Risk perception: a field of interest for the interface between environment, health, and sustainability

Percepção de risco: um campo de interesse para a interface ambiente, saúde e sustentabilidade[1]

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Abstract

In this article, the authors discuss the complex field of perception, more specifically of the perception of risk, drawing on a theoretical and methodological essay that seeks to stress the importance of risk perception in studies related to the interface environment, health and sustainability. Recognizing that social and cultural elements shape in direct and indirect ways individual's perceptions of different risks, the authors flag that studies in this field can point out specific interests, values, and points of conflicts that exist in the arenas and offer insights that would help decision makers improve their decision making processes with greater involvement of society. In addition to risk perception, the article also discusses examples of investigations conducted by the authors focusing on environmental perception. Searching for a critical perspective to cover the subject, the authors recognize the need to understand, in environmental and societal processes, the setting of socio-environmental risks and how they are perceived.

Keywords: Perception; Risk; Theoretical Approaches; Methodological Possibilities; Interdisciplinarity.

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Resumo

Neste artigo, os autores discutem o complexo campo da percepção, em particular da percepção de risco, a partir de um ensaio de natureza teórica e metodológica que busca destacar a sua relevância em pesquisas que dialogam com a interface ambiente, saúde e sustentabilidade. Reconhecendo que fatores sociais e culturais influenciam direta e indiretamente as percepções que os indivíduos têm sobre diferentes riscos, os autores sinalizam que estudos nesse campo podem evidenciar os interesses, os valores e os pontos de conflitos existentes nas arenas e oferecer *insights* que ajudariam os tomadores de decisão a aperfeiçoar processos decisórios com maior envolvimento da sociedade. Para além da percepção de risco, o artigo discute também exemplos de investigações conduzidas pelos autores com enfoque sobre percepção ambiental. Buscando uma perspectiva crítica para tratar o tema, reconhecem a necessidade de compreender nos processos ambientais e em contextos sociais a configuração dos riscos socioambientais e suas percepções.

Palavras-chave: Percepção; Risco; Abordagens Teóricas; Possibilidades Metodológicas; Interdisciplinaridade.

Introduction

In the 1960s, the British anthropologist Mary Douglas pointed to the fact that the selection of what is considered dangerous and the strategies to face it are socially constructed (Douglas, 1966, 1996; Lupton, 1999). In this understanding, judgment about risk would be political, moral, aesthetic and built through cultural frameworks.

This anthropologist's view on the judgment of risk is an interesting starting point to think about the concept of risk perception, understood as the processing of physical signals and / or event information of potentially dangerous activities and the formation of judgement about the seriousness, probability and acceptability of a relevant event or activity[2] (Renn, 2008).

The risk perception field emerged as sub-discipline in 1969, at the roots of the debates motivated by the article *Social Benefit Versus Technological Risk*, written by the engineer Chauncey Starr and published in the journal Science. Douglas (1996) contextualizes the emergence of this discipline in a time when a criticism movement was rising—one that spread and achieved broad support—against nuclear and chemical waste, against inadequate protection of people who worked with asbestos and against the contamination of atmosphere and water.

The current debate on risk perception considers, in particular, that social and cultural factors influence directly and indirectly the perceptions that people have about different risks. Among these factors are aesthetic judgments, contextual variables, semantic images, values, effects of communication (including the media), trust in organizations and institutions (at their various levels) involved in the regulation and management of risk, cultural prototypes, political arenas and global feel of individualized and pluralistic societies, among others (Kasperson; Kasperson, 2005; Marandola Jr; Hogan, 2009; Renn, 2008, 2011; Leiserowitz et al, 2012;. Oreskes, 2007; Weber, 2010; Schipper, 2008 ; Giddens, 2009; Flynn, Slovic, 2000; Douglas; Thompson; Verweij, 2003; Herber, 2004; Brody et al, 2008;. Slovic et al, 2010).

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2 Physical signs are understood as the direct observations that individuals make through their senses; Information refers to the exchange of verbal and nonverbal messages about uncertain consequences of events or activities (Renn, 2008).

Based on the field of risk perception, from its different theoretical perspectives and methodological possibilities, in this article the theme is analyzed with special attention to its use in studies that dialogue with the interface environment, health and sustainability, from examples of studies on risk perception and environmental perception that sought to highlight what matters to individuals, the points of conflict, their beliefs and disbeliefs and existing values stand out.

