

RITA ISABEL DE OLIVEIRA SOARES BRANCO DOMINGUES

**LIVING WITH COASTAL HAZARDS:
PLACE ATTACHMENT AND RISK PERCEPTION AT FARO BEACH**



UNIVERSIDADE DO ALGARVE

Faculdade de Ciências Humanas e Sociais

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**LIVING WITH COASTAL HAZARDS:
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Doutoramento em Psicologia

Trabalho efetuado sob a orientação de:

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Living at the coast...

No other region is more threatened by natural perils than coasts. Fierce winds, storm surges, large waves and tsunamis expend their destructive energy when they reach the coastline.

Wolfgang Kron (2013)

But still...

People are not logical. They are psychological.

Unknown

ABSTRACT

Risk perception and place attachment are constructs frequently studied in the context of environmental hazards. Risk perception is a subjective and emotional judgement about the severity of a risk, and it may be influenced by place attachment, the emotional connection between an individual and a specific place. The interplay between these constructs influences how individuals deal with risks.

Faro Beach is a vulnerable and heavily urbanized settlement in the Ria Formosa barrier island system, exposed to beach erosion and overwash caused by storms, that have resulted in house and road destruction. However, residents, mainly fishermen and their families, have accepted the risks in exchange for benefits that they perceive as largely exceeding potential personal damages. Although residents are aware of the coastal hazards impacting the area, they do not seem worried or prepared to deal with the associated risks, and they refuse to relocate to safer locations. The main goal of this thesis is to understand the psychological variables, particularly risk perception and place attachment, that influence residents' perceptions towards coastal risks.

Both qualitative and quantitative approaches were used. Content analysis of semi-structured interviews with selected stakeholders allowed the development of self-report questionnaires that were applied to Faro Beach residents. Quantitative data were analysed using descriptive and correlational statistics, and relationships between constructs were tested with partial least squares structural equation modelling. Two psychometric instruments aimed at measuring risk perception and sense of place were also developed and validated.

Overall, it was confirmed that Faro Beach residents are aware of the risks they face, most of them have witnessed coastal hazards, but they feel safe living at the beach. A strong emotional attachment to the place, influenced by a long residence time, familial heritage, and social ties, is at the root of residents' low risk perception and unwillingness to relocate to safer grounds. In addition, an optimism bias and the perception that threats are distant in time prevent the adoption of effective

preparedness measures to deal with a potential disaster. Despite some limitations, mainly related to the small samples used, this thesis made significant contributions to environmental psychology and has relevant implications for coastal management.

Keywords: place attachment; risk perception; preparedness; coastal risks; coastal management; environmental psychology.

RESUMO

A percepção de risco e o apego ao lugar são construtos frequentemente estudados no contexto das ameaças ambientais. A percepção de risco é um julgamento subjetivo e emocional acerca da severidade de um risco, e pode ser influenciado pelo apego ao lugar, que se define como a ligação emocional entre um indivíduo e um dado local. A interação entre estes construtos influencia a forma como os indivíduos lidam com os riscos.

A Praia de Faro é um local vulnerável, fortemente urbanizado, no sistema de ilhas-barreira da Ria Formosa. A praia está exposta a erosão costeira e galgamentos causados por tempestades, que já provocaram a destruição de casas e estradas. Os residentes da Praia de Faro, sobretudo pescadores e as suas famílias, aceitam os riscos que correm em troca dos benefícios que são percebidos como excedendo amplamente potenciais danos pessoais. Apesar dos residentes terem consciência das ameaças costeiras que afetam a zona, não parecem preocupados ou preparados para lidar com os riscos associados, e a maioria dos residentes recusa uma realocização para zonas mais seguras. A principal objetivo desta tese é, assim, compreender as variáveis psicológicas que influenciam a percepção dos residentes da Praia de Faro relativamente aos riscos costeiros.

Primeiramente (capítulo 2) aplicou-se uma análise de conteúdo qualitativa a entrevistas semiestruturadas feitas a residentes da Praia de Faro. Três temas foram extraídos das entrevistas: o que os residentes sentem em relação à praia; como é que

percecionam os riscos costeiros; e como lidam com esses riscos. Foram identificados sentimentos positivos associados à praia nos residentes, o que reflete um forte sentido de lugar que inclui níveis elevados de apego ao lugar, enraizamento, sentido de comunidade e identidade ao lugar. A inexistência de consequências mortais ou impactos irreversíveis levam a uma subestimação dos riscos a que estão expostos. A pouca vontade dos residentes em participar em medidas de minimização do risco parece estar associada a barreiras comportamentais influenciadas pela falta de confiança nas autoridades. Os residentes também revelaram baixos níveis de preparação face às ameaças costeiras, provavelmente devido à sua baixa percepção de risco e à percepção das ameaças como distantes no tempo.

De seguida (capítulo 3) aplicou-se novamente a análise de conteúdo qualitativa a entrevistas realizadas a cientistas e gestores da costa, de forma a compreender a percepção destes *stakeholders* relativamente aos residentes da Praia de Faro. Tanto gestores como cientistas reconhecem que os residentes estão bem informados acerca dos riscos, mas acreditam que estes esquecem rapidamente os problemas devido a um viés de otimismo e experiências anteriores “positivas” com riscos, uma vez que nunca houve nenhuma fatalidade ou consequências graves, levando a uma subestimação da gravidade dos riscos. Estes *stakeholders* consideram que a educação e a informação são as melhores soluções para aumentar a percepção de risco dos residentes.

Com base nos resultados qualitativos dos capítulos 2 e 3, o capítulo 4 apresenta uma abordagem quantitativa, com a aplicação de um questionário de autorrelato para avaliar a percepção de risco e variáveis associadas numa amostra de residentes da Praia de Faro. Os resultados mostram que os residentes da Praia de Faro possuem um conhecimento significativo sobre os perigos costeiros que deriva sobretudo da sua experiência de vida. Fontes de informação como campanhas de educação ambiental ou discussões públicas são irrelevantes para os residentes. Os residentes acreditam que as ameaças costeiras não são muito perigosas e são distantes no tempo; consequentemente, a sua preparação para lidar com potenciais riscos é baixa. A percepção de risco dos residentes está relacionada com o tempo de residência na praia,

a sua experiência anterior positiva com os riscos, que nunca resultaram em fatalidades, e a distância psicológica em relação às ameaças.

No capítulo 5 avaliam-se as relações entre sentido de lugar, percepção de risco e preparação na população da Praia de Faro. Especificamente, formulou-se a hipótese de que o sentido de lugar e a experiência anterior com riscos teriam um efeito negativo na percepção de risco, e a percepção de risco influenciaria positivamente a preparação. Foi aplicado um questionário de autorrelato a uma amostra de residentes da Praia de Faro e os dados foram analisados através de modelos de equações estruturais. Os resultados mostram que a menor percepção de risco está associada à forte ligação emocional ao lugar, pois os residentes tendem a aceitar o risco como parte do seu ambiente. No entanto, a experiência anterior contribuiu para uma maior percepção de risco dos residentes da Praia de Faro, muito provavelmente porque os residentes têm uma experiência direta e pessoal com os perigos, estando assim plenamente conscientes das suas consequências. Além disso, a percepção de risco foi negativamente associada à preparação; embora a sua percepção de risco seja modesta, os residentes fazem ainda assim alguns preparativos para lidar com um potencial desastre.

Por fim, pretende-se contribuir para a discussão sobre conceptualização e operacionalização do construto sentido de lugar, através do desenvolvimento de um novo modelo e instrumento psicométrico de autorrelato, apresentado no capítulo 6. Os resultados sugerem que o sentido de lugar é um fator de segunda ordem com quatro fatores de primeira ordem: lugar, pessoas, tempo e *self*. A dimensão "lugar" integra conteúdo emocional associado ao lugar e pode ser comparada ao apego ao lugar noutros modelos. A dimensão "pessoas" corresponde ao sentido de comunidade, enquanto a dimensão "tempo" reflete a importância do tempo de residência e da transmissão intergeracional no desenvolvimento do sentido de lugar. Finalmente, a dimensão "*self*" é mais focada internamente do que as outras dimensões, refletindo o papel do lugar para a identidade e autoestima do indivíduo. O novo instrumento possui 32 itens e revelou-se uma medida válida e confiável, tendo por base uma estrutura quadripartida do construto sentido de lugar.

Foram identificadas algumas limitações neste trabalho, relacionadas sobretudo com as pequenas amostras usadas. Apesar das limitações, os resultados obtidos representam uma contribuição significativa para a disciplina da psicologia ambiental e têm implicações relevantes para a gestão costeira, uma vez que um conhecimento aprofundado dos determinantes psicológicos e respostas aos riscos costeiros é essencial para uma gestão costeira eficaz.

Palavras-chave: apego ao lugar; percepção de risco; preparação; riscos costeiros; gestão costeira; psicologia ambiental.

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Chapter 1

General introduction

1.1 Psychology and the environment

1.1.1 Environmental problems and human behaviour

We live in a changing world – our Planet is currently facing serious environmental problems, such as climate change, eutrophication, or ocean acidification, most of which caused and/or enhanced by human behaviour (Gardner & Stern, 1996; Gifford, 2014b; Swim et al., 2009). Interdisciplinary approaches are fundamental to address such multifaceted issues and to provide thorough knowledge for ecosystem management and restoration. These approaches usually combine ecological, sociological, and economic components (Gari et al., 2014; Schmidt et al., 2014; Schmidt & Delicado, 2014), but the critical psychological aspects have been consistently overlooked (Gifford, 2008; Reser & Swim, 2011). However, only the inclusion of a psychological perspective will allow a genuinely interdisciplinary research and effective policy initiatives addressing environmental change (Reser & Swim, 2011), minimising the consequences of present day environmental threats.

The current conversation on the psychological dimensions of environmental change is a thriving interdisciplinary discipline that joins natural sciences and psychology with the ultimate goal of encouraging the conservation of a sustainable natural world while promoting environmentally-responsible behaviour (Gifford, 2014b). Given that most environmental problems are caused and/or enhanced by human behaviour, understanding human behaviour will aid the resolution of these problems (Gifford, 2014b). This seems a simple and logical tenet, but it was only in 2009 that the relevance of joint efforts between the natural sciences and psychology in climate change research was recognized (Swim et al., 2009). In the last years, significant progress has been made across developed countries on the human perspectives of environmental and climate changes (Milfont et al., 2014; van der Linden, 2015). Still, human behaviour is the least understood aspect of the environmental change system (IPCC, 2014). Given that intra-individual processes are powerful mediators of risk

perceptions and understandings, coping responses, behavioural adjustments, and psychological and social impacts (Reser & Swim, 2011), comprehensive studies on the psychological dimensions of environmental change are crucial. The passage of knowledge to policy-making will then allow the creation of structures that provide guiding behavioural contexts (Ernst & Wenzel, 2014), contributing to the mitigation of these problems.

1.1.2 Brief history of environmental psychology

Environmental psychology is defined as the study of the interplay between individuals and their physical settings, namely the natural and built environment (Gifford, 2014a; Steg et al., 2019). This discipline examines not only the influence of the environment on human experiences, behaviour, and wellbeing, but also the influence of humans on the environment (Steg et al., 2019).

The recognition of environmental psychology as a field of psychology is relatively recent; it was only in the late 1950's and early 1960's that the study of human-environment interactions received recognition as a full discipline (Steg et al., 2019). The two most important precursors of environmental psychology were Egon Brunswick and Kurt Lewin (Gifford, 2014a). Brunswick (1903-1955) was one of the first psychologists to claim that psychology should give as much attention to the environment of the individual as it does to the individual itself, and was the first to use the term environmental psychology (Steg et al., 2019). Lewin (1890-1947) argued that behaviour is a function of the person and the environment, conceptualizing the environment as a key determinant of behaviour (Steg et al., 2019). Although Brunswick and Lewin's works would not be classified today as environmental psychology, their ideas inspired many students who, in turn, shaped the direction of environmental psychology (Gifford, 2014a).

In the late 1960's, the first scientific journals on environmental psychology were created. Two major organizations for the study of environment-behaviour, the Environmental Design Research Association (EDRA) and the International Association of People-Environment Studies (IAPS), were also established in the late 1960's. Environmental psychology was also recognized by the American Psychological Association (APA), with the establishment of Division 34 "Population and Environmental Psychology"; the division's name was later changed to "Society for Environmental, Population and Conservation Psychology" to accommodate the growing focus of environmental psychologists on the conservation of the natural environment (López-Cabanas & Aragonés, 2019). Dedicated conferences on environmental psychology started to be held in the late 1960's, and the first Ph.D. program in environmental psychology was established at the City University of New York in 1968 (Gifford, 2014a). Environmental psychology has steadily developed in the following decades; today, several dedicated journals are well established, the most prominent of which being the *Journal of Environmental Psychology* and *Environment and Behaviour*, and comprehensive handbooks on the subject were published (e.g., Clayton, 2012; Gifford, 2014b).

Despite the growth of environmental psychology in the last decades, it remains one of the smaller areas in psychology. For instance, on SCImago journal rankings (<https://www.scimagojr.com/>), environmental psychology as a category within the field of psychology does not exist. The *Journal of Environmental Psychology* is included in the "social psychology" and "applied psychology" categories, whereas *Environment and Behavior* is not even included in the Psychology subject area, but in the Environmental Science instead (probably reflecting the interdisciplinary nature of this field; see 1.1.4). As a field of study in the higher education system, not every university or college teaches environmental psychology (Gifford, 2014a). For instance, in most universities in Portugal, environmental psychology is offered just as an optional course for undergraduate Psychology students.

Today, environmental psychology is a highly dynamic field that has been rising in popularity and relevance around the world. It is a thriving area of research that gathers individuals with distinct backgrounds, driven by personal conviction to a cause (Gifford, 2014b). It is therefore relevant to promote interdisciplinary studies but with a particular focus on the psychological aspects, contributing to the further development and affirmation of this discipline.

1.1.3 Major research areas in environmental psychology

Current research in environmental psychology may be divided into three major areas. The first, and the most relevant to this thesis, deals with environmental influences, positive and negative, on human behaviour and well-being. Classical themes are the study of environmental risk perception and environmental stress, with an emphasis on the critical role of people's perceptions in understanding the negative impacts of the environment (van den Berg & Steg, 2019). Another major focus is the study of consequences of and responses to climate change and the relationships with cognitive, affective, motivation, interpersonal, and organizational responses and processes (Swim et al., 2011). The positive influences of the environment on humans is another subject included in this first area, namely the function of nature and urban green spaces as sources of health, well-being, and residential satisfaction (van den Berg & Steg, 2019). Studies on the effects of the natural environment on children (Steg & Groot, 2019) and people's responses to wild nature (Jacobs et al., 2019) are also increasingly acknowledged by environmental psychology. The impacts of urban environments on human behaviour and well-being are also addressed, particularly the relationships between residential environment and residential satisfaction in urban settings (Gifford & McCunn, 2019). Finally, the study of place attachment is another major theme in this area of environmental psychology, dealing with the way individuals form emotional bonds to specific places (Manzo & Devine-Wright, 2019).

The other two major research areas in environmental psychology, with less relevance for this thesis, deal with the factors influencing environmental behaviour, such as values, social norms, or emotions, and, finally, strategies to promote behaviour change and foster proenvironmental behaviour (van den Berg & Steg, 2019).

1.1.4 A discipline of psychology or an interdisciplinary object?¹

Environmental psychology has a long history of crossing disciplinary boundaries (Gifford, 2008; van der Linden, 2014). Although theories and methods used in environmental psychology derive from more “classical” branches of the psychological sciences, such as cognitive and social psychology (Steg et al., 2019), insights from, and collaborations with, other fields of knowledge, such as ecology, geography, sociology, architecture, among others (Vidal, 2015), cannot be dismissed. The fact that environmental psychology works in conjunction with other, non-psychological, disciplines (Hobson, 2006) is, indeed, one of the characteristics that sets environmental psychology apart from the central core of psychology (Gifford, 2014a). This interdisciplinarity is fruitful, as each discipline provides its own view on the problem in question and, together, they provide a comprehensive picture on the phenomenon (Steg et al., 2019).

A proof of this interdisciplinary nature can be obtained by performing a quick article search on any bibliographic database. For instance, when searching journal articles on the topic of “risk perception” and “environment”, Web of Science yields 2108 documents; the largest fraction (25%) are published in journals included in the “environmental sciences” category, whereas only 6% and 4% of the articles belong to the “social sciences interdisciplinary” and “psychology multidisciplinary” categories, respectively; the remaining fraction of papers (65%) are dispersed across many other

¹ Title taken from Vidal (2015).

disciplinary subjects. The same pattern is observed when searching “place attachment”; 29% of the articles (of a total of 2572) are published in the category “environmental studies”, 11% in “psychology multidisciplinary”, and 7% in “sociology”. When combining “place attachment” and “coast”, 32% of the 56 articles belong to the “environmental studies” category, and only 3% and 2% to “sociology” and “psychology multidisciplinary”, respectively².

Therefore, although being rooted in psychology, environmental psychology is, at the same time, living on its edge (Gifford, 2014a). The interdisciplinary nature of this field is undeniably necessary for its success.

1.1.5 Environmental psychology and environmental risks

The interdisciplinary nature of environmental psychology is obvious when addressing environmental problems. Most environmental problems are caused and/or enhanced by human behaviour – and many environmental problems, both human-induced and natural, may cause harmful and long-lasting consequences for humans and nature (Böhm & Tanner, 2019). Therefore, environmental psychologists are, or should be, at the forefront of environmental research, as they possess the knowledge and tools to understand human behaviour. Although contextual factors matter, it is at the individual level that change happens – as Gifford (2008, p. 274) puts it, “policies, programmes, and regulations themselves do not change anything. For one thing, to be acceptable and efficacious to individuals, policies must be ‘bought into’ by individuals.”

Currently, research on environmental change is a focus of environmental and social scientists. In Portugal, however, research on the psychological aspects of environmental change and associated risks is still meagre, with only a few studies on

² Article search conducted on June 16th 2021.

climate change perceptions and adaptation (Fernandes-Jesus et al., 2020; Luís, Lima, et al., 2018; Luís, Vauclair, et al., 2018), and risk perceptions regarding specific environmental risks, such as seismic and volcanic risks (Rego et al., 2018), storms and tsunamis (Liotard et al., 2017), or coastal erosion (Costas et al., 2015). An in-depth understanding of people responses to environmental risks is still necessary. Only then effective mitigation policies and interventions could be developed, as well as helpful assistance to individuals (APA, 2010). Therefore, the need to bring a psychological perspective into the arena of environmental science is urgent; only an understanding of human behaviour will allow the resolution of human-caused or human-enhanced problems.

1.2 Risk perception and place attachment

1.2.1 A *mélange* of approaches

When perusing the literature on environmental risks, two expressions appear frequently: risk perception and place attachment. Exploring these constructs is, however, a cumbersome endeavour – though they are psychological variables related with the environment, they are not the exclusive domain of environmental psychologists. Lewicka (2011) made this point clear by noting that place attachment has been studied in all branches of social sciences, including sociology, community psychology, human geography, cultural anthropology, gerontology, demography, urban studies, leisure sciences and tourism, architecture and planning, forestry, and economics. The same holds true for risk perception – this construct was firstly addressed by psychologists (Slovic, 1987, 1992), and today it is mainly the domain of sociological sciences, although it is also studied across a wide range of disciplines. Due to the *mélange* of researchers and methodologies devoted to the study of these constructs, research on place attachment has been defined as slow, unclear, minimally coherent, lacking theory, and with little empirical development (Lewicka, 2011).

