been mentioned as consequences (Moloney et al., 2014). Similar to previous findings, climate change has been objectified as warming and its far-reaching effects prominently, in the forms of concrete weather phenomena, the polar bear symbol (Smith & Joffe, 2013), and various types of pollution (Baquiano & Mendez, 2015; Gaymard et al., 2015; Höijer, 2011; Leiserowitz, 2005; Lorenzoni et al., 2006; Olausson, 2010; Smith & Joffe, 2013). Impacts on the human world have been evoked, as well (Baquiano & Mendez, 2015; Gaymard et al., 2015), which can indicate the integration of a human-focused view into the SR. Consequently, associations concerning

anthropogenic causes, regarding mainly overuse of plastic and over-emission of carbon, and various passive and active human attitudes and actions appeared, which can position the phenomenon in a broader set of social issues (Wolf & Moser, 2011). Climate change has been connected only to Al Gore before (Höijer, 2011), yet, in this case, it has been personified as Trump or Thunberg. At the same time, associating Trump or Thunberg (both being non-Hungarians), global consequences, and connecting responsibility to politics might be an attempt to distance the phenomenon (Smith & Joffe, 2013; Whitmarsh et al., 2011). Several words referring to emotions associated with climate change before have been identified as contents in the representation: fear, anxiety, anger, worry, sadness, and hope (Breakwell, 2015; Brosch, 2021; Flores & Amigón, 2018; Harth, 2021; Höijer, 2010; Piermattéo, 2021). As Breakwell (2015) argued, fear and anxiety can be integral parts of SRs of hazards, and accordingly, fear and anxiety were most frequently associated with global climate change. The possible centrality of fear in the SR might be due to the anchoring of climate change as an environmental danger, and to the various consequences that might objectify climate change more concretely. Fear as part of the representational content can organize other elements (Curelaru et al., 2012), and accordingly, one semantic universe in the internal organization is influenced by this emotion: this universe refers to the need for change, actions, and objects that hinder it. This might resonate with the conclusion that fear is related to pro-environmental behavior, and increases action motivation (Wang et al., 2018). In addition to all that, contents associated with strong feelings such as catastrophe, end of the world, or death have also been identified, which might refer to nexuses (Rouquette, 1994), underlying the emotional nature of the representational object.

We explored climate change's anchoring process through anxiety as a psychological anchor (Bouriche, 2014, 2022; Methivier, 2010; Piermattéo, 2021). Overall, the representations of the groups are not identical (Gaymard et al., 2015), although similar in terms of possible centrality and the manner that the contents are represented and positioned. Possible central elements most frequently referred to as natural consequences (Baquiano & Mendez, 2015; Gaymard et al., 2015): ice melting, warming, and extinction have been represented across groups, which could emphasize the emergent nature of the SR defined by warming. Nevertheless, differences in anchoring, contents, internal organizations based on similarity analyses, and the appearance of emotion words could be observed according to anxiety. Those with low anxiety anchored climate change as an uncertain danger characterized by the impact of warming that affects human systems. This representational field consisted of fewer causes referring to waste problems, actions, and passive attitudes. Sadness was specific to this representation, which could reflect resignation (Brosch, 2021). Those with medium anxiety anchored climate change as a danger, but defined it as urgent and problematic. Climate change has been represented as a complex threat inclusive of human-related aspects, to which change, action, and contributions were central. In this representation, fear was central, which might symbolize the more emotional nature of the representational object to an extent, that still allows thinking in terms of change. Those with high anxiety anchored climate change as the end of the world, which is unavoidable, and fear and anxiety as appropriate emotions appeared. The representation was organized around humanity and its responsibility. Despite this, fewer associations of causes referring to air-related issues, actions, and negative positions appeared.

To conclude, we agree with Baquiano and Mendez (2015): based on the results thus far, respondents perceive climate change similarly, which indicates a cross-culturally emergent representation of climate change. This often does not necessarily stem from direct encounters with the issue, but from information conveyed by the media (Höijer, 2010, 2011). At the same time, differences in the content and organization of the representation might be observed due to specific contexts, for instance, in our sample, focusing on human-related aspects and emotions attached to the representational object. Anxiety as a psychological anchor might also add to this variance: our findings are consistent with the concept that higher anxiety deploys attention to threatening over non-threatening information (Knowles & Olatunji, 2020), resulting in more ominous anchoring. Focusing on the consequences of environmental risks is connected to emotions such as fear and anxiety (Böhm & Pfister, 2017), and this seems to be the precedent with SR of climate change as well. In line with this thought, we argue that lower anxiety seemingly allows thinking in terms of causes and reactions, and anxiety might motivate real action (Ojala et al., 2021; Stanley et al., 2021; Stollberg & Jonas, 2021). As an outlook, we would like to draw attention to emotions' role in climate communication. It is still discussed whether fear appeals in climate communication might be useful (Brosch, 2021). Our results suggest that fear appeals might only reach those with medium anxiety, as fear is central to their representation and might activate different representational elements referring to actions. Those with lower anxiety might be unaffected, as fear is not part of their representation. Those with higher anxiety might be discouraged from acting, as fear might strengthen the elements referring to the uncontrollable nature of the issue. To sum up, fear appeals could be effective to a certain kind of audience, but the focus should be placed also on other emotions' effects.

Limitations and conclusions

Considering the study's limitations, firstly, although the applied analyses provided insight into the possible arrangement of the representation, at the same time, they could not account for its structure with certainty. Additional analysis could confirm the associations' centrality (Lo Monaco et al., 2016). Secondly, we conceptualized anxiety as a dispositional emotion, which, depending on its levels, organized the representation differently, but did not account for specific vocabularies. It could bring interesting results to link anxiety much more to climate change: for example, to examine the effect of eco-anxiety (Ojala et al., 2021) on the representation. Thirdly, based on perceptual, theoretical-appraisal studies, emotions influence information processing differently (Böhm & Pfister, 2017; Keller et al., 2012), so they probably impact SRs as well. Based on this, it would be worthwhile to examine other emotions and compare their effects on representations, even with a different procedure that does not require a questionnaire (e.g., Joffe & Elsey, 2014; Leiserowitz, 2005; Sarrica et al., 2019; Sarrica et al., 2015). And finally, in line with the previous thought, our research might reflect the first three phases of Bouriche's fresh theoretical proposal (2022). A full articulation of the integrative framework in research could account for a more complex view of SRs as cognitive-emotional processes. In this manner, representational fields could be nuanced and embedded more in the social context.

The main contribution of the study is its focus on emotions: considering them both as components and anchors of representations may represent an integrative approach to examining the social construction of risks. In sum, we believe we contributed to the studies of the interrelation between SRs and emotions, to the representational research on global climate change, and to the study of emotions from a socio-constructivist perspective.

Notes

1. Iramuteq software was used to perform the analyses (iramuteq.org, Ratinaud, 2019).
2. Words that occur only once.
3. The Jaccard index between two words, A and B, is $J(A, B) = |A \cap B|/|A \cup B|$, thus, the instances the two words appear together (intersection) divided by their total appearance (union) (Kent & Coker, 1992).
4. The hypergeometric distribution is a discrete probability distribution that calculates the likelihood an event happens k times in n trials when you are sampling from a small population without replacement (Ratinaud, 2019; Sousa, 2021).
5. Iramuteq's specificity indicator represents the decimal logarithm of a probability. For example, a result greater than 3 indicates that there is less than one in a thousand chance of getting as high a frequency of the word in the partition as the one that was found (Sousa, 2021).
6. The four most and least typical words by the group are presented in the brackets, followed by their specificity index.

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