What weighs in our risk perceptions

Perceptions include qualitative considerations, such as fear, catastrophic potential, controllable character of events, equity, uncertainty, risk for future generations and trust, as well as the descriptive facts in the risk equation. Although loaded with value, these qualitative considerations reflect legitimate questions with great social and political significance and must be taken into account in political decisions about risk (Flynn; Slovic, 2000, p 110.)

Herber (2004) also points out the question of identity as an important element in risk perception. For the author, individuals, even when living in areas considered at risk, have strong attachment to the place where they live and understand that the place where they were born and grew up is very important to build and give continuity to their identities. Experiences that involve living in a contaminated or slide-susceptible area, forced relocations due to environmental risks or changes in the physical landscape can be traumatic and cause a sense of loss or grief in the affected individuals.

Bringing this debate to studies related to global environmental changes, in particular to climate phenomena, Weber (2010) argues that there are multiple reasons that answer why the public in general may differ in opinion about climate change and the risks associated to it. The reasons, according to him, are psychological and cultural and relate to perceptions that individuals have about changes triggered by climate. According to the author, while for scientists these perceptions are strongly based on the analysis process and the results obtained with the use of analytical tools, for the public the perceptions are being built in the midst of a process of association and affectivity, based on information that individuals have, in the attention they give to the subject and in the trust they have in the data made public. Moreover, personal experiences, such as the knowledge level achieved (through publication of statistics, evidence and facts), contribute to perceptions[3].

Brody et al. (2008), when analyzing the perceptions of risks associated with climate change, make evident how the focus on location and proximity is important in this process. For these authors, individuals tend to perceive a higher risk associated with climate change if they reside in areas that: (i) have statistically significant experience of temperature change over time; (ii) are prone to natural disasters; and (iii) have high carbon dioxide emission levels. Considering the risks indicators associated with physical places, they argue that the perception tends to be higher if individuals reside: (i) near the coastal zone; (ii) in low altitude coastal zones; (iii) in areas at high risk of rising of sea level and flooding; and (iv) in flood plains, where the negative effects of increased rainfall and associated storms will be more strongly felt.

Wardekker (2004) also notes that the absence of a sense of urgency and responsibility about the problem of climate change among citizens and stakeholders is, too, an issue related to the communication of the risks associated to this phenomenon. Moreover, since the effects of climate change are referred to as psychologically remote, often seen as distant in time and space, perceptions of individuals are diverse and contextual.

Several trends

When reviewing studies related to risk perception, Renn (2008) highlights three main trends: the psychological one, the cultural one, and the social one.

3 Is worth remembering that if the public is influenced by emotion and by the affections of both simple and sophisticated nature, so are scientists. The public is influenced by worldviews, ideologies, values and their social context. The same goes for scientists (Flynn; Slovic, 2000, p. 126)

In this article, the authors briefly revisit some of these theoretical perspectives, in order to facilitate the understanding of the field of risk perception, without exhausting other approaches and the density of each presented perspective.

For psychological studies, one of the approaches adopted is based on the idea that most risks are not experienced directly by human senses but are learned through communication—in this case, the perception of risk is not as much a product of personal experience or evidence, but a result of social communication. This approach considers the fact that we use strategies to select information about risk, since there is a difference between the amount of information we receive on a daily basis and what we can, in fact, process and remember. The strategies, in this case, involve ability (physical possibility of receiving a message without distraction) and motivation (the receiver's interest in processing the message). This approach also considers the processing of information: if, once received, it is studied in depth or whether we choose to make a quick judgment.

The cognitive heuristics approach considers triggered mechanisms that process the information and help the receiver make inferences. The term "heuristic" thus denotes the subconscious process of evaluating information and making choices (Patt; Dessai, 2005). Therefore, as pointed out by Renn (2008), the intuitive biases in risk perception would include: (i) availability—events that people remember immediately are seen as more likely; (ii) anchor effect—odds are estimated according to the plausibility of the contextual relations of cause and effect, not on the knowledge of statistical frequencies; (iii) representation—there is a difference between personal experiences and experiences that occurred to others; and (iv) cognitive divergence—unknown information is often ignored or underestimated.