Likewise, the risk field has been called “a patchwork of many different schools and perspectives” (Renn et al., 1992, p. 138). For the sake of simplicity, and because this is a thesis in psychology, the subsequent chapters adopt the environmental psychology approach to the study of risk perception and place attachment in the context of coastal hazards – “social” factors are important, but the unit of analysis is the individual (Gifford, 2008).

1.2.2 Risk perception

The definition of risk is not straightforward, but most characterizations of risk include a notion of danger from future damage and focus only on negative outcomes (Joffe, 2003). The most widespread definition of risk perception is the one by Slovic (1987, p. 280): risk perception is “the judgement people make when they are asked to characterize and evaluate hazardous activities and technologies”. In other words, it is the assessment of the severity of the impact and the likelihood of the event occurring; risk perception is determined by the fear of being affected, the uncontrollability of the event, and the immediacy of the consequences (Slovic et al., 2004). However, this judgement is a complex process; it is highly emotional, rather than analytical or rational (Gifford, 2014a). In addition, there are at least five different dimensions that underlie risk perception: cognitive, subconscious, affective, socio-cultural, and individual (Helgeson et al., 2012).

The study of risk perception is highly relevant in communities exposed to risks, given its predictive value in the assessment of the impact of hazards (Navarro et al., 2020). This construct is one of the most studied dispositional factors in coping strategies (Sjöberg, 2000; Slovic, 1987), due to its relevance as a determinant of protective behaviours in response to hazards (Slovic, 1987).

Overall, there are two main approaches to the study of risk: 1) the perception of risk as a result of individual processes and cognitive functioning, and 2) the social

representation of risk, based on social, cultural, and contextual processes (Michel-Guillou & Meur-Ferec, 2017). The affective component is a major one; it is well known that risk perception is strongly influenced by affective and emotion-driven processes such as feelings of fear, emotion, or dread (Loewenstein et al., 2001). This is why common strategies to increase risk perception of populations at risk barely work; in particular, more information and education may even have the opposite effect and lead to the normalisation of risk, a decrease in risk perception as a way to psychologically cope with the threat (Luís et al., 2016). However, the effect of social influences on people's behaviour is undeniable; people construct and derive their opinions and decisions based on the observation of others (van der Linden, 2014, and references therein). For instance, the cultural theory of risk suggests that values and beliefs are a major influence on people's interpretation of risks, leading to different perceptions of the same risks within the society (Tansey & O'Riordan, 1999).

Despite the many variables, either individual or contextual, that influence risk perception, one of the most addressed in the environmental psychology realm is an emotional one - place attachment. The sense of attachment to the place of residency is, indeed, a major determinant of risk perception, given that environmental risks are, by definition, place-related (Ghozlane Fleury-Bahi, 2008).

1.2.3 Place attachment³

The definition of place attachment draws from the attachment theory (Ainsworth & Bell, 1970; Bowlby, 1969): place attachment is a positive affective bond between an individual and a specific place, characterized by the desire to maintain closeness to the object of attachment (Hidalgo & Hernández, 2001). Other variables related to place attachment have been conceptualised and operationalised, such as

³ A detailed description of place attachment and related constructs can be found in Chapter 6.

place dependence, place identity, or sense of place. Sense of place is a more general concept, or “umbrella” term, that may include other place-related concepts (Jorgensen & Stedman, 2001).

The concept of place attachment has been increasingly used in the environmental and natural sciences, particularly focusing on its role as predictor of conservation behaviours (e.g., Admiraal et al., 2017; Jones et al., 2018; Poe, Donatuto, & Satterfield, 2016). The relationship between place attachment and risk perception has also been studied extensively, given that place attachment is considered a predictor or determinant of risk perception, but results are mixed and often contradictory. A strong emotional attachment to the place usually leads to feelings of safety and security in individuals (Billig, 2006). Even in high-risk places, people are normally well aware of the risks associated with their environment and they accept those risks (Michel-Guillou & Meur-Ferec, 2017), usually in exchange for the benefits they obtain by living there (Costas et al., 2015). However, place attachment may also be associated with higher risk perception. Overall, the type and probability of the risk modulate the relationship between these variables.

1.3 Coastal hazards and coastal risks

A hazard can be defined as the occurrence of extreme conditions of the natural environment or the malfunctioning of the human-built technological environment (Cvetkovich & Earle, 1985). Natural hazards include floods, hurricanes, earthquakes, etc., and they are usually large magnitude events, many are unpredictable, allowing little or no time for preparation, may cause injury or death, destroy property, and disrupt social and economic activities (Gifford, 2014a). When hazards have such consequences to the system, they constitute risks. A risk is defined as the result of the

interaction of a hazard, including the probability of occurrence of the phenomenon, and the vulnerability of the system exposed (UNDRO, 1980).

Coastal zones are highly dynamic systems affected by several forcing factors, including sea level rise, extreme events, local oceanic and atmospheric processes, among others (Benveniste et al., 2019). Despite being natural events, coastal hazards are magnified by human action, including population growth, limited land use planning, and lack of policy measures to prevent or mitigate risks (Lam et al., 2016). The combination of natural hazards, human activities, and climate change significantly increase the risks to coastal populations, particularly those living in low elevation coastal zones (altitude < 10 m). These zones cover only 2% of the Earth's land, but are home for 10% of the world's population (McGranahan et al., 2007), and due to rapid population growth and coastward migration, coastal population is expected to double by 2060 (Benveniste et al., 2019). Therefore, coastal hazards are a growing threat to coastal populations around the world.

Despite the risks that coastal populations face, coasts attract people, businesses, and industries (Kron, 2013), and rightly so. Coasts offer subsistence resources, access points to marine trade and transport, recreational and cultural activities, and even a sense of place at the land-sea interface (Neumann et al., 2015). Yet, living by the coast is a high-risk choice and requires awareness at all levels of society (Kron, 2013). In addition, a thorough knowledge of the psychological processes that drive individuals' preparation for, and response to, coastal hazards, is essential for an effective coastal management.

1.4 The intricate case of Faro Beach

The extensive Portuguese coastline is a hotspot of coastal vulnerability; not only it is located in a region highly vulnerable to climate change (IPCC, 2014), it is also

subjected to numerous physical and biological hazards such as erosion and coastline retreat (Ferreira & Matias, 2013), sea-level rise (Ferreira et al., 2008), eutrophication and harmful algal blooms (Domingues et al., 2014, 2015), among others. These hazards result in increased threats to human health (Galvão et al., 2008), loss of ecosystem services (Glibert et al., 2014), negative economic and social consequences (Schmidt et al., 2014; Schmidt & Delicado, 2014), and severe psychological impacts (Swim et al., 2009).

One of the most vulnerable systems in Portugal is the Ria Formosa, at the southernmost end of the Portuguese coast, which includes a coastal lagoon protected by sandy barrier islands and peninsulas split by several inlets. The human occupation of the Ria Formosa has always raised much debate, due to its high exposure to coastal hazards. Management plans such as POOC (Plano de Ordenamento da Orla Costeira) and POLIS (Programa Polis Litoral - Operações Integradas de Requalificação e Valorização da Orla Costeira) have included several measures to prevent coastal risks and promote nature conservation and biodiversity, through the protection and requalification of the coastal zone. Such measures include inlet relocation, beach nourishment, dredging of navigation channels, waterfront requalification, and the demolition of houses; the latter has not been well accepted and has generated several public debates and confrontations with managers and policymakers. Faro Beach (Figure 1.1), located at the westernmost part of this system, is the most threatened location within the system and is one of the major sources of tension and disagreement among stakeholders. However, most people living at Faro Beach have voluntarily accepted to live in a highly risky area in exchange for benefits that they perceive as largely exceeding potential personal damages (Costas et al., 2015).

Recent projects, such as the EU FP7 Collaborative project RISC-KIT (Resilience-Increasing Strategies for Coasts – toolKIT), have focused not only on the potential detrimental effects of human occupation and constructions on the natural ecosystem, but also on the risk that people living in such areas are constantly exposed to. Whilst

socio-economic and political aspects are often taken into consideration by researchers, managers and policymakers, the wealth of psychological research dealing with natural hazards and risks is not contemplated in decision making processes, nor the potential psychological impacts of life-altering events, such as demolitions of fishermen's houses, which may affect people's behaviour and threaten their well-being and identity.

A psychological perspective is particularly relevant in the case of Faro Beach. Researchers have puzzledly observed that residents are aware of the risks they face, yet they do not seem worried or prepared to deal with those risks, thus showing a low risk perception that does not correspond to the "actual" risk (Costas et al., 2015). The study of the psychological variables associated with risk perception could shed light on this incongruence – hence the setting for this thesis.

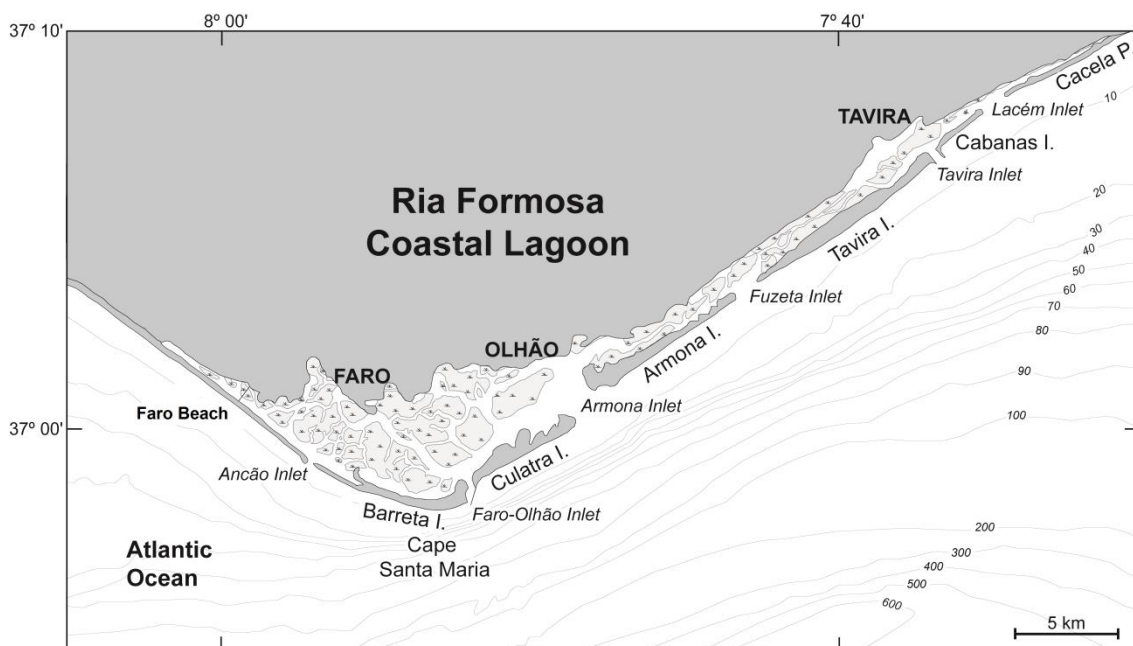


Figure 1.1 - Location of Faro Beach at the Ria Formosa barrier island system. Source: Ana Matias, CIMA-UAlg.

1.5 Objectives and thesis outline

The main goal of this thesis is to provide a systematic account of the psychological dimensions that shape individuals' perceptions and behaviours towards coastal hazard; Faro Beach will be used as a case study.

This thesis is organised around five chapters, each corresponding to a published or submitted article in the IMRAD format (Table 1.1), which build upon each other and jointly represent a systematic understanding of the antecedents and outcomes of risk perception in the coastal population from Faro Beach. After the preceding General Introduction, chapter 2 presents a qualitative content analysis of Faro Beach residents' interviews that provides a first insight on the way individuals feel about the Beach, how they perceive coastal risks, and how they deal with those risks. Chapter 3 focuses on stakeholders other than residents, namely scientists and coastal managers. Using a qualitative content analysis, stakeholders' views on residents' risk perception are analysed, contributing to the identification of differences and similarities towards improved communication among stakeholders and, overall, a better coastal management. Chapter 4 uses a quantitative approach with a descriptive analysis to evaluate residents' awareness and risk perception of coastal risks, based on self-report questionnaires. The fifth chapter draws on the previous qualitative and quantitative results and uses psychometric instruments to evaluate sense of place, risk perception, and preparedness in a sample of Faro Beach residents; hypotheses regarding the relationships between these latent variables are tested using partial least squares modelling. Finally, chapter 6 presents the development of the Sense of Place Scale (employed in Chapter 5), a new psychometric instrument with a quadripartite structure that considers sense of place as a broad construct that includes "people", "place", "time" and "self" dimensions. To bookend this thesis, chapter 7 summarizes the main findings of the previous chapters and offers a general conclusion.

The overall contribution of this thesis is to bridge together knowledge from natural and psychological sciences into a comprehensive framework that can be used by environmental scientists and psychology professionals to understand what drives individuals' behaviour toward coastal hazards and how that affects their preparedness. Results will also be useful for policymaking, providing a scientifically sound basis for more effective coastal management.

Table 1.1 – Outline of the thesis.

<i>Chapter</i>	<i>Objective</i>	<i>Method</i>	<i>Publication status</i>
1. General introduction		-	-
2. Sense of place, risk perceptions and preparedness of a coastal population at risk (Faro Beach, Portugal): a qualitative content analysis	Understand the relationships between risk perception, preparedness and other construct in Faro Beach residents	Qualitative content analysis	Domingues RB, Costas S, Jesus SN, Ferreira Ó (2017) Journal of Spatial and Organizational Dynamics V: 163-175
3. Assessing stakeholders' risk perceptions in a vulnerable coastal tourism destination (Faro Beach, southern Portugal)	Analyse the views/opinions of scientists and managers regarding risk perception and awareness of Faro Beach residents	Qualitative content analysis	Domingues RB, Costas S, Jesus SN, Ferreira Ó (2019) Journal of Spatial and Organizational Dynamics VII: 22-38
4. How a coastal community looks at coastal hazards and risks in a vulnerable barrier island system (Faro Beach, southern Portugal)	Evaluate awareness and risk perception of Faro Beach regarding coastal hazards	Quantitative self-report questionnaire; descriptive statistics	Domingues RB, Santos MC, Jesus SN, Ferreira Ó (2018) Ocean and Coastal Management 157: 248-256
5. Living with coastal hazards: place attachment, risk perception, and preparedness of a coastal population at risk	Evaluate relationships between place attachment, risk perception, and preparedness in Faro Beach residents	Quantitative self-report questionnaire; partial least squares modelling	Domingues RB, Jesus SN, Ferreira Ó (2021) International Journal of Disaster Risk Reduction 60:102288
6. Measuring sense of place: a new place-people-time-self model	Develop and test a new instrument to measure sense of place as an overarching multidimensional construct	Exploratory and confirmatory factor analysis	Domingues RB, Gonçalves G, Jesus SN (submitted)
7. Final remarks		-	-

Chapter 2

Sense of place, risk perceptions and preparedness of a coastal population at risk: a qualitative content analysis

Sense of place, risk perceptions and preparedness of a coastal population at risk (Faro Beach, Portugal): a qualitative content analysis

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Abstract

Faro Beach, a heavily urbanized settlement in Ria Formosa, southern Portugal, is highly vulnerable to coastal hazards, namely beach erosion and overwashes caused by storms, that have resulted in house and road damage on several occasions. Despite the risks, local residents accept to live there. Four semi-structured interviews were conducted to understand residents' beliefs, risk perceptions and preparedness regarding coastal risks. We used a qualitative content analysis to derive manifest contents from the interviews. Three main themes were identified in the interviews: how residents feel about Faro Beach; how they perceive coastal hazards and risks; and how they deal with those risks. Positive feelings regarding Faro Beach were identified in all residents, reflecting a strong sense of place that includes high levels of place attachment, rooting, sense of community and place identity. Residents' personal experiences with hazards probably undersized their perceptions regarding the risks that they are exposed to. Their willingness to participate in disaster risk reduction measures seemed associated with behavioral barriers driven by mistrust in authorities and externalization of responsibility. Residents also revealed low levels of preparedness towards coastal hazards, probably due to their low risk perceptions and their perception of threats as distant in time.

Keywords: place attachment, risk perception, coastal management, content analysis

2.1 Introduction

Coastal areas are widely recognized as one of the most important ecosystems in the world; they provide a myriad of services and resources (Kennish & Paerl, 2010), whilst suffering from increasing anthropogenic pressures due to human population growth and economic development (Lloret et al., 2008). Although attractive from natural and socioeconomic perspectives, coastal areas are dangerous places to live in. These regions, particularly low elevation coastal zones (<10 m altitude: McGranahan, 2007), are extremely vulnerable to natural hazards, such as erosion, overwash, cliff collapse, floods, harmful algal blooms, among others. In the last decades, human-induced climate change has been added to the myriad of threats that coastal populations are exposed to. At the same time, population growth in coastal regions and urbanization of coastlines have been increasing worldwide (Neumann et al., 2015). Thus, it is important to consider coastal areas as linked ecological-socioeconomic systems that co-evolve spatially and temporally (Crooks & Turner, 1999), and to balance the needs of development and the protection of ecosystem resources, by taking into consideration the public's concern about the environmental, socio-economic and cultural state of the coastline (EEA, 2006).

One of the most vulnerable areas in Portugal is the Ria Formosa coastal system, at the southernmost end of the Portuguese coast, which includes a coastal lagoon protected from the direct impact of ocean waves by a chain of sandy barrier islands and peninsulas split by several inlets. Due to its ecological and economic importance, the Ria Formosa and its hinterland were established as a Natural Park and, currently, a multitude of governmental organizations are responsible for its management, including national and regional organizations as well as municipalities (Costas et al., 2015; Guimarães, 2010).

The sandy islands and peninsulas, particularly the Ancão Peninsula at the westernmost part of the Ria Formosa, have a history of human occupation that extends

over the last five decades, although a significant increase in the number of buildings and population was only observed from the 1980's onwards. Faro Beach, located at Ancão Peninsula (Figure 1.1), is one of the most threaten locations of the Ria Formosa system (Figure 2.1) and it is also a major source of tension and disagreement among stakeholders. Land occupation at Faro Beach developed chaotically, in a disorganized manner, without consideration for aesthetical and urbanism principles (Dias, 1993). Nowadays it includes a traditional fishermen community and second residences occupied mainly during summer by Faro inhabitants and tourists. A total of 623 buildings and 245 all-year residents (and over 4000 residents during summer: Viegas, 2003) have been identified at Faro Beach (Costas et al., 2015).

Coastal management plans such as POOC (Coastal Zone Spatial Plan) and POLIS Litoral (programme on integrated operations towards the renewal and enhancement of the coastal zone) contain several measures to prevent coastal risks and promote nature conservation and biodiversity in the Ria Formosa, through the protection and requalification of the coastal zone. Such measures include inlet relocation, beach nourishment, dredging of navigation channels, waterfront requalification, and the removal of houses. The latter has not been well accepted by local residents and homeowners, mainly because it does not consider all residents/owners equally and has generated several public debates and confrontations with managers and policymakers.

Despite the high risks, residents of Faro Beach have accepted to live there in exchange for benefits that they perceive as largely exceeding potential personal damages (Costas et al., 2015). Although residents are aware of the hazards impacting the area, they do not seem worried or prepared to deal with the associated risks, hence showing low levels of risk perception (Costas et al., 2015). Risk perception is a complex emotion-based construct, rather than a rational one, and it is influenced by many other psychological variables and, in turn, affects preparedness and coping behaviors (Gifford, 2014a); therefore, a thorough knowledge on the psychological drivers of risk

2. Sense of place, risk perceptions and preparedness of a coastal population at risk: a qualitative content analysis

perception and the role of risk perception on people's preparedness is critical for the proper development and implementation of coastal management tools and disaster risk reduction strategies. A previous work identified the cultural, socio-economic, and ecological framework of Faro Beach and the factors shaping risk perceptions, through in-depth interviews with selected stakeholders (Costas et al., 2015). The present paper adds a psychological perspective to Costas et al. (2015), by re-analyzing the interviews using a qualitative content analysis to derive manifest content from the interviewees' discourses. The main goal of this work is, thus, to understand the relationships between risk perceptions, preparedness, and other psychological constructs in Faro Beach residents.



Figure 2.1 – Storm at Faro Beach that led to loss of houses in 2010 (the house shown here is the same as in Figure 2.2). Source: <http://adefesadefaro.blogspot.pt/2011/02/ilha-de-faro-sob-risco-iminente.html> (used with permission).

2.2 Methods

2.2.1. Participants and data collection

The material reported in this paper was collected within EU FP7 Collaborative project RISC-KIT (Resilience-Increasing Strategies for Coasts – toolKIT) that aimed, among other goals, to integrate stakeholders' risk perceptions into management tools, to reduce risk and increase resilience to hydro-meteorological events in problematic coastal zones (Costas et al., 2015). Faro Beach was one of the case studies included in RISK-KIT project, due to its high vulnerability to coastal hazards.

Individual, semi-structured interviews were conducted in early 2014 with each of four selected stakeholders. Interviewed stakeholders were 1 local resident and fisherman (and leader of a fishermen association), 1 local resident and business owner, 1 business owner (non-resident) and 1 second residence owner⁴. These individuals were selected due to their representativeness within the community and/or extensive knowledge of the area. Contrary to local managers, authorities, academics and other stakeholder groups, local residents may provide direct insights on the needs, perceptions and values of the local population, as well as on the occurrence and impacts of past hazardous events (Risc-Kit, 2016).

Four main topics were addressed in the interviews (Costas et al., 2015): (1) socio-cultural and environmental values and traditions in the community; (2) risk perception; (3) coastal disaster risk reduction knowledge; (4) participation and constraints to the application of coastal disaster risk reduction strategies. A guide with open-ended questions was used flexibly by the interviewer; participants could elaborate on their answers, and they were not asked the same questions with the same

⁴ For the sake of simplicity, hereafter we refer to this group of stakeholders as "residents", even though two of the interviewees do not reside at the Beach the whole year.

wording. The interviews took about an hour and all the content was recorded and transcribed.

2.2.2. Data analysis

A qualitative content analysis based on an inductive approach was conducted to compile and analyse the interview data, following guidelines suggested by Gondim & Bendassolli (2014) and Mayring (2000). An inductive content analysis was used because the interviews were not structured around any previous psychological theory or model; therefore, an abstraction process that includes open coding and creating categories derived from the data is more suitable (Elo & Kyngäs, 2008). For that reason, the coding was primarily done by the first author and afterwards the co-authors checked the coding to ensure reliability.

The units of analysis considered were the interviews as a whole. The transcripts were read several times and meaningful units were gradually identified and open-coded. The codes were then formulated into sub-categories, and overarching categories were created out of the subcategories. Finally, main themes were identified.

2.3. Results and Discussion

The content analysis allowed the identification of three main themes: (a) how individuals feel about Faro Beach; (b) how individuals perceive coastal risks; and (c) how individuals deal with coastal risks. Each theme will be presented and discussed with quotations from the interviews to illustrate the different categories identified.

2.3.1. How individuals feel about Faro Beach

When asked about how long they have been living/working at Faro Beach, why they have decided to move/stay there, how would they describe Faro Beach to outsiders and what they think is truly special about the beach, interviewees demonstrated strong and multifaceted emotional bonds to the place that were categorized as “sense of place”. Despite the different terminologies that exist for such constructs (e.g., place attachment, place identity, place dependence, sense of community, etc.), we opted to consider “sense of place” as a broad construct that includes cognitive, affective and conative dimensions (Jorgensen & Stedman, 2001), and that were sub-categorized in our analysis as place attachment, rooting, sense of community and place identity (Michel-Guillou & Meur-Ferec, 2017).

Place attachment, generally defined as an affective bond or link between people and specific places (Hidalgo & Hernández, 2001), was clear in all individuals. They said, *“We built a link to this place, I like the island⁵ very much and I like living here”*, or *“I always felt a strong link to this area, I feel like I was born here”*. This bond is reflected on a desire to maintain closeness to the object of attachment, which is, ultimately, the main characteristic of the concept of attachment (Ainsworth & Bell, 1970): *“I don’t want to leave the island”*, *“That island... if they take this away from me, they take everything from me...”*. This strong emotional attachment to Faro Beach seems to be associated to the concept of rooting, a type of spatial anchoring often reinforced by temporality, memories, intergenerational transmission and heritage (Michel-Guillou & Meur-Ferec, 2017). Interviewees have been living or working at Faro Beach for many decades (*“I’ve been living at Faro Beach for 38 years”*, *“I’ve been living here for 40 years, since I was 8”*, *“The restaurant was owned by my father, since almost 40 years ago”*, *“I have a house at Faro Beach since I was born”*) and they demonstrated the effect of heritage and intergenerational

⁵ Although not an island, but a peninsula (Península do Ancão), residents and outsiders usually refer to it as an island, because the attachment to the mainland is approx. 4 kilometers away from the end of Faro Beach and the only road connection between the mainland and the beach is a bridge.

transmission, not only the whole-year residents but the second resident as well: *“Part of the family died, and we stayed here, this is our land and homeland”*; *“My mom was born here, so was her family and we built our small house (...) I have four children that are also living here”*; *“I spent all my childhood there and all summers I come here, come rain or come shine”*; *“We come every summer, especially because of the kids – here, they are like I was, in a state of total freedom”*.

Interviewees also showed a strong sense of community, related to their connections to local social networks and the interactions between them (Raymond et al., 2010). These social ties are especially relevant within the fishermen community and were evident in residents' discourses: *“The fishermen are a very strong community, they help each other”*, *“We help each other when something happens”*, *“We are a fishermen community, this is our heritage”*, *“This is a very small population, and we've known each other for many years, and sometimes you get the seafood from one and the fish from others”*.

Place identity is another construct that can be integrated in the overarching category of sense of place, and refers to a person's sense of continuity, self-esteem, self-efficacy and sense of distinctiveness (Twigger-Ross & Uzell, 1996). The distinctive character of Faro Beach, i.e., the characteristics of the place the individual uses to differentiate it from others, was obvious in the discourses: *“I think that the Ria Formosa and Faro Beach are among the most beautiful things we have here in Portugal”*, *“This is the paradise, for us this is the paradise”*, *“The freedom you get by living here, you'd never have living in a city”*, *“I would say that it is the best beach in the world (...) and it is the best place for working”*, *“I've had the opportunity to visit several places in the world and I've never found anything as good as this”*.

We can argue that residents' place attachment has had positive effects on their place perception, leading to a perceptual bias. Like Gifford (2014) puts it, *“being attached to a place is like wearing rose-colored glasses, and its flaws and dangers become less apparent”*. The inflation of the place's qualities can be explained by the social identity

theory (Tajfel & Turner, 1986), as an unconscious process that people use to maintain their self-esteem, given that one's self-identity is strongly linked to the places that are important for the individual (Gifford, 2014a). Consequently, place attachment, place identity and related constructs will influence risk perceptions; strongly attached people will most likely (but not always, see review by Bonaiuto et al., 2016) minimize the risks associated to their place of attachment (e.g., Billig, 2006; Brown et al., 2003).

Considering the person-process-place framework of place attachment (Scannell & Gifford, 2010), place attachment of Faro Beach residents seemed to be both at the individual level, mainly due to length of residence and familial heritage, and at the community level, due to the strong sense of community that has developed there, particularly among fishermen. The affective component is obvious from interviewees' answers and it comprises positive feelings about the place and the desire to maintain closeness to that place; indeed, in terms of behavioral outcomes, residents show no intention of leaving the beach, not even in the future to mitigate potential problems caused by coastal hazards (Costas et al., 2015).

This resistance to relocation in Faro Beach residents has been viewed by coastal managers as a consequence of a misunderstanding of risks and, consequently, low risk perceptions (Costas et al., 2015). The same have been observed in other coastal populations; for instance, in the Aveiro region in NW Portugal, the majority of residents considered that it would be difficult for the population to move and adapt to areas farther away from the sea, due to their affective connections and economic dependence (Martins et al., 2009).

Research has shown that high levels of place attachment lead to feelings of safety and security in individuals (Billig, 2006); people are usually well aware of the risks associated with their environment and they accept those risks (Michel-Guillou & Meur-Ferec, 2017), usually in exchange for the benefits they obtain by living there (Costas et al., 2015). Individuals highly attached to a place also tend to view place

change as negative (Anton & Lawrence, 2016), given that it may affect their place identity (Twigger-Ross & Uzell, 1996). This negative relationship between place attachment and risk perception has been observed not only for natural hazards and associated risks, such as seismic risks (Armaş, 2006) and volcano risks (Donovan et al., 2012), but also for war-related risks (Billig, 2006). However, positive relationships between place attachment and risk perception have also been found for volcano risks (Bird et al., 2011), drought risks (Stain et al., 2011) and other environmental risks.

Either way, place attachment and related constructs play significant roles as predictors, mediators or intervening factors in risk perceptions; therefore, people's attachment to their places should be addressed in natural hazard risk management (Bonaiuto, Alves, et al., 2016).

2.3.2. How individuals perceive coastal risks

Participants were asked several questions that aimed to understand their perceived levels of threat in relation to coastal hazards at Faro Beach, such as which are the major risks they face at the beach, if they feel people should be concerned and if they feel at risk. All residents revealed awareness about risks and some concern, but their risk perceptions are low (Costas et al., 2015). When asked if people in the region should be concerned about storms and coastal erosion, they answered *"We have to be concerned about the storms"*, *"The wind can remove part of our roofs"*, *"I am more concerned about waves suddenly coming in than about a large storm; (...) a storm is well predicted today and there are alerts"*, *"The people living and working here are concerned about the storms"*.

Being aware of risks, i.e., having information and knowing about hazards and associated risks, does not necessarily lead to concern or increased risk perception. Concern about risks and risk perceptions are sometimes used interchangeably, but we consider concern a more rational, information-based process and risk perception an emotion-based construct or a subjective judgment that individuals make regarding the

characteristics and severity of a risk (Gifford, 2014a; van der Linden, 2015). That is why the concern about risks that residents demonstrated was not reflected in high risk perceptions; despite being aware of risks, people feel safe at the beach: *"We feel safe here at the beach", "I was never afraid of the storms", "There is no risk for living here. We are not at risk; the houses are not at risk. Our houses do not fall, only if people don't take care of them", "I was not afraid, because I did not feel my life at risk", "I never felt at risk myself, because I felt everything was under control."*

Risk perception is influenced by many individual and contextual variables, such as age, gender, personality, social influences, information, education, etc. Another important variable that influences beliefs and perceptions is individuals' past experience with hazards (Guo & Li, 2016; Qasim et al., 2015; Takahashi et al., 2016). When asked how often they have experienced hazards and disasters in the region, all interviewees answered that they have witnessed storms at the beach and they described past episodes: *"I saw how the water passed over a car parked here at the back", "When we moved here and built our house, the sea came into the house... and we had to collect parts of the house (that were transported along the shore)", "It was very usual for strong winds to damage the roofs of the houses", "Two or three years ago, two very large waves came suddenly and the entire bar was inundated", "I remember huge storms, some years better, other years worse".*

Although residents of Faro Beach have witnessed coastal hazards, most of them were not personally impacted by those hazards. The consequences of these events at Faro Beach have only been the destruction of houses (Figure 2.2) and roads that are usually rebuilt afterwards (Costas et al., 2015). The absence of serious consequences, like fatalities, may have contributed to an optimistic bias, making residents believe that they are personally less likely to experience negative outcomes than other people (Breakwell, 2014). The availability heuristics (a simple information-processing rule that relies on immediate examples that individuals easily remember: Tversky & Kahneman, 1974) may have also contributed to an underestimation of more frequent,

less serious events (such as storms and erosion at Faro Beach) in relation to rare and catastrophic events (such as earthquakes and tsunamis) that are more easily remembered and overestimated. Therefore, past experience with hazards at Faro Beach in combination with cognitive biases may have played a significant role in decreasing risk perceptions of Faro Beach residents, explaining why they still feel safe living there.



Figure 2.2 – House threatened by storm-induced erosion at Faro Beach in the winter 2003 (the house seen in the photo is the same as in Figure 2.1). Source: author’s photo.

2.3.3. How individuals deal with coastal risks

This theme was divided in two overarching categories: public participation in disaster risk reduction measures and preparedness towards coastal hazards. Disaster risk reduction (DRR) measures such as beach nourishment, dune rebuilding, coastal armoring, relocation, among others, have been suggested by stakeholders for the Ria Formosa system and, particularly, for Faro Beach (Costas et al., 2015). When asked about their willingness to participate in the implementation of such measures, interviewees demonstrated some openness and interest: “*We would like very much to*

help, I would like very much to help improve the island”, “If they ask people to volunteer, they will help, and it will be very cheap”, “The people living here have much to tell and they should be listened to”, “The fishermen should be listened to, because they are pearls of wisdom.” However, residents are only willing to participate in the implementation of measures that allow their permanence at the Beach, such as *“planting plants and taking care of them”* (to preserve the dune).

However, behavioral barriers to participation were also evident from residents’ discourses, mainly the threat perceived as distant in time, mistrust in authorities and the externalization of the responsibility/blame regarding coastal hazards and environmental problems. Regarding the latter, interviewees believe that *“All the risks from sea rise could be partially avoided if, for instance, the authorities plan or preserve the dune”, “The future of the beach will be black with what the authorities are planning to do”, “They should definitely take measures to avoid the risk”, “The administration only thinks about cleaning the beach, but not on keeping or maintaining the beach”*. Residents have shown disappointment for being invited only for informative sessions about measures to be implemented, but never to actual discussions about those measures: *“They should invite us to accompany the process of discussion, but no, they have only invited us once everything was decided; they never asked us anything”, “If we ask for a meeting, we have to wait forever”, “They have never communicated or asked us anything”*. The same scenario is observed in other coastal populations in Portugal, where people feel that their opinions are not considered by authorities, public meetings are not properly publicized and they consist more of public presentations of projects than discussions about them (Schmidt et al., 2014). Indeed, public participation is usually very low in participatory strategies, because the majority of local people underestimates their potential influence (Schmidt et al., 2014); this may lead to a low perceived self-efficacy regarding coastal management decisions, acting as behavioral barrier to participation in discussions and DRR plans. Consequently, the mistrust that residents feel towards authorities is obvious: *“The problems come from the relationship with the public institutions”, “I could say*

that we were abandoned by the institutions (in charge of the Ria Formosa)", "(The politicians) promise but then they do nothing when they get to the power", "The authorities have never met with us", "They do not consider us anymore", "There are too many conflicts of interests here that we are missing".

Besides the externalization of responsibility and lack of trust in authorities, interviewees also perceive coastal risks as distant in time. Perceiving a threat as distant in time or space is a common psychological barrier that leads to a lack of concern and preparedness to act (Spence et al., 2012). This psychological distancing has been most commonly observed for global scale risks such as climate change (Lorenzoni et al., 2007; Pidgeon, 2012), but it was also evident in Faro Beach residents regarding local coastal hazards: *"In the future, I think Faro Beach will stay like this, and if there are any changes they will take a long time, not during my generation or my children's", "We all think that someday the sea will come and it will make minor and major damages. Someday, the sea will take all the houses"*. Psychological distance is an important factor in shaping people's concern and risk perception, and it should be considered in risk communication strategies and environmental politics (Sacchi et al., 2016; Spence et al., 2012). The large psychological distance that residents of Faro Beach demonstrate towards coastal hazards may have also contributed to their low risk perceptions.

Finally, considering that residents' risk perceptions regarding coastal hazards are low, the externalization of responsibility and the psychological distancing, it is no surprise that their preparedness in case of disaster is also extremely low or even non-existent. When asked if they have measures or plans in case a storm or other event affects their houses or businesses, they said *"I don't have a plan B", "I don't have another hypothesis, I'll just wait and see what happens", "We never had any problems, so we have no alternative plans", "No, I don't have any sort of preparation in case something happens; I cannot do anything against nature"*.

Given that a major goal of coastal management is to increase people's preparedness and resilience to coastal risks, it is crucial to understand how and why individuals engage in preparation strategies (Lindell & Perry, 2000). Research has shown that preparedness is positively associated with risk perception (Miceli et al., 2008); given that risk perception is an emotional construct and it is affected by other variables that are mostly emotion-based, such as place attachment, it is clear that emotional factors are more important than cognitive ones in convincing people threatened by hazards to engage in preparation strategies. This is why giving people more information and education about hazards may not increase their risk perception, as intended. In fact, informed people, particularly those who expose themselves voluntarily to risks (Twigger-Ross & Breakwell, 1999), develop illusions that allow them to psychologically cope with the threats, and thus maintain their mental health and psychological well-being (Luís et al., 2016). This process, known as risk normalization, often results in a decrease in risk perception (Lima, 2004; Lima et al., 2005; Luís et al., 2016).

2.4 Conclusions

Faro Beach is an intricate case in terms of coastal management and implementation of disaster risk reduction (DRR) strategies. It is located in a highly ecologically and economically valuable ecosystem, subject to multiple anthropogenic stressors and highly vulnerable to extreme storm events that often result in house and road destruction. Residents seem to be aware of the risks to which they voluntarily expose themselves to and all interviewees have witnessed coastal hazards but given that there were never fatalities or serious consequences, they have low risk perceptions. Residents feel safe living at the beach and show no intentions of ever leaving, mostly due to their strong emotional attachment to the place, based on decades of residency, familial heritage, and social ties.

2. Sense of place, risk perceptions and preparedness of a coastal population at risk: a qualitative content analysis

Based on the qualitative content analysis, a conceptual model of risk perception, preparedness and related variables in Faro Beach residents was developed (Figure 2.3). Residents' risk perceptions seem to be negatively influenced by their sense of place (includes place attachment, rooting, sense of community and place identity), their past experience with hazards and their perception of threats as distant in time. Risk perception, in turn, influences residents' willingness to participate in disaster risk reduction strategies and their preparedness towards hazards. The mistrust that residents feel towards authorities and their (seemingly contradictory) externalization of responsibility also negatively impact their preparedness and participation in DRR measures. A psychometric approach should follow to quantitatively evaluate the proposed relationships.