The psychometric approach, on the other hand, considers that risk is a subjective estimate of individual fears and expectations about undesirable consequences related to an activity or event. Using standardized questionnaires, psychological scales and multivariate analysis, psychometric studies seek to build cognitive maps of risk perception to discover general patterns and causalities (Zinn, 2008). They analyze judgment on the nature and magnitude of the risk from four points of view: i) focus on personal preferences for probability and try to explain why individuals do not base their judgments of risk on expected values, as analyzes and decisions suggest; ii) more specific studies on perception of probabilities in decision making have identified several biases in the ability of individuals to make inferences from probabilistic information; iii) studies on risk perception show the importance of contextual variables (e.g. number of fatalities, losses, catastrophic potential, situational characteristics, beliefs) on individual estimates and assessments of risk; and iv) these same studies have revealed that the different meanings assigned to risk depend on the context in which the term is used (Jaeger et al., 2001).

The repercussions of psychometric studies have gained momentum with the work of psychologist Paul Slovic and colleagues and have shown, for example, that the acceptance of certain risks is related to the seriousness and the catastrophic potential even when the probability is quite low. Risks with low probability, but more extreme consequences are perceived as more threatening than those of more moderate consequences. They also show that having personal control over a risk or being more familiar with it are factors that can decrease an individuals' perception of risk (Slovic, 1987; Lupton, 1999).

Still within the psychological trend, there is the approach that focuses on semantic images, based on the idea that individuals construct their own reality and evaluate the risk according to their subjective perceptions. Intuition is thus based on how risk is communicated and the mechanisms used to process uncertainties and contextual characteristics. Semantic images of risk include pending danger, a twist of fate, personal emotion / excitement, games and indicators of an insidious danger.

As Renn (2008) argues, psychological studies based on some field theories, despite their potential, do not focus on the issues of which social or cultural stimuli evoke certain standards or why specific attributes are associated with different types of risk.

In an attempt to obtain those answers, sociological and cultural studies on risk perception tend to consider cultural values, perspectives of the world, institutional relations and the social climate.

In general, as Hannigan (2006) recognizes, the sociological perspectives on risk focus on (i) analyzing how the perceptions of risk differ between groups that deal with different life opportunities and in understanding if the framework of individual choices is mainly a consequence of the differences of power between social actors; (ii) the search for a model that (re)conceptualizes the problem of risk perception considering the social context in which human perceptions are formed, taking into account that individual perception is affected by primary influences (friends, family, co- work) and secondary (public figures, media) that act as filters of information dissemination in the community; (iii) in the idea that risks, especially those of technological origin, have been understood as one component of a complex organizational system—in other words, they are inherent to the technological device.

One of the aspects of sociological and cultural studies on risk perception focuses on how values are a guide for judgment and how they drive behavior. This approach aims to show that the risks are loaded with traditional and ethical values, which have indirect roles in risk perceptions, act as selection and attention filters and add an emotional bias in the processing and consideration of conflicting information about risk (Renn, 2008).

Another trend, better known as a cultural approach, is characterized by the emphasis on the cultural character of all risk settings, which leads to the blurring of differences between laymen and experts and differentiation of multiple rationality of social actors in dealing with risks. When the anthropologist Mary Douglas—greatest expression of this approach—pointed out that the risk analysis conducted by experts and used to stipulate the limits of what would or not be an acceptable risk was not rational, she not only showed that there were no logical elements in these valuation techniques, but also made evident the cultural relativism, by questioning modern reasoning and blind faith in the autonomy of scientists and experts in deciding what risks people should or not take. Following the feverous debate of the 1960s about culture's contributions to interpretation of the real world and about the excess of objectivity and reductionism of science, the author introduced the cultural dimension to the

discourse about risk and showed that the selection and responses to risks are influenced by the socio-cultural organization of a social group (Douglas, 1966; Lupton, 1999).

This approach attempts to focus on the significance of culture as a mediator between action and structure, to look at the symbolic construct of the meaning of discourse and narratives and understand the risks as experience embodied concretely, thereby pointing out the moral issues and power relationships associated with the risks studied (Lupton, 1999; Douglas, 1966, 1994, 1996; Douglas; Wildavsky, 1982; Di Giulio, 2012).