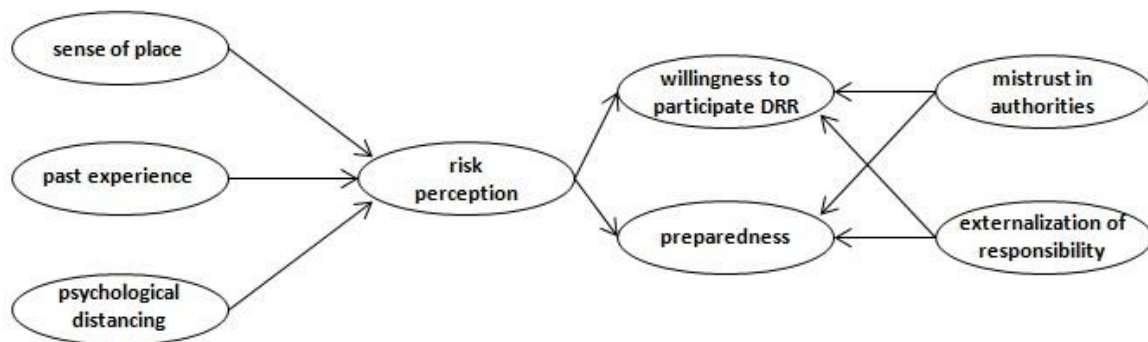


Figure 2.3 – Conceptual model of risk perceptions, preparedness and related psychological and behavioral variables, based on interviews conducted with Faro Beach residents. Source: own elaboration.

In terms of socio-political implications, knowledge on the psychological dimensions of coastal hazards is critical for an informed and sustainable management. Education and information are not a panacea to solve environmental problems and may even have the opposite effect, by decreasing risk perceptions through the process of risk normalization (Luís et al., 2016). Indeed, “people are not logical, they are psychological” (anonymous) – in order to increase awareness, risk perception, preparedness and resilience of coastal populations, *i.e.*, to change beliefs, attitudes and

2. Sense of place, risk perceptions and preparedness of a coastal population at risk: a qualitative content analysis

behaviors, a thorough understanding of the emotional, cognitive and conative processes that drive individuals is a critical component. Therefore, a holistic approach that integrates not only sociological, economic, and ecological perspectives, but also a psychological one is critical to increase the effectiveness and feasibility of management plans and the implementation of DRR measures in vulnerable coastal regions.

Chapter 3

Assessing stakeholders' risk perceptions in a vulnerable coastal tourism destination

Assessing stakeholders' risk perceptions in a vulnerable coastal tourism destination (Faro Beach, southern Portugal)

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Abstract

Effective coastal management is essential in regions where tourism is a main economic activity. However, poor communication and disagreement between stakeholders hamper the way decisions are conveyed to residents and home/business owners, potentially affecting economic development. We analysed managers and scientists' views regarding risk perceptions of Faro Beach (Algarve) residents, contributing to the identification of differences and similarities towards a sustainable management. We used a qualitative content analysis of managers and scientists' discourses. Managers and scientists recognize that residents, particularly fishermen, are quite knowledgeable about the risks they face by living at the beach. However, scientists and managers believe that residents easily forget about the problems due to an optimism bias and positive previous experience with hazards, that never caused fatalities or serious consequences, leading to an underestimation of the severity of the risks. Managers think that residents are not concerned about the environmental problems of Faro Beach, and both scientists and managers see education as the best solution to increase risk perception and concern of residents. We suggest that truly collaborative approaches to coastal management should be promoted, including an active involvement of residents in the decision process, thus increasing their self-efficacy and behavioural control.

Keywords: risk perception, public participation, coastal hazards, coastal management, content analysis.

3.1 Introduction

Although attractive from natural and socio-economic perspectives, coastal areas are rough places to live in, due to their susceptibility to a myriad of coastal hazards. However, population growth in coastal regions and urbanization of coastlines have been increasing worldwide (Neumann et al., 2015), and therefore the exposure to the hazard, resulting in increased risk. Thus, it is important to consider coastal areas as linked ecological-socioeconomic systems that co-evolve spatially and temporally, where integrated management approaches should be implemented across scientific disciplines (Crooks & Turner, 1999).

This is particularly relevant in the Algarve (southern Portugal), where tourism is the main economic driver (Noronha Vaz et al., 2013), driven by “sun and beach” products (Guerreiro et al., 2016), and also by nature and environmental quality (Barreira & Cesário, 2018). However, the Algarve is also extremely vulnerable due to the existence of fragile ecosystems and the location of urban infrastructures in areas subjected to coastal erosion (Noronha Vaz et al., 2012). One of the most vulnerable systems is the Ria Formosa coastal lagoon, a multi-inlet system protected by sandy barrier islands that extends over 55 km (Figure 1.1). Due to its ecological and economic importance, the Ria Formosa and its hinterland, with a total area of 185 km², were established as a Natural Park in 1987. Currently, a multitude of governmental organizations are responsible for its management, including at least five national organizations and five municipalities (Costas et al., 2015; Guimarães, 2010).

The human occupation of the Ria Formosa with residential and tourist infrastructures has always raised much debate, due to its high vulnerability to coastal hazards; indeed, the safety of human settlements and the restoration of ecological value on the sandy islands and peninsulas have been major concerns of several management plans. These plans aim to preserve landscapes and natural heritage, prevent coastal risks, and promote nature conservation and biodiversity, through the

protection and requalification of the coastal zone, using an integrated and sustainable management approach (www.polislitoralriaformosa.pt). Measures to achieve these goals include inlet relocation, beach nourishment, dredging of navigation channels, waterfront requalification, and the demolition of houses. Some measures have been well accepted by residents and home/business owners, but other measures, particularly the demolitions, have generated several public debates and confrontations with the authorities.

Faro Beach, located at the westernmost part of the Ria Formosa, is one of the most threaten locations of the system and is one of the major sources of tension and disagreement between residents, scientists, managers, and policymakers. This location is exposed to several coastal hazards, particularly storm consequences (e.g., overwash and erosion), that have resulted in house and road destruction, but no casualties were ever observed. Probably because of that, most people living at Faro Beach have voluntarily accepted the risk in exchange for other benefits that the beach provides (Costas et al., 2015). Managers and outside observers believe that Faro Beach residents do not understand the risk to which they are exposed, given that they always return after storms to rebuild their houses (Costas et al., 2015). However, it has been shown that residents, particularly fishermen and their families, possess significant knowledge on coastal hazards and awareness of risks that derive mainly from life experience (Domingues et al., 2018). This incongruence probably reflects the lack of communication between these groups. In order to improve communication and understanding between actors, this study aims to analyse the views/opinions of managers and scientists regarding risk perception and awareness of Faro Beach residents, using a qualitative approach based on a discourse content analysis. Understanding the perceptions of different stakeholder groups towards one another is essential for an effective coastal management, which, in turn, will positively affect this regions' economic activities.

3.2 Methods

3.2.1 Participants and data collection

Participants were scientists and managers involved in the study and management of the Ria Formosa system, particularly Faro Beach. The main method used to collect data were semi-structured interviews (see Costas et al., 2015 for details); in addition, stakeholders' discussions during a meeting to apply a multi-criteria analysis (MCA) method towards coastal management (Barquet & Cumiskey, 2018) were also transcribed and used as a complement to the interviews. Data was collected as part of EU FP7 Collaborative project RISC-KIT (Resilience-Increasing Strategies for Coasts – toolKIT) which, among other goals, aimed to integrate stakeholders' risk perceptions into management tools, to reduce risk and increase resilience to hydro-meteorological events in problematic coastal zones (Costas et al., 2015).

As qualitative research is more interested in searching for depth of meaning through intensive, rather than extensive, research, small groups of respondents (<20) are acceptable (Crouch & McKenzie, 2006). In addition, given the homogeneity of the participants in our study (well-educated individuals working on coastal risks at Faro Beach), we considered that more participants would not add any new or relevant data, according to the saturation principle of qualitative research (Dworkin, 2012). Therefore, our qualitative study is based on semi-structured interviews to eight individuals and a stakeholder meeting with another six individuals.

The semi-structured interviews were conducted in early 2014 to three scientists, three regional-level coastal managers and two local-level coastal managers, selected based on their extensive knowledge of the area. We included one consultant involved in coastal management and a civil protection officer in the managers group as 'managers' is used *sensu lato*. Four main topics were addressed in the interviews, namely socio-cultural and environmental values in the community, risk perception,

coastal disaster risk reduction knowledge, and constraints to the application of coastal disaster risk reduction strategies (Costas et al., 2015). The interviewer (S. Costas) used a guide with open-ended questions, and the interviewees could elaborate on their answers. The interviews were recorded, and the content was transcribed. The same method was also applied to residents discourses and published elsewhere (Domingues et al., 2017).

Data were also collected during a meeting to apply a multi-criteria analysis (MCA) for assessing disaster risk reduction measures, conducted in September 2016. Stakeholders present in the meeting included four coastal managers, two scientists, and one resident; two other residents and one business owner were invited but did not attend. The meeting was led by a “content-neutral” facilitator (O. Ferreira); two co-facilitators (one of them S. Costas) in charge of the logistics and one observer with training in psychological sciences (R. Domingues) were also present. The goal of the MCA was to evaluate and rank individual and combined disaster risk reduction measures (*e.g.*, house removal and improvement in communication channels) for Faro Beach. The discussion between stakeholders was registered by the observer, particularly the issues and concerns raised regarding Faro Beach and its residents.

3.2.2 Data analysis

Data collected in the semi-structured interviews and in the MCA meeting were examined using a qualitative content analysis based on an inductive approach (Gondim & Bendassolli, 2014; Mayring, 2000). The inductive approach was chosen given that the interviews and the meeting were not structured around a specific theory or model; therefore, a more suitable abstraction process that includes open coding and creation of categories derived from the data was used (Elo & Kyngäs, 2008). Three categories of stakeholders were considered in data analysis: scientists (professors and researchers involved in the scientific study of the Ria Formosa), local managers

(managers involved in coastal management at a local-level, e.g., municipality, local civil protection), and regional managers (managers involved in coastal management at a regional level, e.g., environmental protection agencies, natural parks).

3.3 Results

The analysis of managers and scientists' discourses allowed the identification of three main themes: a) stakeholders' views on residents' risk perception and concern (Table 3.1); b) stakeholders' explanations for residents' risk perceptions (Table 3.2); and c) solutions to increase residents' risk perception (Table 3.3).

3.3.1 Managers and scientists' views on residents' risk perception and concern

Overall, managers and scientists believe that residents *"know about the risk"* they face by living at Faro Beach, given that *"they are used to live with the risk"* and *"they have experience"* with the risk, particularly fishermen. Scientists view fishermen as quite knowledgeable about the Ria Formosa, *"they know a lot about the functioning of the Ria, and they know about the risk of building in a barrier island"*. However, managers think that residents *"do not understand the severity of the risk, or the risk that they are exposed to"*, and they are not concerned about the risk or are only concerned about the risk *"when it happens"*, *"when the storm is coming and during the storm"*. Scientists, on the other hand, believe that residents *"are concerned with storm and storm surges"* and *"fishermen know that they can lose their houses at any moment"*; one regional manager admits that residents *"are worried about their homes"*.

When asked about their views on residents' concern with environmental problems, regional managers believe that residents are not concerned, or are only concerned when the problem *"affects them directly"*. Some regional managers believe that the environmental concern of residents is seasonal or intermittent, as *"people only*

care (about overwash) during the winter” or “they care if something bad happens”. On the contrary, one local manager thinks that residents “are concerned about the environment, because they have an affective relationship with the Ria”. A scientist suggests that residents may have a utilitarian view of the Ria Formosa, as “their vision of the Ria has not changed over time, the Ria is there to be used as their parents did”.

Regarding the relationship with authorities and the implementation of disaster risk reduction (DRR) measures, stakeholders think that residents of Faro Beach “do not believe in authorities”, but, in contrast, they externalize the responsibility, “I think that the general feeling is that somebody else will solve the problems”. One scientist believes that most residents “would be (willing to participate in the implementation of DRR measures), the fishermen yes, but I am not sure if people with a second house would be interested, because they may think that they will lose more than what they’ll get”.

3.3.2 Explanations for residents' risk perception and concern

All managers agree that residents of Faro Beach easily forget the problems and the risks they have faced at the beach. They say, “people have a very short climatic memory”, “in the summer, the beach recovers, and they forget” and “people have time to forget about the problems”. Other explanation found by one of the regional managers to justify their apparent lack of concern with coastal hazards is that residents are convinced that serious consequences of coastal hazards will never happen to them, it may happen to their neighbours but not to them.

3. Assessing stakeholders' risk perceptions in a vulnerable coastal tourism destination

Table 3.1 – Content analysis of stakeholders' discourses. Theme 1 – Scientists and managers' perceptions of residents' risk perception and concern. Sc – scientist; LM – local manager; RM – regional manager.

Categories	Codes	Meaning units	Stakeholder
Stakeholders' perceptions of residents' risk perception and concern	Risk awareness and perception	The people living here (...) are used to live with the risk.	RM
		The ones that are living (at the Beach) are more at risk but they are used to it and know where they are, and do not demand, and they collaborate because they know that they are at risk.	RM
		They are worried about their homes.	RM
		I would say that people living there are concerned with storm and storm surges, but this is specific of the small area within the Ria where the hazard associated with storms is high and they know it.	Sc
		They do know (about the risk), the fishermen know that they can lose their houses at any moment.	Sc
		Yes, they know, they know a lot about the functioning of the Ria and they know about the risk of building in a barrier island, however, once things are installed in a place, they are very difficult to remove, people react very badly to that.	Sc
		I think fishermen know the kind of risk they face, and they have the experience.	Sc
		I do not think that people are concerned about the risk.	RM
		The people living here do not understand the severity of the risk, or the risk that they are exposed to.	RM
		They are concerned about the risk only when it happens.	RM
		No, I do not think (that people living at the Beach have risk perception), they only have risk perception when the storm is coming and during the storm, but then they forget.	RM
	Concern	People that live here are only concerned when a problem related to the environment affects them directly.	RM
		I think that people only care (about overwash) during the winter.	RM
		They do not care much, although this has improved, but they care if something bad happens.	RM
		Their vision of the Ria has not changed over time, the Ria is there to be used as our parents did.	Sc
		People living here help us to deal with a problematic situation, they are very resilient.	LM
		I do think (that people are concerned about the environment), because they have an affective relationship with the Ria.	LM
		I think that the general feeling is that somebody else will solve the problem.	RM
	Trust in authorities	They do not believe in authorities.	Sc
		In many cases people do not like managers' decisions.	Sc
	Willingness to participate in DRR measures	I think that they would be (willing to participate in the implementation of DRR measures), the fishermen yes, but I am not sure if people with a second house would be interested, because they may think they will lose more than what they'll get.	Sc

3. Assessing stakeholders' risk perceptions in a vulnerable coastal tourism destination

Some stakeholders refer the affective bond between residents and Faro Beach to justify their attachment to that place. One local manager says that residents *“do not want to move away from the Beach, because they have everything there”* and *“they have an affective relationship with the Ria”*. One scientist referred the length of residence as a factor explaining the willingness (or lack thereof) of residents to move away from the Beach; one scientist says that fishermen *“want to stay there, they have been there forever”*, whereas a few other residents, younger, *“say it wouldn't be a problem to relocate if they were compensated”*. Other scientist refers that *“once things function in a certain way, they are very difficult to change, people react very badly to change”*.

Table 3.2 - Content analysis of stakeholders' discourses. Theme 2 – Scientists and managers' explanations for residents' risk perceptions. Sc – scientist; LM – local manager; RM – regional manager.

Categories	Codes	Meaning units	Stakeholder
Explanations for residents' risk perceptions	Optimism bias	We are convinced that those things (bad things) will never happen to us, it may happen to our neighbors, but not us.	RM
	Availability and affect heuristics	Time deletes everything.	RM
		People have a very short climatic memory.	LM
		In the summer, the beach recovers and they forget.	RM
		I think that they forget, they only have risk perception when the storm is coming and during the storm, but then they forget.	RM
		People have time to forget about the problems.	LM
	Place attachment	I do think (that people are concerned about the environment), because they have an affective relationship with the Ria.	LM
		They do not want to move away from the Beach, because they have everything there.	LM
		(regarding relocations) I would say there are three versions: 'we want to stay here, we have been here forever' (...) they just want to save their homes, even if there is no beach anymore; this is the typical vision of the fishermen. (...) You also have those who would like to preserve the beach in front of their homes (...) and then, there are a few, younger, that say it wouldn't be a problem to relocate if they were compensated.	Sc
		Once things function in a certain way, they are very difficult to change, people react vary badly to change.	Sc

3.3.3 Solutions to increase residents' risk perception

Education is the main (and only) solution referred by stakeholders to increase residents' risk perception and environmental concern at Faro Beach. Managers and scientists agree that *"the only way to change this (risk perception) is to educate the new generation"*, because *"if you educate people, they may help"*. They also believe that people will engage more with environmental issues *"as a result of an investment in education"*. However, not all stakeholders agree that education of residents may lead to good results in the implementation of measures; a regional manager refers that educating residents could not work, as they *"only believe in what they see"* and *"if you go there trying to educate them... they are not open at first, they prefer when people benefit from the experience; if we stand there as doctors, it's over, and you cannot reach them"*. This regional manager also suggests that *"the way to reach them is different, because most of the experience they have is very helpful, so it depends on how we approach them"*.

Despite the importance of education, suggested by all stakeholders, some managers and scientists believe that education may not lead to higher risk perception. One of the regional managers points out, referring to cliff erosion signs warning people to stay away from cliffs at other beaches in southern Portugal, that *"warning signs at the beaches have no effect on people's behaviour"*, and one scientist agrees, *"this says a lot about people's affinity to what we teach them – it's absolutely incredible how people lay there, close to the warning signs (close to sea-cliffs in risk of falling); the information is there, the education is there, but something is missing"*.

Finally, local and regional managers also referred the lack of communication between scientists and managers. A regional manager says that there is *"a lack of communication between the academia and the administration. I am tired of listening to recommendations for managers that do not get out of their research papers"*. Also, a local manager refers that *"all this information (from research) is not transferred to those who actually need it (...) I feel that the information does not reach us..."* Figure 3.1 represents

expected and actual communication channels between managers, scientists, and residents of Faro Beach, based on stakeholders' discourses (this study and Domingues et al., 2017).

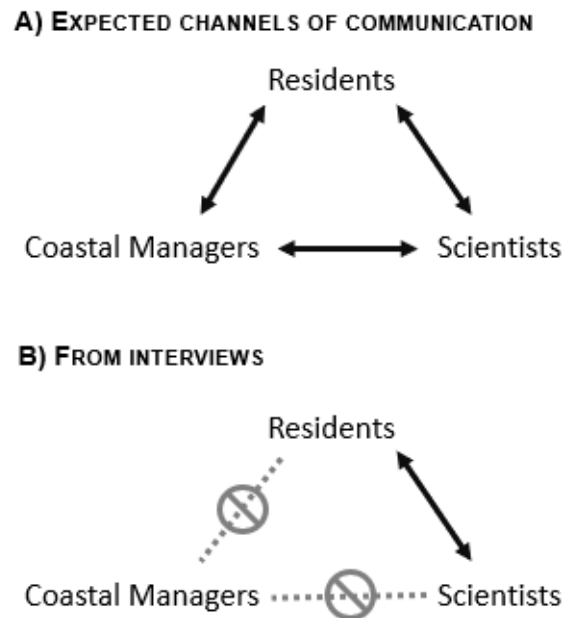


Figure 3.1 – A) Expected communication channels between residents, scientists and managers, and B) actual communication channels between stakeholders at Faro Beach.

3.4 Discussion

This study aimed to understand the opinions of managers and scientists involved with the Ria Formosa system on the risk perception and awareness of Faro Beach residents. Overall, managers and scientists believe that residents' risk perception and awareness of coastal risks is relatively high, given that they have experience with risks, but residents easily forget the problems and the risks that they face at the beach, demonstrating a low concern; education is seen by these stakeholders as the best solution to increase risk perception and environmental concern of Faro Beach residents.

3. Assessing stakeholders' risk perceptions in a vulnerable coastal tourism destination

Table 3.3 - Content analysis of stakeholders' discourses. Theme 3 – Scientists and managers' solutions for problems. Sc – scientist; LM – local manager; RM – regional manager.

Categories	Codes	Meaning units	Stakeholder
Stakeholders' solutions for problems	Education and information	The only way to change this (risk perception) is to educate the new generations.	RM
		It's logic that more information will increase the acceptability of this measure (demolition of houses).	
		(People engage more with environmental issues) as a result of an investment in education.	RM
		I do not think (that educating people could be good), I think they only believe in what they see.	RM
		If you go there trying to educate them ... they are not open at first, they prefer when people benefit from the experience; if we stand there as doctors, it's over, you cannot reach them.	RM
		The way to reach them is different, because most of the experience they have is very helpful, so it depends on how we approach them.	RM
		If you educate people, they may help.	LM
		When people know certain things, they have a totally different reaction (to the implementation of measures).	LM
		Informed people collaborate better in the resolution of problems – I think we can all agree on that.	RM
		People will be more receptive (to change) when they have more information.	
		If there was more information, more explanations regarding the demolitions (maybe residents would agree)...	LM
		If there was a continuous education of residents, like every year or so, then improvements in communication channels could be effective.	LM
		Warning signs at the beaches have no effect on people's behaviour.	RM
		If there was a continuous education of residents, like every year or so, then improvements in communication channels could be effective.	LM
		People will be more receptive (to change) when they have more information.	Sc
		It's logic that more information will increase the acceptability of this measure (demolition of houses).	Sc
		This says a lot about people's affinity to what we teach them – it's absolutely incredible how people lay there, close to the warning signs (close to sea-cliffs in risk of falling); the information is there, the education is there, but something is missing.	Sc
	Communication between scientists and managers	It looks like all this information (from research) is not transferred to those who actually need it. I do not need very deep information, I need the results to understand the risk, and I feel that the information does not reach us...	LM
		(There is) a lack of communication between the academia and the administration. I am tired of listening to recommendations for the managers that do not get out of their research papers.	RM

3.4.1 Risk perception and awareness

In the interviews and MCA meeting, managers and scientists consistently referred to risk *perception* when what they meant was risk *awareness*. These two terms are commonly used interchangeably by stakeholders, the public and the media, but they represent distinct, although related, psychological constructs. Risk awareness refers to having information about hazards and risks (Gifford, 2014a; Luís et al., 2016), or to recognize the risk, accept its possibility and understand its mechanisms and impacts. Raising awareness of a risk has been used as a synonym of increasing risk perception (e.g., Cologna et al. 2017), but psychological research shows that being aware of a risk does not necessarily lead to increased risk perception (Schuetz et al., 2011). In fact, risk perception is not a rational, analytical or objective process, but rather a subjective judgment that an individual makes regarding the characteristics and severity of a risk (Slovic, 1987). It is driven by unconscious emotional processes, such as feelings of fear or anxiety (Gifford, 2014a), and cognitive heuristics, that are mental shortcuts expressed as simple information-processing rules that individuals use when making decisions and judgments, and that may lead to biases in decision making (Tversky & Kahneman, 1974). The cultural and social context may also influence risk perception and lead to social representations of risk (Michel-Guillou & Meur-Ferec, 2017), given that individuals tend to shape their views to match those of people with whom they identify (Brown, 2014).

Most stakeholders agree that Faro Beach residents, particularly fishermen, have high risk awareness, as they know that they are at risk, they are worried about their homes, they know the kind of risks they face, and they know that they can lose their houses at any moment. Scientists see residents as very knowledgeable about the functioning of the Ria Formosa, but managers believe that residents do not understand the severity of the risk, and they are concerned only when something bad happens. Drawing from the stakeholders' discourses, residents of Faro Beach apparently have a considerable risk awareness, i.e., they have information about hazards and they are

aware of the potential risks; the lack of concern that managers refer may be interpreted as a low risk perception, i.e., residents, unconsciously and subjectively, underestimate the severity of the risks.

Risk perception has been evaluated at Faro Beach in previous studies using both qualitative and quantitative approaches, and results are inconsistent. Qualitative analysis of residents' discourses suggested that residents are well aware of the risks, but nonetheless their risk perception is low, as they feel safe at the beach and feel that their lives are not at risk (Costas et al., 2015; Domingues et al., 2017). However, a quantitative approach based on the psychometric paradigm demonstrated that residents have medium/high levels of risk perception, informed by past experience with hazards, but they believe hazards are not very dangerous and are distant in time (Domingues et al., 2018).

3.4.2 Cognitive biases, heuristics, and place attachment

Managers and scientists explained residents' apparent lack of concern making references to cognitive biases, which are systematic deviations from norm or rationality when making judgements, leading individuals to draw inferences or adopt beliefs in a non-logical manner, without or with insufficient evidence to do so (Haselton et al., 2005). One of the managers referred that residents believe that bad things only happen to other people, expressing their optimism bias, and several managers pointed out the "*short climatic memory*" of residents, related to the availability heuristics.

Individuals with an optimism bias usually believe that they are personally less likely to experience negative events, and more likely to experience positive events, than other people (Breakwell, 2014). Optimism bias has been observed not only in regard to natural hazards, such as hurricanes (Trumbo et al., 2011) and earthquakes (Helweg-Larsen, 1999), but also in relation to other hazards, such as health-related or

terrorism events (see Breakwell, 2014 and references therein). Optimism bias is informed by personal experience with hazards; experience may either increase or decrease risk perceptions (see review by Wachinger et al. 2013), depending on how individuals interpret their experiences (Lindell & Perry, 2004). At Faro Beach, optimism bias is rooted in the 'positive' personal experience that most residents have with coastal risks, particularly storms and beach erosion that have led to the destruction of buildings, but never to the loss of lives (Domingues et al., 2018). This represents a behavioural barrier that may hamper residents' preparedness in case of disaster (Domingues et al., 2018), as optimism bias might be at the root of the unwillingness of individuals to take precautions to protect themselves from hazards (Breakwell, 2014). Optimism bias is, indeed, an important psychological barrier that hinders self-protective and proenvironmental behaviours (Gifford, 2011).

Optimism bias is closely associated with the availability heuristic, a mental shortcut that individuals use when estimating the probability of an event, based on how easily previous similar events can be recalled. This is what stakeholders called a "*very short climatic memory*", referring that Faro Beach residents only have high risk perception/awareness when the storms are happening, in the winter; when the summer starts and the beach recovers, residents easily forget the hazards and the risks they faced in the winter. Events that people recall and probability judgements that people make are influenced by many variables, including beliefs, expectations, and frequency of exposure (Tversky & Kahneman, 1973). Faro Beach residents are frequently exposed to storms and other hazards, which could, according to the availability heuristic, lead to an easier recall of problems and risks. However, the positive emotions, feelings, and expectations associated with hazards at Faro Beach, informed by the 'positive' personal experience that residents have with hazards, lead to the opposite effect: high-frequency storm events that never had serious consequences (e.g., fatalities) are easily forgotten or underestimated. The same has been observed in a location in Jakarta exposed to tsunamis, typhoon storm surges and

dyke-break induced floods, where residents are aware of the risks they face, but seem to underestimate their severity, most likely due to a high frequency of exposure to hazards in the recent past (Esteban et al., 2017). If the severity of personal disaster consequences were high, the intensity of negative emotions would be higher; according to the affect heuristic, or the risk-as-feelings hypothesis, negative emotions increase risk perceptions (Loewenstein et al., 2001), which would lead to an easier recall of events; consequently, the probability of occurrence of disaster events would be judged as higher. As the personal consequences of disasters cannot be exacerbated from an ethical viewpoint, one way to increase risk perception would be to decrease optimism bias, by increasing the availability heuristics (Jolls & Sunstein, 2005), i.e., making frequent events, such as storms, more prominent and easy to recall. Exposing individuals to more information about the risk does not necessarily eliminate optimism and it may even strengthen their belief that bad things only happen to others (Weinstein et al., 1998).

In addition to cognitive biases and heuristics that affect judgements, residents have affective connections with Faro Beach, as referred by one local manager. Place attachment, defined as an affective bond or link between people and specific places (Hidalgo & Hernández, 2001), may have contributed to lowering residents' risk perceptions, as already observed for other environmental risks, such as seismic (Armaş, 2006) and volcanic risks (Donovan et al., 2012). However, increases in risk perception have also been observed in association with place attachment, for volcanic (Bird et al., 2011), hurricane (Burley et al., 2007) and drought risks (Stain et al., 2011).

One scientist referred that length of residence is a factor that differentiates residents who have been living at the beach "*forever*" and refuse to leave the beach, from younger residents who may accept a potential relocation. Indeed, length of residence is a significant predictor of place attachment, thus influencing risk perception. Most residents have lived at the beach for most of their lives (Domingues et al., 2018), and a longer length of residence is associated with higher familiarity with

the risk. This familiarity with the risk leads to an increase in an individual's sense of control over the risk (Bernardo, 2013), and, consequently, a decrease in risk perception.

3.4.3 Education and normalization of risk

Providing more education to residents was exhaustively referred by managers and scientists as the best way to increase their risk perception and, more important, their acceptance of measures, particularly house removal. Environmental education was referred several times as one of the measures that should be implemented to get people on board with managers' decisions, by increasing people's awareness of coastal risks and, hence, their risk perceptions. Information is indeed a major variable influencing risk awareness and risk perception, and it may be very effective in increasing awareness of hazards (Charrière et al., 2017; Hajito et al., 2015). However, information may not always act in the way that is intended by managers and policy-makers; this approach to risk communication is naïve and ignores fundamental aspects of psychological functioning, such as the use of cognitive biases and heuristics, and the conflict with existing beliefs (Lindell & Perry, 2004). The idea, known as the information deficit model, that public misunderstanding, scepticism, objections or hostility towards science and technology is due to a lack of knowledge that can be overcome by providing more information to the public (Rowe & Frewer, 2000), still persists in coastal management strategies, probably due to its logic and simplicity. However, psychological research has shown that the effects of awareness on risk perception are not straightforward.

Higher awareness about hazards and risks may lead to higher risk perceptions, as desired by managers, but it can also lead to a decrease in risk perception (Lima, 2004; Lima et al., 2005; Luís et al., 2016; Luís, Vauclair, et al., 2018) - the opposite of what is intended with more education. Awareness about coastal risks may not result in higher risk perceptions because people develop strategies to psychologically cope

with the threats, hence decreasing the subjective judgment they make about the risk (Luís et al., 2016). This psychological strategy is known as risk normalization, and it commonly occurs when people expose themselves voluntarily to risks (Twigger-Ross & Breakwell, 1999), like Faro Beach residents (Costas et al., 2015).

Residents of Faro Beach are fully aware of the risks they face by living there (Domingues et al., 2017, 2018); in fact, most individuals living in coastal zones demonstrate high levels of awareness and knowledge about coastal hazards and associated risks (Delicado et al., 2012; Schmidt et al., 2014). However, due to their physical proximity, emotional bonds, and previous experience with hazards, they developed strategies to cope with the threats, namely by normalizing the risk and thus decreasing their risk perceptions.

Despite the general belief that more education will result in higher risk perception, some managers and scientists have already realized that more information may not always work, referring to cliff erosion signs that have no effect on people's behaviour. A higher public involvement may be achieved, not by educating people, but rather by directly involving the public in the decision process, leading to higher compliance to measures and reducing the need for enforcement (Smith, 2012). In fact, the most important source of knowledge on coastal hazards at Faro Beach is not formal education or environmental education campaigns, but rather life experience (Domingues et al., 2018). In addition, stakeholders are well aware that residents do not trust the authorities, given that they feel that their opinion is not considered by coastal managers (Costas et al., 2015; Domingues et al., 2017).

3.4.4 Communication among stakeholders

Overall, managers and scientists are quite accurate regarding the views, beliefs, and risk awareness and perception of Faro Beach residents (Costas et al., 2015; Domingues et al., 2017, 2018). The most prominent discrepancy relates to the role of

education/information on risk perception. Most managers and scientists believe that education is the most effective way to increase environmental concern and risk perception, but some recognize that more information may not work, as already observed with beachgoers in beaches with sea-cliffs in risk of falling.

Conversely, residents regard education (includes environmental education, formal education and public discussions) as the least important source of information on coastal hazards and risks, in comparison with life experience, which they consider their major source of information (Domingues et al., 2018). Only one of the stakeholders, a regional manager, expressed that education may not work with these individuals, due to the important role that their personal experience with coastal hazards plays.

Communication between actors is, thus, a major issue in Faro Beach, and improvements in communication channels are deemed necessary for a sustainable management of this coastal system (Cumiskey et al., 2018). As scientists and managers have an appropriate understanding of residents' opinions and beliefs regarding coastal hazards and risks, this knowledge could be applied to improve communication with residents. To begin with, residents should feel that their opinion matters. Public discussions should be discussions between actors, not one-way information exchanges that leave no room for higher levels of engagement (Rowe & Frewer, 2000). An active involvement of people whose lives are affected by the program under discussion must be pursued in all phases of the process, including the selection and evaluation of measures. If residents' opinions were heard and taken into consideration, their perceived behavioural control and self-efficacy would increase – people would feel that they can make a difference. In addition, higher public engagement based on participation (and not just communication) could also help individuals cope with threats in more adaptive ways (Luís et al., 2016), eliminating risk normalization and hence developing more realistic risk perceptions. However, residents' cognitive biases and heuristics, which can affect judgements and decision-making, must be firstly

identified. Thus, psychology experts should be included in coastal management programs to work not only with residents, but also with the other stakeholders, and help them overcome their cognitive shortcuts. Indeed, decision-makers, like every human being, make decisions based on their values, beliefs, and past experiences; scientists can also play an important role in helping decision-makers, by shaping their beliefs (von Winterfeldt, 2013) with adequate scientific evidences.

However, communication between scientists and managers is often poor, as scientific results are not readily accessible to managers, and scientists may not understand which information is the most relevant for decision-makers (von Winterfeldt, 2013). In order to bridge the gap between these stakeholders, scientists should be trained to write for policy-makers, scientific results should be actively communicated and marketed, and precise recommendations to policy-makers should be included (Choi et al., 2003). Although it can be challenging for decision-makers, the legitimacy and acceptance of coastal management decisions can only be achieved with truly collaborative approaches that include the opinions of residents and the recommendations of scientists.

3.5 Conclusions

The qualitative content analysis of managers and scientists' discourses regarding risk awareness and perception of Faro Beach residents showed that managers and scientists recognize that residents, particularly fishermen, are aware and quite knowledgeable about the risks they face by living there. However, managers and scientists believe that residents easily forget the risks due to an optimism bias and positive personal experience with hazards that lead to an underestimation of the severity of the risks. An effective communication between all stakeholders is essential for a sustainable coastal management, but managers are aware that residents mistrust the authorities and externalize the responsibility for coastal problems. Additionally,

managers complain about the lack of communication between them and scientists, as scientific results that could be useful for coastal managers seldom reach them. A possible approach to improve coastal management and decrease risks would be to promote an active participation of all stakeholders in the discussions and decision-making processes, based on trust and on the sharing of experiences among stakeholders. Long-term collaborative projects that include all stakeholders and multidisciplinary teams are thus necessary for a sustainable coastal management at Faro Beach.

Chapter 4

How a coastal community looks at coastal hazards and risks in a vulnerable barrier island system

How a coastal community looks at coastal hazards and risks in a vulnerable barrier island system (Faro Beach, southern Portugal)

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Abstract

Faro Beach is a vulnerable and heavily urbanized settlement in the Ria Formosa barrier island system, exposed to beach erosion, overwash and other hazards that have resulted in house and road destruction. Residents have accepted the risks in exchange for the benefits of living at the beach. Previous qualitative studies have suggested that residents' risk perception is low and incongruent with the real risk to which they are exposed to. In this study we aimed to evaluate residents' awareness and risk perception, as well as determinants and outcomes of risk perception, using a quantitative approach based on the psychometric paradigm.

Results show that Faro Beach residents possess significant knowledge on coastal hazards and awareness of risks that derive mainly from life experience. Other sources of information (environmental education campaigns, public discussions, and formal education) are mostly irrelevant for residents. Their risk perception is relatively high, but they believe hazards are not that dangerous and are distant in time; consequently, their preparedness towards risks is low. Residents' risk perception is related to their length of residence at the beach (mostly >10 years), their "positive" past experience with hazards, that never resulted in fatalities, and their psychological distance in relation to threats, all of which may hamper residents' preparedness in case of disaster. Other behavioural barriers, such as mistrust in authorities, externalisation of responsibility, optimism bias, or low self-efficacy, may also hinder their preparation efforts. Authorities' efforts to give more information and education to coastal populations in order to increase risk perceptions or decrease psychological distance

may have the opposite effect, given that individuals use a variety of strategies to psychologically cope with threats and thus maintain their psychological well-being. A thorough knowledge of the psychological determinants and responses to coastal risks is thus highly relevant in the context of coastal management.

Keywords: risk perception; awareness; preparedness; psychological distance; coastal hazards.

4.1 Introduction

Coastal ecosystems are among the most productive systems in the world, but also among the most threatened by growing human population, exploitation pressure (e.g., Agardy et al., 2005) and marine hazards. Marine hazards have significant impacts in coastal areas, particularly low elevation coastal zones, defined as the contiguous area along the coast that is less than 10 m above sea level, where an estimated 10% of the world's population lives (McGranahan et al., 2007). These regions are extremely vulnerable to damage from wave forcing and flooding, aggravated by climate-related sea level rise and other human-induced changes (Nicholls & Cazenave, 2010).

Barrier island systems, which constitute 6.5% of the world's open ocean shoreline (Stutz & Pilkey, 2001), are narrow, long low lying sedimentary deposits separated from the hinterland by a shallow bay or lagoon. Barrier islands are characterized by their sandy/gravel composition, low elevation and exposure to storms and inlet processes; thus, they are extremely vulnerable to erosion, overwash, flooding and breaching (Vila-Concejo et al., 2006). Barrier islands have been occupied by humans for thousands of years, with a degree of human utilisation ranging from negligible to extreme (Stutz & Pilkey, 2005). Due to the vulnerability of barrier islands, coastal human settlements can thus be severely impacted by several coastal hazards such as inundation and overwash, storm-induced erosion, long-term shoreline retreat,

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or even larger disasters such as tsunamis (Nicholls & Cazenave, 2010). Therefore, living at the coast is a high-risk choice (Kron, 2013; Neumann et al., 2015). Nevertheless, many coastal populations feel safe living in risky coastal areas, despite being relatively aware of the risks they face by living there (Costas et al., 2015; Luís et al., 2016; Martins et al., 2009).