On the other hand, the branch that focuses on trust and credibility in studies on risk perception seeks to show how these elements are important in processing of signals and information and in the formation of judgement. The first sociological studies on risk perceptions, as Zinn (2008) recognizes, assumed the superiority of technical and scientific knowledge and considered as inferior the general public's understanding about technologies and risks, a direct result of lack of information and irrational influences and emotions. Studies conducted by Wynne (1989a, 1989b, 1989c), however, showed that the general public does not act irrationally, but follows another social and / or subjective rationality that includes their own experiences and the experiences and failures of experts. These studies have, therefore, shown that the issue of trust is fundamental to understanding the controversy between the lay public and experts, noting that risk perceptions are built according to the degree of confidence the public has in the institutions responsible for administration and management of risk. For this author, lay responses to risk and information about risk are supported by a rationality that emerges from their experiences and judgments of credibility and their trust in institutions that assume their control, involving issues such as performance, attitudes, openness or transparency of industries and regulatory agencies.

Still in the perspective of knowledge and information expert systems it is possible to perceive, as noted by Giddens (1996), the influence of globalization interfering in real needs and local capabilities of response and the creation of *artificial*

uncertainties. Hence, given the specificities of the 'new risks'—artificially manufactured, caused by scientific and technological development, with serious consequences and difficult to estimate—and in the absence of 'super experts' on who we can rely to make decisions, the calculation of risks also includes the risk of deciding which expert to consult or which authority to obey (Giddens, 1996).

In a more structuralist perspective, the approach of *Social Amplification of Risk* (SAR) is dedicated to the effort of understanding the effects of information on the amplification or attenuation of the perceptions about a particular risk. Developed from the studies of Kasperson and colleagues, with the publication of the article *The social amplification of risk: a conceptual framework*, in the journal Risk Analysis in 1988, the SAR is based on a dilemma identified by the authors in contemporary societies: the need to use risk analysis to design public policies and the inability of the concepts about risk to anticipate and explain the nature of the public's response to it. Kasperson and colleagues suggest this approach in an attempt to integrate to the technical analysis of risk, cultural and social factors and individual responses that shape the experience of risk. The SAR, whose main focus is the perception and communication of risk, assumes that the perception of risk is primarily determined by how it is communicated through the media[4] and other sources. The analysis of how this information is communicated could explain thus the gain or attenuation of concerns about a certain risk (Pidgeon; Kasperson; Slovic, 2003).

The approach of social amplification of risk considers that information processes, institutional structures, behavior of a social group and individual responses shape the social experience of risk and thus contribute to its consequences that go beyond damage to the environment and human health (Kasperson; Kasperson, 2005). In short, it assumes that the hazards and their material characteristics are real enough, but also interact with a number of psychological, social and cultural processes in a way that risk indicators are transformed. These signals are subject to a filter, going through several stages of social amplification (scientists, media, government agencies, politicians, interests of economic groups), resulting in the enhancement or attenuation of the aspects of risk.

The approach of reflexive modernization also seems to try to bring closer the psychological approaches and those of more socio-cultural character to understand the perceptions of risk. As summarized by Renn (2008), reflexive modernization, proposed with basis in the studies of Beck and Giddens, refers to the consequences of modernity, which include individualization, pluralization of knowledge and moral standards and globalization (of world trade, production, consumption, communication and cultural world perspectives). Generally speaking, this approach comes from the idea that the rationality goal of modernity (instrumental rationality, efficiency, justice through economic growth, constant improvement of individual living conditions due to scientific and technological progress) have lost their rightful power. The inability of science and technology to solve social conflicts and the plurality of knowledge (in other words, the ambiguity[5] in addressing the complex problems of the current risks) have led the public to growing irritation (Renn, 2008). As a result of this confusion about the merits and risks of modernization, individuals share a general skepticism about the role of science and technology in the production of social benefits and about the belief in progress.

As noted by Beck (1995), when it is not possible for human senses to distinguish risks, these become a combination of scientific rationale, institutional deliberation and efforts of environmental organizations.

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4 Hansen (2000) argues that the media is a key public arena in which the voices, definitions and claims are publicly exposed and compete with each other for legitimacy. Therefore, the media plays a central role in reinvigorating the public sphere and can be directed to create a new forum for public discourse. In terms of risks, the media plays a crucial role in the organization and dissemination of knowledge about political and economic decisions regarding the control of the uncertainties associated with risk. Faced by scientific uncertainties, the lay public, as argued by Allan, Adam and Carter (2000), looks to the media to understand what is at stake. Journalists thus have a responsibility to challenge, dispel myths, investigate and critically produce their analysis of these uncertainties to the public, relating them to the experiences of modern life.

5 Ambiguity, in the sense of coping with risk, is understood as giving space to different, meaningful and legitimate interpretations of acceptable outcomes of the assessment (Renn, 2008).

By focusing on the symbolic level of the risk legitimization process (addressing questions about how risks are made legit, negotiated and justified by regulators without prior consent or greater participation of the public in these decisions), the reflexive modernization approach assumes that most people reject a worldview in which knowledge and moral judgments are considered arbitrary. However, confused because of the plurality of lifestyles and values at stake, people look for "mental anchors" that can provide them with a sense of security and stability. These anchors, which directly and indirectly influence their perceptions, include, for example, religious beliefs, faith in an enlightened rationality and in the governance system, reliance on judgments of a reference group or revitalization of traditional values.

Another approach that tries to make a connection between the psychological approaches and those of more socio-cultural character is phenomenology, which, in the words of Merleau-Ponty (1962), seeks to bring to light the internal relations of man with things around him and the interpretation each person develops in face of a certain phenomenon. Authors who also use this approach to study the field of perception understand that the concept of risk should be understood as a phenomenon that exists both in the perceptual level and at the experiential level. This means understanding that risks have a material dimension, thus presenting physical manifestations that interferes in a given spatial organization, and a socio-cultural dimension, which gives them meaning and value while giving them existence (Marandola Jr, 2008).

In the phenomenological approach there is an understanding that the phenomena will be *experienced* by individuals from their life stories, their social and familial relationships, their religious beliefs, their formal academic training or their life experience, as Marandola Jr. (2008) recognized. Therefore, perception is understood as a response of the individual's senses to the external stimuli emitted by the space that surrounds him. In other words, the individual, when understanding certain phenomena that permeate his way of relating to the environment he lives in, is able to take environmental attitudes that transform his own space (Ingold, 2000).

For the authors of ethno-phenomenological perspective, microsituation or "minor behaviors" or even the "sociology of circumstances," according to Goffman (1975), come to make possible the understanding of the meaning of risk behaviors and their accidental forms in the individual's construction.

Methodological possibilities to assess risk perceptions

In general, studies on perception focus on understanding how individuals respond to risk and the information available about such risk, which factors interfere in their responses, how they respond to the social dimensions (implied or otherwise) in their real-life situations, how they define risks, how they feel affected by these risks and how they imagine addressing them.

Therefore, these studies take advantage of several methods. Among the quantitative are, for example, psychological scale, multivariate analysis and standardized questionnaires for conducting surveys. Regarding qualitative methods, the studies may involve semi-structured interviews, random approach of actors in action to capture life stories, focus groups, among others. Considering our empirical experiences, three methods are explored in this article: surveys, semi-structured interviews and focus groups.

Conducting a survey involves the production and application of a standardized data collection tool (questionnaire), which may be aimed at identifying how risks are perceived by individuals and the possibilities of strategies to address them. Thus, the survey allows us to analyze judgment on the nature and magnitude of the risk, focusing on personal preferences and contextual variables (fatalities, losses, catastrophic potential, situational characteristics and beliefs, for example) on individual estimates and assessments of risk, contributing to a better understanding of what the public thinks about a particular issue.

From this perspective, Leiserowitz (2007) reminds us that public opinion is a key component of the socio-political context in which the decision makers operate, especially in situations of risk. Public opinion can force or push for political, economic

and social actions to be taken to deal with certain situations of risk. Public support or opposition to climate policies such as treaties, regulations, taxes and subsidies, for example, are heavily influenced by public perceptions of the risks associated with climate change. Thus, knowing these perceptions is of great importance for the formulation and implementation of public policies.

Although surveys bring relevant insights about judgment on the nature and magnitude of the risk, it provides few insights into the factors that actually influence perceptions of risk.

To be able to assess personal preferences and contextual processes in the individual estimates and valuations of risk, the results obtained from the questionnaire and the analysis of the responses should be cross-checked with results from the application of qualitative methods, which not only complement and enrich the analysis but also contribute to fill any gaps and to improve the understanding of the social reality investigated (Minayo, Sanches, 1993; Bryman, 2006). Among these qualitative methods, the free format, semi-structured interview seems to be an appropriate tool to capture perceptions of risk. This format allows the interviewer to keep track of the topics in discussion, although naturally, and help the conversation flow between participants (Deacon et al., 1998). As with all methods, this type of interview has benefits and limitations to the convenience, understanding, reports and responses, control and comparison, design and digression (Deacon et al., 1998).