Faro Beach, located at the Ria Formosa barrier island system (southern Portugal; Figure 1.1), is one such example of a human settlement exposed to several coastal hazards, whose residents seem to be aware of the risks but feel safe there and show no intentions of moving to more protected areas (Costas et al., 2015; Domingues et al., 2017). The beach has a history of human occupation that extends over five decades, with a significant increase in the number of buildings and population observed since the 1980's. It currently includes a traditional fishermen community and some non-fishermen residents, in a total of 245 permanent residents; it also includes many second residences occupied mainly during summer by residents of the nearby city of Faro and tourists. Two distinct areas with contrasting characteristics can be found at Faro Beach. In the central area there is a 2 km strip of sandy barrier that has been removed from the maritime public domain in the 1950's and is managed only by Faro municipality. This strip includes 378 buildings, of which 57 are used as first residence and 16 are illegal (NEMUS, 2013). Houses in this area are generally larger and better built than the fishermen's houses, and some are 4 storeys high; most of these houses are second residences or tourists accommodations (Costas et al., 2015). Bordering the 2 km central strip are two fishermen settlements, located in the maritime public domain. This area is managed by governmental institutions and subjected to coastal management plans, namely POOC (Coastal Zone Spatial Plan) and POLIS Litoral (programme on integrated operations towards the renewal and enhancement of the coastal zone). According to these plans, several re-naturalization and re-qualification measures should be implemented in this area, such as beach nourishment, dune recovery and the demolition of all buildings, either first or second residences. Before 2015,

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approximately 232 “illegal” houses, of which 102 were first residences, existed in the maritime public domain area (RioPlano/A.T93, 2011); these houses were smaller and poorer in quality in relation to buildings in the central 2 km strip (Costas et al., 2015). Currently, all second residences and some first residences have already been demolished by authorities, and the plan is to demolish all houses, after appropriate housing elsewhere is given to residents. The main rationale behind these measures, particularly demolitions, is to prevent ecological and socio-economical risks associated with coastal erosion and wave-driven flooding.

Since its inception, the Faro Beach community (and other settlements in the Ria Formosa system) has always been threaten by coastal hazards, particularly storms, that have already resulted in inlet opening, destruction of sandy barriers and damages to houses and roads. Historical records demonstrate the occurrence of four severe storms in the first half of the XIX century that sank fishing boats, ripped roofs and uprooted trees, destroyed fishermen’s huts and caused the collapse of stone walls (Garnier et al., 2018). A relatively calm period followed, free of high intensity storm events, until a violent cyclone hit the Iberian Peninsula in February 1941, causing significant damages in the whole Ria Formosa system and in nearby villages and towns. For instance, eucalyptus and pine trees were uprooted and thrown to the ground, zinc plate roofs were lifted, some houses, street lamps, telegraph and electric poles in the city of Faro were destroyed, many fishing boats and fishing equipment were lost, and fishermen’s houses and huts disappeared; geomorphological changes were significant, with the water level covering a large part of the islands, causing the destruction of an entire village and the opening of a new inlet (Garnier et al., 2018). The last major storm that hit the Ria Formosa and resulted in house destruction in Faro Beach was in the winter 2010, associated with the passage of the extratropical cyclone Xynthia, but every winter strong winds and overwash result in erosion and some material damages. In addition, Faro Beach is located in an area of high seismicity, thus highly vulnerable to tsunami entrance, even for tsunami heights of just 3 m (Nunes et al., 2009). In fact, the entire

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barrier system was most probably overwashed and disrupted by the so-called Lisbon tsunami of 1755 (Andrade, 1992).

Despite the material damages that Faro Beach has suffered throughout the years, no casualties were ever observed due to coastal hazards. In fact, most people living at Faro Beach have voluntarily accepted to live in a highly risky area in exchange for benefits that they perceive as largely exceeding potential personal damages (Costas et al., 2015). Previous studies have approached residents' risk awareness and risk perception, but these terms have often been used interchangeably, although they represent distinct psychological variables. Awareness refers to having information and knowing about hazards and associated risks (Gifford, 2014a; Luís et al., 2016), but being aware of a hazard does not necessarily lead to concern or behavioural changes (Schuetz et al., 2011). Risk perception is an emotion-based variable, often driven by individual's feelings, such as fear and anxiety (Gifford, 2014a). Risk perception is not rational, objective or analytical, but instead an intuitive and subjective judgment that individuals make regarding the characteristics and severity of a risk (Slovic, 1987). It is a mental construct (Sjöberg, 2000), mostly based on individual processes and cognitive functioning (van der Linden, 2015), although social representations of risk may also be constructed due to social, cultural and contextual processes (Michel-Guillou & Meur-Ferec, 2017). Therefore, becoming aware of a risk does not necessarily lead to an increase in risk perception.

Previous qualitative approaches to risk assessment at Faro Beach have not distinguished between awareness and perception, concluding that residents are aware of the hazards but they are not aware of the "real" risk they face (Costas et al., 2015). A qualitative content analysis also suggested that residents' risk perceptions are low and shaped by emotional processes such as place attachment and optimism bias (Domingues et al., 2017).

Therefore, we aim to evaluate the awareness and risk perception of Faro Beach residents regarding coastal hazards, using a quantitative approach based on the psychometric paradigm. Based on a recent conceptual model of coastal risk perception (Domingues et al., 2017), we also aim to analyse potential determinants of risk perception, such as previous experience with risks and psychological distance, and the outcomes of risk perception, namely preparedness, willingness to participate in the implementation of disaster risk reduction (DRR) measures, externalisation of responsibility and trust in authorities.

4.2 Methods

4.2.1 Participants and questionnaire

Structured self-report questionnaires were developed by the authors and distributed at Faro Beach in April and May 2017 to residents, defined as people that have been living at the beach for at least 5 years. Three enumerators recruited participants by knocking on doors; the low level of education of many participants posed a challenge, but the enumerators were trained to clarify any questions and doubts; in some cases, enumerators had to read the questionnaire to respondents, but did not influence their answers.

The first section of the questionnaire included multiple choice questions about residents' self-estimated level of information regarding coastal hazards (used as a proxy for awareness) and their main sources of information, residents' opinion on the severity of coastal risks and on the probability of risks associated with tsunamis, storms, flooding, erosion, overwash, shoreline retreat, and damages due to wind; these variables were treated as categorical variables. The second section was composed by Likert items, i.e., affirmative sentences to be responded on a 5-point rating scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), treated as continuous variables,

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to evaluate residents' risk perception, potential determinants of risk perceptions, namely previous experience with risks and psychological distance (threats perceived as distant in time), and potential outcomes of risk perception, namely preparedness, willingness to participate in the implementation of DRR measures (these measures include house removal, beach nourishment, using sandbags to protect the houses, plantation of native plant species to retain the dune, etc.), externalization of responsibility regarding risks, and trust in authorities. Item order was randomised, and some items were reversed to make sure that participants were reading and responding to the questionnaire carefully (e.g.: item "*In the future, people and houses may be at risk, but now they are not*" is directly evaluating psychological distance; item "*Currently, people living here are at risk*" is reverted). The last section included socio-demographic information, treated as categorical variables.

4.2.2 Data analysis

Descriptive statistics (frequency distributions, means and standard deviations) were used to summarize the data. Significant differences among categorical data for each continuous variable were analysed with independent samples *t*-tests, Mann-Whitney tests, or Kruskal-Wallis tests, depending on the number and size of groups and data normality. Effect sizes were calculated to quantify the strength of the differences between groups. Cohen's *d* was used for *t*-tests and *r* (quotient between the standardized test statistic and the square root of sample size, *N*) for Mann-Whitney tests (including pairwise comparisons following significant Kruskal-Wallis tests). For *t*-tests, *d* values of 0.2 indicate a small effect, 0.5 a medium effect and 0.8 a large effect; for Mann-Whitney tests, *r* values of 0.1 indicate a small effect, 0.3 indicate a medium effect and 0.5 a large effect (Cohen, 1992). Independence between categorical variables was evaluated with chi-square independence tests. Relationships among continuous variables were assessed with Pearson's correlations. A significance level of 0.05 was considered for all statistical tests. Effect sizes were calculated using an online

calculator (<https://www.polyu.edu.hk/mm/effectsizefaqs/calculator/calculator.html>); all other analyses were performed with IBM SPSS Statistics v. 22.

4.3 Results

4.3.1 Socio-demographic profile

A total of 77 Faro Beach residents, representing approx. 30% of the resident population, completed the questionnaire. Gender distribution was well balanced, with 53.2% women and 46.8% men; mean age of respondents was 51.4 years ($SD = 17.5$), ranging between 15 and 88 years. Regarding their level of education, the majority (59.8%) had only basic education, 27.3% possessed high school education and 13.0% had a university degree. Most of the respondents (62.3%) live at the beach since birth, many (35.1%) live there for more than 10 years and only a small percentage (2.6%) live at the beach for less than 10 years, but more than 5.

4.3.2 Awareness of risks

Residents were asked about the degree of information they possess regarding hazards at Faro Beach and the main sources of that information. Most of them (85.7%) considered themselves more or less informed or well informed, whereas 14.3% consider that they are misinformed or have no information at all about hazards (Figure 4.1). Most of the residents (72.7%) consider that their major source of information on coastal hazards is life experience. Media and family, friends and neighbours are also important sources of information referred by 49.4% and 42.9% of residents, respectively. Environmental education campaigns, formal education and participation in public discussions are less relevant, with only 20.8% of residents referring them as sources of information (Figure 4.2).

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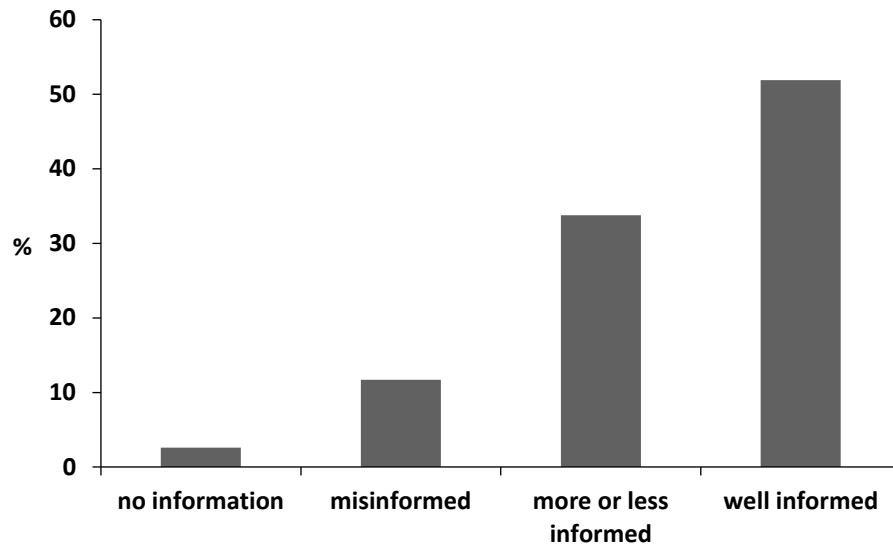


Figure 4.1 - Level of information on coastal hazards in Faro Beach residents.

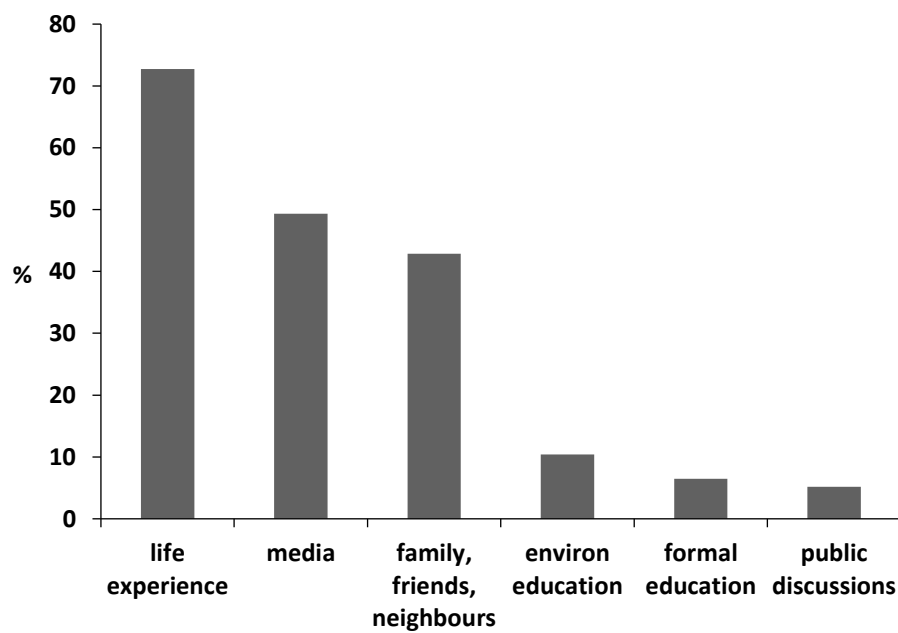


Figure 4.2 - Sources of information on coastal hazards in Faro Beach residents.

Residents were asked about the severity of risks at Faro Beach. Only 5.2% considered coastal risks very relevant, whereas the majority of respondents perceived the risks as relevant (37.7%) or slightly relevant (42.9%); the remainder (14.3%) believe that coastal risks at Faro Beach are irrelevant (Figure 4.3). They were also asked about

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the probability of occurrence of specific phenomena, hazards, and risks at Faro Beach. Overall, most respondents believe that phenomena like storms (Figure 4.4), coastal hazards (Figure 4.5) and risks (Figure 4.6) are likely or very likely to occur. Regarding tsunamis, half of the respondents consider that their occurrence at Faro Beach is unlikely or impossible (50.0%).

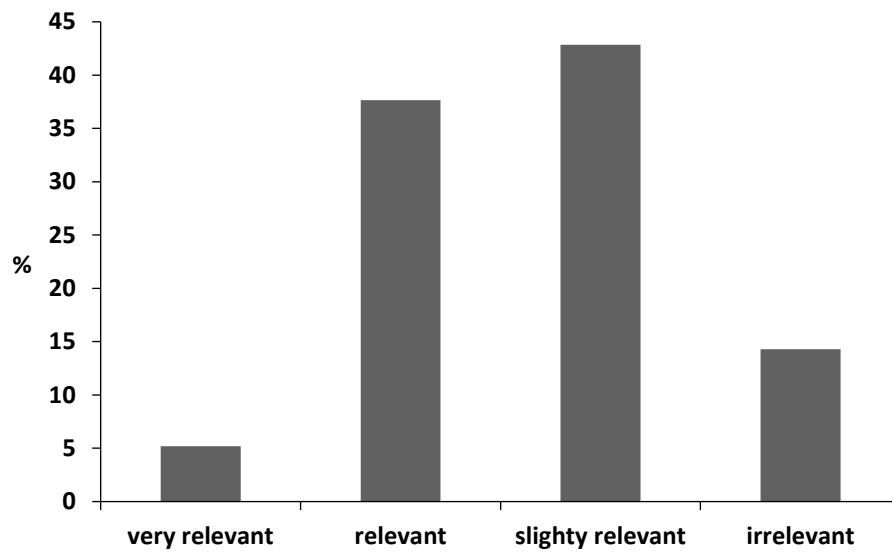


Figure 4.3 - Residents' perception of the severity of coastal risks at Faro Beach.

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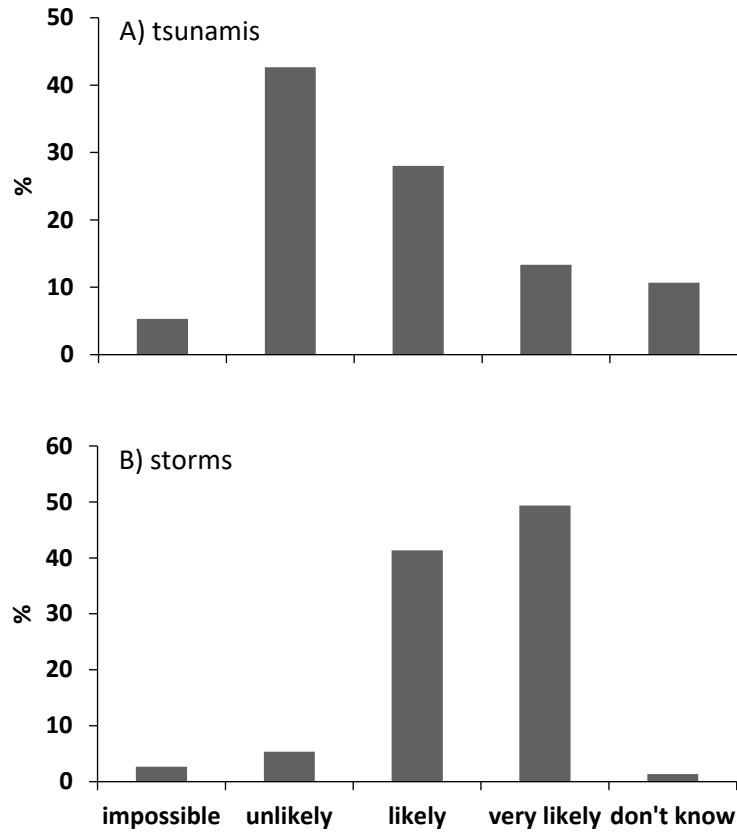


Figure 4.4 - Residents' opinion on the probability of occurrence of A) tsunami and B) storm events at Faro Beach.

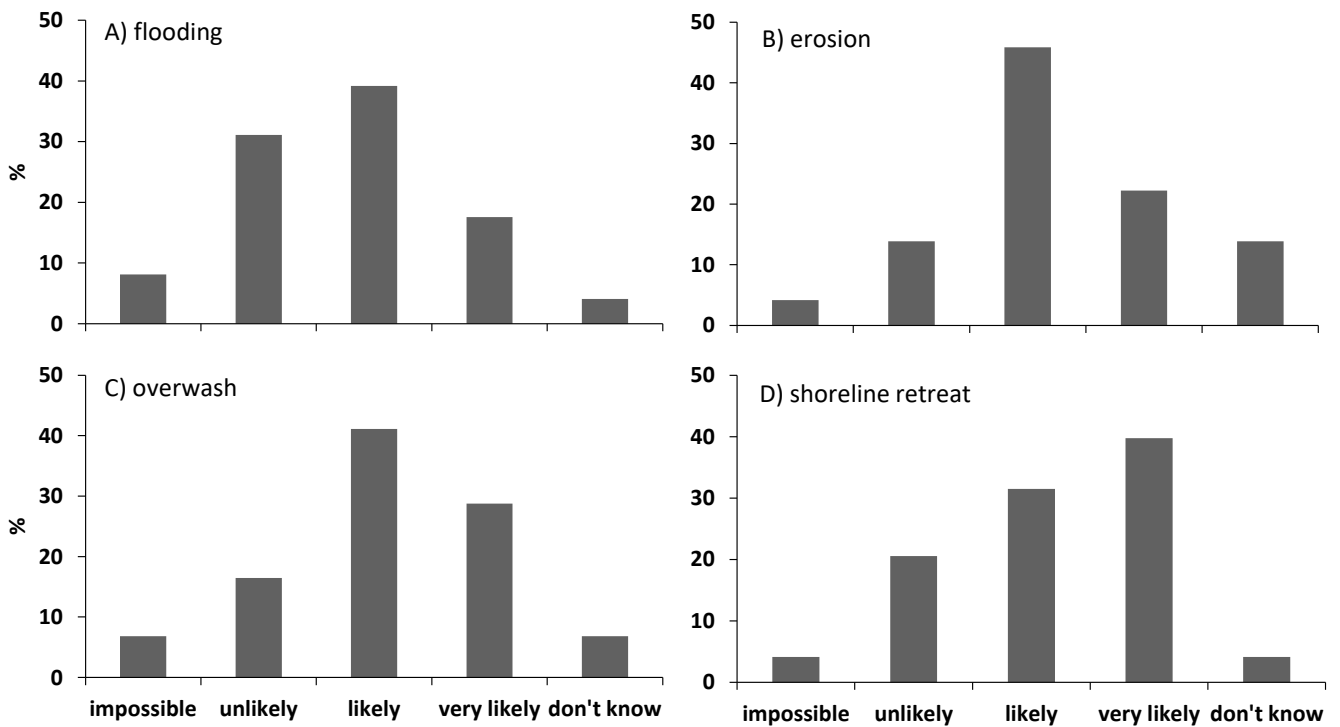


Figure 4.5 - Residents' opinion on the probability of occurrence of coastal hazards. A) flooding, B) erosion, C) overwash and D) shoreline retreat.