As Mason (2002) warns, the choice of semi-structured interviews demands that the researcher has an ontological position, recognizing that the knowledge of the individuals, their visions, understandings, interpretations, experiences and interactions are significant properties of the social reality the research aims to explore. The decision to take depositions as research source means it ill be necessary to extract what is subjective and personal from the reports, allowing to think about the collective dimension and understand the logic of relationships established within the social groups the respondent participates in (Duarte, 2004).

To access potential interviewees, it is possible to use the technique known as snowball. Through this technique, an individual suggests to the researcher the name of another individual, which provides the name of a third person and so on (Atkinson, Flint, 2001). For Penrod et al. (2003), this technique is a non-probabilistic sampling, in which people initially selected for the sample are used as informants and help you find other individuals who necessarily have characteristics that make them "eligible" for research. According to Atkinson and Flint (2001), the snowball technique involves two proposals: i) may be an informal method to reach the target population to be studied involving interviews and that brings advantages for qualitative, exploratory and descriptive studies; but ii) may also be a formal method for making references about a group of individuals that is difficult to be enumerated using other methods such as research involving drug users, prostitution, criminals and disease-carriers.

The technique, widespread in research in social sciences because it is cost-effective and efficient in several studies, requires a degree of trust between researchers and researched so that the initial contact occurs. However, according to these same authors, the snowball method has three shortcomings: i) problems with representativeness and sampling (since sampling is limited, there is a risk of generalizing from the results of a small sample in addition to excluding people who are not connected to the network or who think differently and, therefore, were not mentioned by the first people contacted); ii) difficulties in finding the first informants and starting the snowball process; and iii) difficulties in engaging informants as informal research assistants.

For Penrod et al. (2003), the researcher, when using this technique should be careful not to restrict the survey participants only to those contacted through this process in order to prevent bias in the information collected. To prevent this, the authors also propose the technique known as chains of referrals or multiple snowballs. The idea of this technique is much like that of the snowball (trust that participants will indicate other informants that have lived the phenomenon of interest), however, it requires that multiple networks be strategically accessed, thus ensuring the expansion of the research scope. Therefore, the various chains of informants

(or references) are established and merged to form a sample that more resembles a representative sample of the study group.

A third qualitative method to assess risk perception is the focus group, a qualitative research tool based on group interviews, whose main objective is to provide an understanding of how they form and differentiate perceptions, opinions and attitudes about a fact, product or service. Whereas the perceptions, opinions and attitudes are socially constructed, the focus group method allows a more easy extraction of the participant's expression, since in the interaction process the comments of those involved can stimulate and generate opinions of other participants on the debated issue (Krueger, 1994).

Morgan (1987, 1998), when making a comprehensive review of focus groups, argues that from the point of view of social sciences this method is useful to obtain the interpretations of the participants on the subject under debate and its connections with the issue in a broader context, generate assumptions based on information provided by the participants and subsequently develop questionnaires (for application in surveys and interviews), and capture the participant's perceptions about the issue under debate and seize their experiences and perspectives.

In a focus group, the moderator does not seek to convince, teach, organize or censor participants; his goal is to create an opportunity for others to talk and for him to listen (Morgan, 1998). So it's up to him to provide different types of questions to stimulate and heat the discussion and leave the participants at ease to develop their comments and sustain their arguments. Thus, the moderator can make use of: (i) introductory questions to identify common characteristics among the participants; (ii) introductory questions to ensure the general topic of the debate and provide participants with an opportunity to reflect on their past experiences and their connections with the subject discussed; (iii) transition questions, to help participants observe the issue from a broader perspective; (iv) key questions that, in fact, drive to the study objectives; and (v) finalization questions that should close the discussion, helping participants reflect on the comments made and critically analyze what was discussed (Krueger, 1994).

There are, however, as in other methods used in qualitative research, some limitations. Gondim (2003), when analyzing them, points out some of these limitations, namely: the sample size, noting that the representation of a focus group can make generalization for the study population impractical; the lack of control over moderator performance; the level of response to be considered for analysis in the focus groups, since opinion formation is the result of social interactions and, therefore, the answers are not unique to an individual but emerge in a particular context of group discussion; and the limitations in comparing the results obtained in other focus groups carried out with other investigative techniques.

Research on the interface environment, health and sustainability

Research carried out on the interface environment, health and sustainability has been facing contemporary challenges that require new theoretical and methodological constructs for analysis, in particular to understand the risks associated with the dynamics of the place of residence such as those related to poverty, precarious housing and sanitary conditions, social inequality; risk factors related to environmental changes within communities, associated with industrial development and occupational hazards, urban services and agricultural frontiers; and environmental changes that can be related to globalization, such as the degradation of ecosystems and their life-support services, and climate change.

In this quite diverse and challenging scope, the studies mentioned below, although still supported by more conventional methods and field approaches, have conceptual and methodological value as reference for the field of perception.

Günther and Ribeiro (2002), Ribeiro and Günther (2006) and Ribeiro, Günther and Araujo (2002), for example, by developing research in the municipalities of Espírito Santo do Turvo and Vera Cruz–to investigate effective and continued actions for environmental recovery and conservation as one of the elements to ensure improvements in the quality of living conditions of inhabitants and the sustainable development of the places that house

them—opted for a participatory approach to identify the residents' perception about environmental problems affecting the area studied. Considering that the perception of environmental issues is not only the result of the objective impact of individuals' actual condition, but is also made up of elements of how social intervention and their cultural values act on the experience of these impacts (Jacobi, 1999), the researchers postulated that the social demands and local requirements are based on the assessment of the quality and importance of landscape feature, as well as in the comparison to negative influences and modifying actions.

After assessing the subjects perceived as environmental problems by the communities studied, the results were presented to the communities, which, subsequently participated, in the ranking, selection of priorities and proposal of solutions to environment-health issues deemed most important and feasible to resolve in the short and medium term, thus showing that directing the studies to the analysis of individual and collective insights from the beginning of the project, is a revealing element of environmental problems and a guideline for the steps of the research (Günther and Ribeiro, 2002; Ribeiro and Günther, 2006; Ribeiro, Günther and Araujo, 2002).

In another survey, Alves Filho and Ribeiro (2014) focused on learning the dynamics of life and work in Sustainable Development Projects (*Projetos de Desenvolvimento Sustentável*, PDS) in agrarian reform settlements in the northern / northeastern region of the state of São Paulo, aiming to identify the environmental health scenario of those communities, from the perception of the settled families and other social actors involved. The study aimed to understand the perceptions of the impacts and effects on health of the populations that had been subject to public policies for sustainable rural development.

Using a case study approach, the research made use of the holistic approach and of the ecosystemic focus (Forget; Lebel, 2001) and involved the application of multiple techniques, including focus groups (Morgan, 1987), participant observation and participatory rural appraisal (*diagnóstico rural participativo*, DRP)[6]. For the focus groups, taking into account the topics of the research, the time span for the workshops and the profile of the participating public, three tools were adopted to motivate discussions and understand how perceptions form and differ: (i) timeline; (ii) maps of natural and community resources; and (iii) the problem tree. The topics of environmental health discussed within the focus groups were based on the topics that make up the vision of primary environmental care (*atenção primária ambiental*, APA), namely: a) basic sanitation; b) waste management; c) combating erosion and deforestation; d) pest management and pesticide use; e) protection of water sources; f) animal disease control; g) occupational health (Alves Filho; Ribeiro, 2014).

In the perspective of research more focused on risk perception, dialoguing especially with the approach of social amplification of risk, Di Giulio (2012), based on interviews and analysis of journalistic documents, focused on the elements that influence the perceptions of individuals living in areas with environmental and human exposure to lead. The study shows that among these elements is the way the exposure information was presented by the media and other stakeholders (scientists, environmental technicians, health workers and managers). Other important elements observed were apathy to the problem; affection to the place and, hence, the revolt, denial or confrontation of the problem; the recognition that the risk is a problem of the past; economic interests; social interests; knowledge of the problem; lack of trust in the institutions involved in risk assessment and management; the political-partisan character (with the contamination problem being used for political purposes); the controversies and uncertainties associated with the risk and effects of contamination; the association of the risk with poverty; health problems for future generations; the absence of the exposed communities in the suggestion and implementation of actions and the need to return to everyday life and forget about the problem (Di Giulio, 2012; Di Giulio et al., 2013, Di Giulio et al., 2012; Di Giulio; Pereira; Figueiredo, 2008.)

6 The DRP approach, initially presented by Chambers (1983), has been used as an important social technology for the efforts to development and foment rural areas by the United Nations Food and Agriculture Organization (FAO), in studies involving rural population and communities (FAO, 1999).