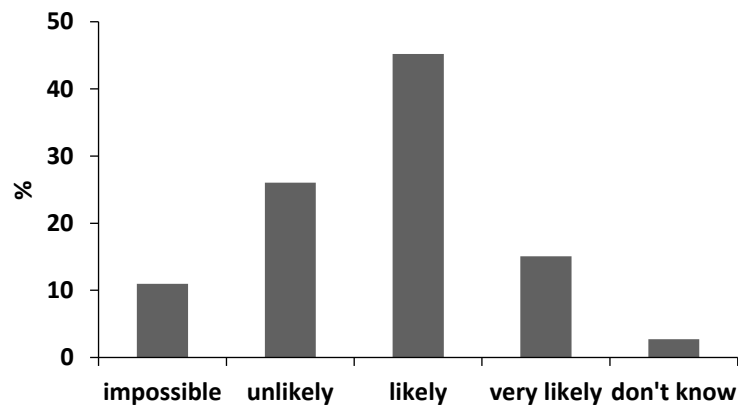


Figure 4.6 - Residents' opinion on the probability of occurrence of a specific coastal risk (damage/destruction of houses and roads due to wind) at Faro Beach.

4.3.3 Risk perception, determinants, and outcomes

Residents were asked about their risk perception towards coastal risks at Faro Beach with Likert items such as *"I feel safe where I live"*, *"Where I live, I am not at risk and my house is not at risk"*, or *"I feel that my house and my life are at risk due to coastal hazards"* (reverted item). Overall, residents risk perception was relatively high ($M = 3.86 \pm 0.72$, on a 1 to 5 scale), with 67.5% of respondents agreeing that they are at risk (Figure 4.7). They were also asked about their previous experience with coastal risks with items such as *"I have seen houses being destroyed due to coastal hazards at Faro Beach"* or *"I have seen people losing their belongings due to storms/flooding where I live"*; approximately a third of the residents agree that they have experienced risks before (36.4%), a third referred that they do not have previous experience with risks (29.9%) and a third (33.8%) did not express clearly their past experience, with a mean value of 3.08 ± 1.15 (Figure 4.8A). The perception of threats as distant in time (psychological distance) was evaluated with items such as *"In the future, people and houses may be at risk, but now they are not"* or *"Currently, people living here are at risk"* (reverted) and more than 50% of residents neither agree nor disagree, thus not expressing a clear opinion. The other residents are balanced between those who believe that risks will probably happen in

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the future (24.7%) and those who believe that they are already at risk (19.5%), with a mean value of 3.08 ± 0.75 (Figure 4.8B).

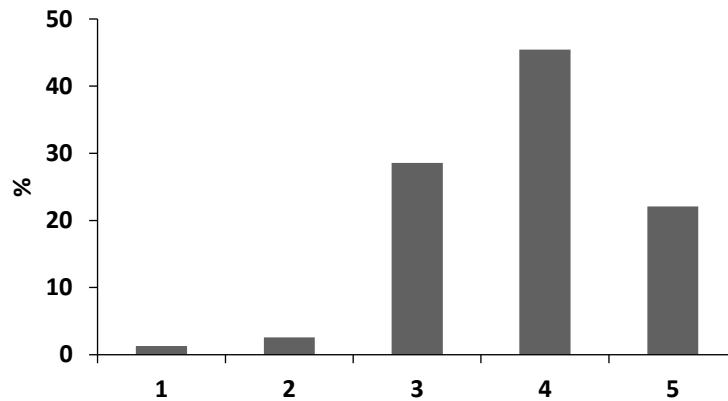


Figure 4.7 - Risk perception of Faro Beach residents towards coastal risks. Responses were given to Likert items on a 5-point rating scale, from 1 = strongly disagree (low risk perception) to 5 = strongly agree (high risk perception).

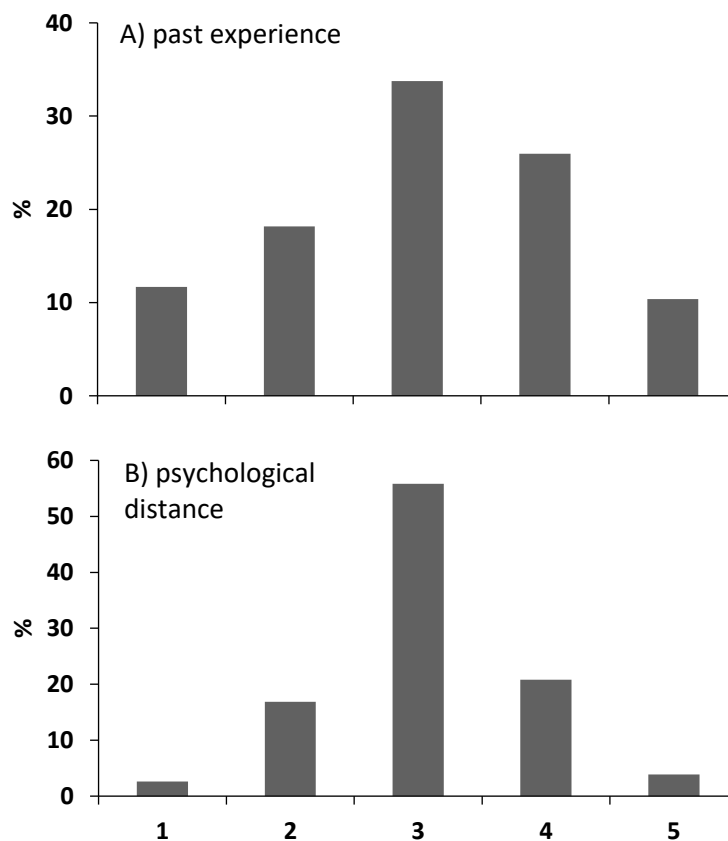


Figure 4.8 – Potential determinants of risk perception of Faro Beach residents: A) past experience with risks and B) psychological distance (perceiving threats as distant in time). Responses were given on a 5-point rating scale; lower and higher values indicate lower and higher past experience/psychological distancing, respectively.

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Variables that may potentially be influenced by risk perception were also assessed. Residents were asked about their preparedness towards risks with items such as *“In case of disaster, I am ready to face it”* or *“If something happens where I live, I have a plan B”*. Most respondents either disagree that they are prepared (37.3%) or claim that they are more or less prepared in case of a disaster (35.1%), with a mean value of 2.84 ± 1.02 (Figure 4.9A). Residents’ willingness to participate in the implementation of disaster risk reduction (DRR) measures was evaluated with items such as *“I would voluntarily collaborate in the implementation of DRR measures where I live”* or *“I don’t mind participating in the implementation of DRR measures, but it would depend on the type of measures”*. The majority of respondents (78.4%) agree or strongly agree when asked about their willingness to participate in DRR measures ($M = 3.96 \pm 0.71$) (Figure 4.9B). The externalization of responsibility regarding coastal risks was also evaluated; the majority of respondents (48.1%) neither agreed nor disagreed with items like *“The authorities are responsible for solving problems related with coastal risks”* or *“People who live in regions exposed to coastal risks should participate in the resolution of associated problems, together with the authorities”*, with a mean value of 3.15 ± 0.61 on a 5-point rating scale (Figure 4.9C). Finally, residents’ trust in authorities was also assessed with items like *“I am confident in the authorities’ capacity to solve our problems”* or *“I believe the authorities can solve our problems”*. Responses were relatively balanced between disagree, neither agree nor disagree and agree categories, with a mean value of 2.85 ± 0.99 (Figure 4.9D). Risk perception and psychological distance were positively correlated ($r = .547, p < .001, n = 77$); correlations between other variables were weak or negligible.

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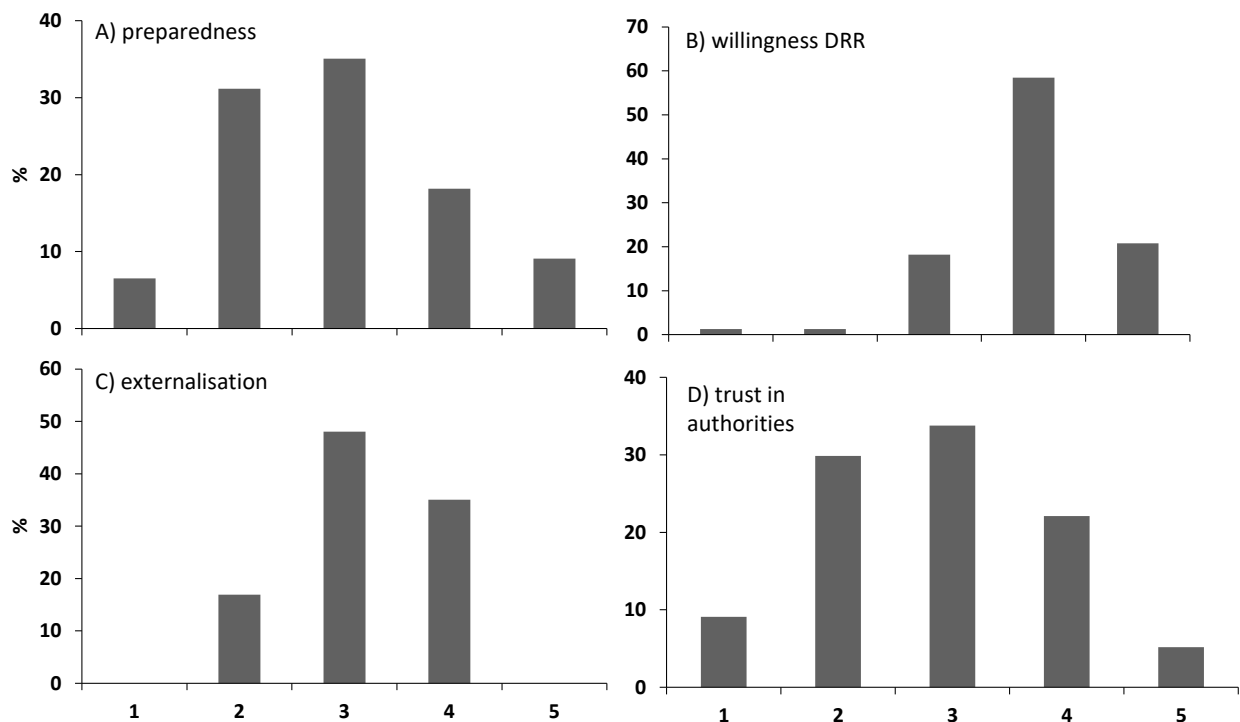


Figure 4.9 – Potential outcomes of risk perception in Faro Beach residents: A) preparedness, B) willingness to participate in the implementation of DRR measures, C) externalisation of responsibility, and D) trust in authorities.

4.3.4 Relationships between risk perception, awareness, and socio-demography

Significant differences among different socio-demographic groups were found for some variables. Gender differences were found for the self-perceived levels of preparedness in case of disaster, with men ($M = 3.19$, $SD = 1.08$, $n = 41$) scoring significantly higher ($t(75) = -3.03$, $p = .003$, $d = 0.68$) than women ($M = 2.52$, $SD = 0.87$, $n = 36$). Men ($M = 4.16$, $SD = 0.77$, $n = 41$) also demonstrated more willingness to participate in the implementation of DRR measures ($t(75) = -2.34$, $p = .022$, $d = 0.53$) than women ($M = 3.79$, $SD = 0.61$, $n = 36$).

More preparedness was also found in the age group ≤ 30 years ($Mdn = 3.67$, $n = 8$), whereas older people (≥ 61 years, $Mdn = 2.67$, $n = 27$) were less prepared ($U = 23.12$,

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$adj-p = .029$, $r = .46$). Age differences were also found for the psychological distance in regard to coastal risks; older people (≥ 61 years; $Mdn = 3.67$, $n = 27$) perceive the risks as more distant in time than younger people, particularly in relation to the age group 31-60 years old ($Mdn = 3.00$, $n = 42$) ($U = -15.63$, $adj-p = .012$, $r = .35$).

Differences in preparedness and psychological distance in relation to threats were also observed across study level. Residents with basic education or less ($M = 2.57$, $SD = 0.86$, $n = 46$) are less prepared than residents with more than basic education ($M = 3.24$, $SD = 1.12$, $n = 31$) ($t(75) = -2.96$, $p = .004$, $d = 0.67$), and their perception of threats as distant in time ($M = 3.28$, $SD = 0.70$, $n = 46$) was also significantly higher ($t(75) = 3.07$, $p = .003$, $d = 0.71$) than more educated residents ($M = 2.77$, $SD = 0.74$, $n = 31$).

Residents' perception of their level of information regarding coastal hazards was not related with any of the socio-demographic variables, but some associations with risk perception, psychological distance and trust in authorities were found. People that considered themselves more or less informed or well informed ($Mdn = 4.08$, $n = 66$) showed significantly higher risk perceptions than people with no information or misinformed ($Mdn = 3.33$, $n = 11$) ($U = 580$, $p = .002$, $r = .36$). Likewise, better informed people ($Mdn = 3.00$, $n = 66$) showed significantly higher levels of trust in authorities than less informed participants ($Mdn = 2.00$, $n = 11$) ($U = 527.5$, $p = .016$, $r = .27$). Better informed participants ($Mdn = 3.33$, $n = 66$) also demonstrated a significantly higher degree of psychological distance in relation to threats ($U = 544.5$, $p = .007$, $r = .30$) than less informed people ($Mdn = 2.67$, $n = 11$).

Respondents' opinion on the severity of risks was also not related with socio-demographic variables. Opinions on the severity of risks were associated with risk perception, past experience with hazards and psychological distance. People who perceive the risks as dangerous or very dangerous ($M = 3.80$, $SD = 0.89$, $n = 33$) have more past experience with risks ($t(75) = 3.39$, $p < .001$, $d = 0.78$) than people who think that the risks are not dangerous or only slightly dangerous ($M = 3.15$, $SD = 0.78$, $n = 43$).

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However, their risk perception is lower ($M = 3.43$, $SD = 0.68$, $n = 33$) than risk perceptions of those who think that risks are not that dangerous ($M = 4.18$, $SD = 0.59$, $n = 43$) ($t(75) = -5.16$, $p < .001$, $d = 1.18$). Besides having lower risk perceptions, people who believe the risks are dangerous or very dangerous ($M = 2.87$, $SD = 0.79$, $n = 33$) showed lower levels of psychological distance in relation to participants who think that risks are not that dangerous ($M = 3.23$, $SD = 0.69$, $n = 43$) ($t(75) = -2.17$, $p = .033$, $d = .49$). Residents' self-estimated level of information on hazards and opinion on the severity of risks were significantly associated ($p = .007$, two-tailed Fisher's Exact Test), with less informed participants finding coastal risks more serious.

4.4 Discussion

This study aimed to evaluate coastal risk awareness and perception in residents of a coastal settlement located in a vulnerable barrier peninsula in southern Portugal. Overall, higher risk perception was associated with higher self-estimated knowledge about coastal hazards that derives mainly from life experience; although seemingly contradictory, participants with higher risk perception also believe that coastal risks are not that relevant or serious and perceive the threats as distant in time. Participants with lower risk perception find the risks more severe and immediate and have less knowledge on hazards.

Previous qualitative studies at Faro Beach have shown that residents are well aware of coastal hazards, but they do not seem worried about potential risks, thus having low risk perceptions (Costas et al., 2015). Our quantitative results showed that risk perceptions of Faro Beach residents are not as low as previously reported through qualitative methods; residents are aware of the risks, and they intuitively and subjectively feel that coastal hazards can pose threats. Coastal populations, particularly social groups as fishermen, are usually well aware of coastal hazards, showing concern and knowledge about their causes and the effectiveness of

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interventions (Schmidt et al., 2013). Faro Beach residents with higher risk perceptions also believe that the risks are not very serious. These beliefs are probably informed by their “positive” past experiences with hazards; coastal hazards at Faro Beach never had major consequences besides house and road destruction that are rebuilt afterwards (Costas et al., 2015), contributing to an evaluation of the severity of risks as only slightly relevant or even irrelevant. The same has been observed in a coastal community in Jakarta, Indonesia, where local inhabitants exposed to coastal floods are aware of the hazards but underestimate their severity, probably due to high frequency exposure in the recent past (Esteban et al., 2017). However, when asked about their subjective feelings of security regarding coastal risks, i.e., their risk perception, Faro Beach residents admit that their lives and houses may be at risk.

Residents with higher risk perceptions are those who possess more knowledge on hazards; they have also lived at the beach for most of their lives and possess low levels of formal education, a socio-demographic profile that corresponds to fishermen and their families. Higher length of residence is usually associated with a strong place attachment (Anton & Lawrence, 2014; Raymond et al., 2010), defined as an affective bond between people and places (Hidalgo & Hernández, 2001) that is reflected as a desire to maintain closeness to the object of attachment (Ainsworth & Bell, 1970). Individuals strongly attached to a place can minimize the risks associated with that place (Billig, 2006; Brown et al., 2003), but not always. In fact, the relationship between risk perception and place attachment is not straightforward, depending on the probability and impact of risks (Bernardo, 2013). For instance, place attachment and risk perception were positively correlated for volcanic eruption risk in Iceland (Bird et al., 2011), drought risk in Australia (Stain et al., 2011), and hurricane risk in Louisiana, USA (Burley et al., 2007). In contrast, negative relationships between place attachment and risk perception were found, for instance, for seismic risk in Romania (Armaş, 2006) or volcanic risk in Indonesia (Donovan et al., 2012) (see review by Bonaiuto, Alves, et al., 2016). At Faro Beach, residents have shown strong emotional attachments at

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distinct levels, including a sense of community related to their social connections, a sense of rooting associated to memories, length of residence and intergenerational transmission, and a significant place identity (Domingues et al., 2017).

Faro Beach residents also have significant past experience with hazards and risks, which is the most effective source of knowledge on coastal phenomena and a major driver of risk perception in other vulnerable locations (Kung & Chen, 2012; Pagneux et al., 2011). Despite “non-technical”, this “lay” knowledge found in fishermen and their families is usually very rich and multifaceted; fishermen in particular show a comprehensive understanding of coastal evolution, coastal change and their multiple causes (Delicado et al., 2012). Indeed, Faro Beach residents have shown high awareness and knowledge regarding the occurrence of several coastal hazards and risks at Faro Beach. They find that storms, storm-induced hazards such as flooding, erosion, overwash and shoreline retreat, and also the destruction or damage of houses and roads due to wind, are likely to occur at Faro Beach. In fact, all these events have affected Faro Beach in the past; for instance, aeolian transport has caused burial of roads and house yards, overwash has resulted in property damage and barrier breaching, and dune erosion has caused the destruction of houses and roads located at the shorefront (Ferreira et al., 2016). Only the occurrence of a tsunami is perceived as unlikely, presumably because residents have no recollection of tsunamis that have affected the Ria Formosa system (although the system is located in an area of high seismicity).