In a later study, recognizing the need to expand her theoretical and methodological scope, the author, in a qualitative study based on focus groups and interviews on the northern coast of São Paulo, seeking to identify and understand how individuals (especially those that are potentially exposed and those who need to respond urgently to risk situations) perceive the risks associated with environmental changes, showed that climate change, although concerning for individuals, appear as a relatively low priority compared to other issues (including environmental ones.) Among the factors that influence individuals' perceptions, this study pointed out, for example, the controversial data released about weather forecasts (lack of reliability); the communication of risk, with special note to the lack of access to the results of studies conducted in the region, lack of information and media coverage on the subject, characterized in general by ambiguity and the alerting tone; the emotional attachment to the place; the question of identity; economic and social factors; the religious component and the belief that the risk would not materialize (Di Giulio; Ferreira, 2013; Serrão-Neumman et al., 2013; Di Giulio et al., 2014.)

When thinking about the range of issues that permeate the interface environment, health and sustainability we could cite other topics relevant to the field of perception, such as air quality in urban areas, quality and access to water, waste generation and degradation of soil quality, environmental disasters and extreme events, exposure to emerging and re-emerging contaminants, climate change and human displacement.

In the perspective of a research with national and international interests, the energy issue seems promising, especially considering the current debate on climate change and the need to transition to an energy matrix based on renewable sources.

Considering the Brazilian case[7], it becomes important to research the perception of environmental and health risks associated with the production of biofuels, such as ethanol, particularly in regions where large areas of monoculture of sugarcane and sugarcane and alcohol production industry are sources of emission of greenhouse gases, with great potential for impact on well-being and health of the population.

Despite the large areas of sugarcane plantation in Brazil, world's second largest ethanol producer, with the state of São Paulo as the country's main producer of fuel-grade ethanol, a search on the Scopus database for a 40-year period (1974-2013)[8], showed few public health studies related to the topic. The search on the database, with the keywords *sugarcane, and health and air*, located 33 general publications and, of these, 14 were related to Brazil. Of the 24 scientific articles found, 11 were from Brazil and six from the US. From the 11 Brazilian articles, two publications relate to health and working conditions of sugarcane cutters and the other nine studied possible impacts on the health of the general population. The studies point to impacts on respiratory health and a possible increase in cancer incidence. In none of them, however, were the individuals consulted about their opinions on the risks associated with air pollution coming from agricultural and industrial activities required to produce ethanol from sugarcane. This survey thus confirms that there is a gap in risk perception studies of individuals on these polluting activities.

Final remarks

In this article, we discuss the complex field of risk perception by bringing to debate different theoretical perspectives and methodological possibilities seeking to highlight its relevance in researches that dialogues with the interface environment, health and sustainability.

We aim to indicate the importance of not looking at the socio-environmental phenomena from linear conceptualizations avoiding, thus, considering the

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7 In Brazil, the government in recent years has shown signs of an ambiguous position regarding the future of the national energy matrix. While that seemed to declare its position in favor of biofuels, in a wide political and commercial campaign for expansion of consumption and international marketing of Brazilian ethanol - strongly supported by the context of environmental debates on reducing greenhouse gas emissions - initiating also the ambitious project of exploration and exploitation of oil in the country with the so-called pré-sal.

8 Research done on 07/01/2014

perceptions of risk out of context, out of a 'grammar' specific to social groups.

Broadening our view, as researchers, positively to different perspectives and contributions from the knowledge generated by human, social and environmental sciences, trying to understand environmental changes and social contexts, particularly in the configuration of socio-environmental risks, looks to us as a promising avenue for further research.

Studies that propose to understand perceptions have to resort to an understanding about the relationship between perception and everyday life. As Protesoni (2001) reminds us

"si bien la vida cotidiana se nos presenta como experiencia inmediata, para generar pensamiento sobre ella se requiere mediatizar, poner a jugar la función simbólica. La vida cotidiana no está dada, no es transparente, no se accede a ella directamente, no es superficial, hay que decifrar los múltiples hilos que la componem" (p. 19).

Therefore, the incorporation of conflicts, differences of values, struggles for power, social relations, relations of power and hierarchy, cultural beliefs, trust in institutions, scientific knowledge, experiences, emotions, discourses, practices and collective memories must, increasingly, be seen as fundamental research in the field of risk perception, revealing uncertainties, differences, inequalities and the various interests that are part of real life.

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