The importance of life experience as a source of knowledge on hazards was obvious at Faro Beach, in contrast with the small impact of formal education and environmental education campaigns. The idea, known as the information deficit model, that giving more information and education to people will result in more awareness and behavioural change persists in coastal management strategies. However, psychological research has shown that the effects of knowledge on awareness and risk perception are not straightforward; educating people may result

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in higher risk perceptions and behavioural changes as intended, but for most hazard situations this does not occur (Gifford, 2014a). More education may actually have the opposite effect due to the process of risk normalisation (Lima, 2004; Lima et al., 2005; Luís et al., 2016), a way of psychologically coping with risks by decreasing the subjective judgment about the severity of a risk. Risk normalisation is usually observed in people that expose themselves voluntarily to risks (Twigger-Ross & Breakwell, 1999), like Faro Beach residents.

These results are particularly relevant in the context of environmental education campaigns. Faro Beach residents have expressed that educational actions could be included in DRR measures to increase environmental consciousness (Costas et al., 2015), and managers have also emphasized the need for more communication between experts and residents (Domingues et al., 2019). Other stakeholders also conveyed the need for more information and education to increase environmental conservation in the Ria Formosa system (Guimarães, 2010). These beliefs are clearly grounded on the information deficit model, a popular strategy among the “hard” scientists to communicate with the public (Simis et al., 2016). The deficit model has been largely criticized by social scientists, particularly for being a one-way, top-down communication process (Miller, 2001), and rarely sufficient to foster behavioural change or public engagement (Moser, 2009). Indeed, higher public engagement is accomplished when stakeholders directly affected by management decisions are part of the decision process itself, increasing compliance and reducing the need for enforcement (Smith, 2012). However, there is a lack of trust, low collaboration and poor communication among coastal stakeholders in Portugal (Schmidt et al., 2014). At Faro Beach, residents’ trust in authorities is not high, as they feel that their opinion is not considered by coastal managers and policy-makers (Costas et al., 2015; Domingues et al., 2017), but still, they are willing to participate in the implementation of DRR measures. In other vulnerable coastal settlements in Portugal, 84% of residents showed willingness to participate in coastal planning, but only 3% have already done it

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(Martins et al., 2009). Besides the mistrust in authorities, other behavioural barriers can prevent behavioural change and action in residents, such as a low perceived self-efficacy (they believe their actions will not have much impact) and the externalisation of responsibility (they believe that authorities should take the lead) (Gifford, 2011; Lorenzoni et al., 2007). At Faro Beach, medium levels of mistrust in authorities and externalisation of responsibility, and high scores on willingness to participate in DRR measures were observed, suggesting that residents are aware that they must play a part in preserving their lifestyle.

Despite residents' awareness and perception of coastal risks, their self-reported preparedness in case of disaster is medium/low. It is commonly assumed that individuals with higher levels of awareness will more easily engage in preparation strategies than unaware individuals (Miceli et al., 2008); however, this causal relationship between awareness and preparedness is not straightforward (Scolobig et al., 2012). Indeed, attitudes are not the best predictors of behaviours; for instance, Wicker's classical review on the attitude-behaviour relationships found that attitudes and behaviours only correlated $r = .15$ (Wicker, 1969). Moderators such as attitude strength and mediators such as behavioural intentions also play significant roles in the attitude-behaviour relationship (Armitage & Christian, 2003). In the context of coastal hazards, not only attitudes towards coastal hazards may affect preparedness, but also a myriad of other variables, including awareness and risk perception, past experience with hazards, emotions, trust in authorities, and responsibility (Domingues et al., 2017; Fox-Rogers et al., 2016). Past experience in particular may be a major driver of risk judgements; individuals with personal experience with risks estimate their chance of being negatively affected by risks as less likely than individuals without such experience (Halpern-Felsher et al., 2001). At Faro Beach, most residents have had experience with coastal risks, but given that the outcomes were never fatal, a feeling of optimism may have developed, expressed as a belief that nothing really serious will

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ever happen– thus, engaging in preparation strategies is not a priority for Faro Beach residents.

Another potential barrier to take action or, in the specific case of Faro Beach, to make preparations to deal with potential disasters, is the psychological distance, defined as a subjective experience that something is close or far away from the individual, here and now (Trope & Liberman, 2010). If an event is perceived as distant from the self, either in time or space, the event will be perceived as less real or relevant (McDonald et al., 2015), thus potentially preventing action, such as preparedness efforts. Climate change, for instance, is usually perceived as psychologically distant, rather than an immediate or personal threat (Manning et al., 2017; Spence et al., 2012). At Faro Beach, residents that perceive the threats as distant in time are also the better informed participants and those who believe that risks are not very serious. Psychological distance is also associated with older residents and lower education levels, corresponding to the socio-demographic profile of fishermen. In addition, psychological distance is correlated with risk perception, which could be counterintuitive at first – if people perceive the threats as distant in time, they will not feel at risk at the moment. However, psychological distance could be a way to psychologically cope with the threats, much like risk normalisation. Individuals that normalise the risk decrease their subjective judgement about the severity of the risk (Luís et al., 2016), whereas other individuals may engage in a process of psychological distance to emotionally distance themselves from the threat, while maintaining the perception of the risk as serious – but distant. Much like risk normalisation, psychological distance can also be activated when individuals are faced with information that could potentially make the threat more personally relevant (Manning et al., 2017). Thus, trying to educate people and giving more information to residents in an attempt to increase their risk perceptions or to lower their psychological distance may, indeed, have the opposite effect. A sound knowledge of the psychological

processes that shape risk perceptions is thus critical for an effective coastal management.

4.5 Conclusions

This study aimed to quantitatively evaluate awareness and risk perception in a coastal population exposed to coastal hazards. Faro Beach residents, mainly fishermen and their families, demonstrated high levels of awareness and risk perception, informed by past experience with hazards due to a high length of residence at the beach; however, an optimism bias, a high psychological distance and other behavioural barriers are probably responsible for the low levels of preparedness in case of disaster. Our results also suggest, in agreement with extensive research in the social and psychological sciences, that the information deficit model in which risk communication is usually based on is flawed; the major source of knowledge on risks in Faro Beach residents is life experience, and environmental education campaigns and formal education are borderline irrelevant for these coastal populations. Generating worry or fear through education or information in an attempt to increase risk perceptions and preparation behaviours may have the opposite effect, leading people to engage in strategies to psychologically cope with the threats and hence maintain their psychological well-being. Individuals may thus normalise the risk, *i.e.*, decrease their risk perceptions, or increase the psychological distance, *i.e.*, emotionally distance themselves for the threat. Indeed, the better informed people at Faro Beach are also those who think that the risks are not that serious. Either way, these processes represent barriers to take action and to engage in preparation efforts.

Considering that collaborative approaches in coastal management may yield more satisfactory results than top-down strategies based on giving information and enforcing policies (an inheritance of the information deficit model), residents' willingness to participate in the implementation of DRR measures should be valued

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and encouraged. Such active participation could decrease their levels of mistrust in authorities and externalisation of responsibility regarding coastal problems, thus reducing other behavioural barriers to action, such as a perceived low self-efficacy, that may hinder individuals' preparedness and engagement in coastal management.

Chapter 5

Living with coastal hazards: place attachment, risk perception, and preparedness in a coastal population at risk

Living with coastal hazards: place attachment, risk perception, and preparedness in a coastal population at risk

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Abstract

Living by the coast is a high-risk choice, but most people do it voluntarily. At Faro Beach, a heavily urbanized settlement located on a sandy barrier peninsula exposed to coastal hazards, houses and roads were destroyed due to storm action. However, residents feel safe living there and have no intentions of relocating. The development and implementation of coastal management plans and disaster risk reduction measures require the understanding of psychological drivers of residents' risk perception and behaviours. Thus, the main goal of this study is to evaluate the relationships between place attachment, risk perception, and preparedness in Faro Beach. We hypothesized that place attachment and past experience with hazards would have a negative effect on risk perception, while risk perception would positively influence preparedness. We administered a self-report questionnaire to 131 residents and analysed the data using partial least squares modelling. Results show that stronger place attachment is associated with lower risk perception, as residents tend to accept the risk as part of their environment. Experience contributed to higher risk perception in Faro Beach residents, most likely because residents have had direct and personal experience with hazards and are fully aware of the consequences. In addition, risk perception was negatively associated with preparedness; although residents' risk perception is moderate, probably due to risk normalisation, they still make some preparations to deal with a potential disaster. This study is useful for the design and implementation of more sustainable coastal management plans, as it validates the relevance of affective variables in risk perception and preparedness.

Keywords: coastal risks; sense of place; risk normalisation; coping; PLS-SEM.

5.1 Introduction

Environmental hazards, both natural and technological, are phenomena that pose threats to human lives and property, and may disrupt social and economic activities (Cvetkovich & Earle, 1985; Gifford, 2014a). Coastal hazards are a particular type of natural environmental hazards that are becoming increasingly relevant, given the rapid population increase in coastal zones. Low elevation coastal zones (LECZ), defined as coastal areas with an altitude lower than 10 m, cover only 2% of the Planet's land area, but contain 10% of the world's population (McGranahan et al., 2007). LECZ are exposed to many coastal hazards, such as inundation, overwash, erosion, and shoreline retreat (Nicholls & Cazenave, 2010), but also provide many ecosystem services, particularly coastal protection, maintenance of fisheries, tourism, recreation, education, and research (Barbier et al., 2011). Therefore, people are attracted to these areas, despite the potential risks they face, and the fast growth of coastal populations has been accompanied by an increase in social and economic vulnerability towards hazards (Spalding et al., 2014).

Why do individuals expose themselves to coastal hazards, thus creating or increasing the risk? From a psychological standpoint, there are many variables that shape the way individuals perceive and respond to risks. Age, gender, education, personality, attachment to the place and to the community, previous experience with hazards, knowledge about hazards, among others, influence individual risk perception. Individuals may also shape their perceptions to match those of people with whom they identify (V. J. Brown, 2014), leading to social representations of risk informed by sociocultural, historical, and group-specific contexts (Joffe, 2003). Risk perception is an emotional construct, driven by unconscious emotional processes (Gifford, 2014a; Loewenstein et al., 2001), and affected by cognitive heuristics that may lead to biases in decision making (Tversky & Kahneman, 1974). Thus, risk perception

is not rational or analytical (Gifford, 2014a), but rather a subjective judgement that people make regarding the characteristics and severity of a risk (Slovic, 1987).

Risk perception has been consistently linked to place attachment, which can be broadly defined as a positive affective bond between an individual and a specific place, characterized by the desire to maintain closeness to that place (Hidalgo & Hernández, 2001). The place of attachment possesses certain social and physical characteristics and the attachment is manifested through affective, cognitive, and behavioural processes (Scannell & Gifford, 2010). Several other terms can be found in the literature to describe this concept, namely sense of place, a more general construct that may include the place attachment, place identity, and place dependence constructs (Jorgensen & Stedman, 2001), or a higher-order factor that incorporates place, people, time, and self dimensions (Domingues et al., n.d.). Place attachment has been frequently conceptualised as a predictor or antecedent variable that influences the way individuals perceive risks, but the nature of these relationships is not clear. Both positive and negative correlations, and mediating and moderating relationships between place attachment and risk perception have been described in the context of natural hazards (Bonaiuto, Alves, et al., 2016 and references therein). For instance, strongly attached people may have a higher risk perception in the case of volcanic eruption risk (Bird et al., 2011) or drought risk (Stain et al., 2011), but other studies show that higher place attachment can also lead to the inverse, namely a lower risk perception, regarding earthquake risk (Armaş, 2006) and volcano eruption risk (Donovan et al., 2012).

Risk perception is commonly conceptualised as a predictor of coping strategies, both psychological and behavioural, that individuals adopt when dealing with a risky scenario. The concept of preparedness has been increasingly used to describe a natural behavioural response to potential environmental risks, which translates into the adoption of disaster risk reduction measures that may significantly reduce the impact of hazards (Xu et al., 2018). Preparedness is defined as the knowledge and capacities

developed by individuals to anticipate, respond to, and recover from the impacts of hazards (UNISDR, 2009). However, preparedness is usually not high in disaster-prone populations (V. N. Martins et al., 2019; Mishra et al., 2010; Rego et al., 2018; Roder et al., 2016), and the role of risk perception as a determinant of preparedness behaviours is still not clear. Some studies reported no correlations between risk perception and preparedness (Lindell & Whitney, 2000; Rego et al., 2018; Siegrist & Gutscher, 2006), whereas others have found associations between the two variables (V. N. Martins et al., 2019; Xu et al., 2018). For instance, in the Azores Islands, a lack of preparedness was found despite moderate risk perception regarding seismic and volcanic risks (Rego et al., 2018). In New York, although preparedness levels regarding superstorm Sandy were modest, risk perception had a positive impact on household preparedness (V. N. Martins et al., 2019).

The relationships between place attachment (or sense of place), risk perception, and preparedness have been increasingly addressed in the context of natural hazards, given the need to promote adequate adaptation and coping behaviours in disaster-prone populations. However, most studies are location and hazard-specific and the relationships between variables are weak and inconsistent (Xu et al., 2018). In coastal populations exposed to coastal hazards, understanding the relationships between risk perception, place attachment, and preparedness is of the utmost importance, as living by the coast is a high-risk choice (Kron, 2013), but most people do it voluntarily (Costas et al., 2015; Luís et al., 2016; F. Martins et al., 2009). One such example of a coastal population in a highly risky area is Faro Beach (southern Portugal), a heavily urbanized settlement that occupies a narrow sandy barrier peninsula exposed to several coastal hazards, such as beach erosion and overwash that have resulted in the destruction of houses and roads. Residents are aware of the risks, but they feel safe living there and have no intentions of relocating to a safer location (Costas et al., 2015). It has been suggested that residents' risk perception is low (Costas et al., 2015), but they seem to be well informed about the risks, mainly due to their life experience

(Domingues et al., 2018). A strong sense of place is probably a significant underlying factor in Faro Beach residents' risk perception and low preparedness levels (Domingues et al., 2017), but these relationships are still not well understood.

Coastal management plans for Faro Beach foresee the demolition of houses and the relocation of residents, but this preventive measure was not well accepted by residents. Therefore, the proper development and implementation of coastal management plans and disaster risk reduction strategies require a thorough understanding of the psychological drivers of residents' risk perception and behavioural responses. Previous work at Faro Beach included qualitative approaches with small samples to evaluate residents and other stakeholders' (scientists and coastal managers) risk perceptions, place attachment, and preparedness (Domingues et al., 2017, 2019). However, these relationships were not quantified based on representative population samples. Therefore, the main goal of this study is to understand the relationships between risk perception, place attachment, and preparedness of Faro Beach population. To accomplish this goal, we employed a quantitative approach with a self-report questionnaire administered to a sample of residents and homeowners that have been living or own a house at Faro Beach for longer than 10 years. Drawing from previous qualitative studies and a conceptual model of risk perception and related psychological and behavioural variables (Domingues et al., 2017, 2019), we tested the following hypothesis:

Hypotheses H1, H2: Sense of place (H1) and past experience with hazards (H2) are negatively related to coastal risk perception.

Hypothesis H3: Risk perception is positively related to preparedness.

5.2 Methods

5.2.1 Study site

Faro Beach is a highly urbanized settlement located at Ancão Peninsula in the Ria Formosa barrier island system, a shallow, mesotidal coastal lagoon that extends approx. 55 km E-W and 6 km at its widest point (Figure 1). The lagoon is characterized by saltmarshes, tidal flats, and a complex network of tidal channels; the inner part of the lagoon is bordered by three major cities. Tides are semidiurnal with average amplitudes of 2.8 and 1.3 m for spring and neap tides, respectively; wave energy is moderate, with most incident waves from W-SW (Ferreira et al., 2016). The system is located in an area highly vulnerable to climate change (IPCC, 2014), and is subjected to Mediterranean climate, with hot, dry summers, and moderate winters.

The lagoon is protected from the Atlantic Ocean by five sandy islands and two peninsulas, separated by six tidal inlets. The sandy barriers have an ocean beach, dunes, and a backbarrier (Garnier et al., 2018). Faro Beach is located at Ancão Peninsula, at the westernmost part of the Ria Formosa system, and it presents different morphological and occupation characteristics. In the western part of Faro Beach, where a fishermen settlement is located, the dune crest reaches 8 m above sea level, but the frontal dune ridge is densely occupied, whereas in the eastern part of the beach, human occupation is scarce and is mostly located on the backbarrier (Almeida et al., 2012). In the central part of Faro Beach, the dune ridge was almost completely replaced by houses and buildings, some of which reach four storeys high.

Human occupation of the barriers is relatively recent (19th century) and is limited to a few settlements mainly composed by fishermen and second residents' houses. The occupation of the barriers has been threatened since its inception due to storms, defined as events with significant wave heights higher than 3 m (Almeida et al., 2011). Storms are frequent in the Ria Formosa system and may cause severe impacts. Faro Beach is the most urbanised area in the Ria Formosa and is exposed to

W-SW dominant conditions (Almeida et al., 2012), making this settlement the one with the higher potential risks along the barrier system (Ferreira et al., 2019). Consequences of past storms at Faro Beach have included damage and destruction of houses, infrastructures (parking lots and roads), and dunes, shoreline retreat, opening of new inlets, morphological changes to the beach profile, among others (Almeida et al., 2012).

Historical records show that from 1816 to 1860, thirteen major storms occurred in the area; four of these were severe, with major damages and destruction, such as the sinking of two fishing ships, roofs of houses being ripped off, and trees being uprooted (Garnier et al., 2018). In 1941, a cyclone with winds that reached 12 in the Beaufort scale hit the Iberian Peninsula, leading to the destruction of a village and the opening of a new inlet at Ancão Peninsula (Garnier et al., 2018). From 1969 to 2009, fifteen extreme events have been recorded (Almeida et al., 2012), but no casualties were registered (Garnier et al., 2018). Major storms that cause severe damages and destruction in the Ria Formosa have a return period of 25 years (Garnier et al., 2018).

Recently, two major storms hit the Ria Formosa. In 2010, the passage of the extratropical cyclone Xynthia led to several damages and house destruction at Faro Beach, and in 2018 Emma storm resulted in strong overwash, causing flooding and piling of sediment over roads, parking lots, and house yards, damage to walls and promenades, and threats to houses placed at the front line (Ferreira et al., 2019). The consequences of storms to the Ria Formosa system are mainly derived from storm-related oceanic waves that in conjunction with high tides and storm surges (lower than 1 m) produce inundation and damage (Garnier et al., 2018).

5.2.2 Instruments

A self-report questionnaire was developed and distributed among Faro Beach residents and homeowners. The questionnaire included sociodemographic information, a short version of the Sense of Place Scale (Chapter 6), and specific items to evaluate risk perception, preparedness, and past experience with hazards. The

Sense of Place Scale (SoPS) is composed by 32 Likert-type items, including replicate and positive/negative items to detect random answers and to prevent acquiescence bias, and is responded using a 5-point rating scale, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). This instrument measures sense of place as an overarching construct that includes place, people, time, and self as sub-dimensions. The 32-item instrument possesses adequate psychometric properties, with an excellent internal consistency, and good convergent-related and divergent validities (Domingues et al., n.d.). Due to extension of the SoPS, we included in the present study a short version composed by 7 items with high factor loadings. In addition to sense of place, three scales of the Coastal Risk Awareness Scales⁶ were used to evaluate risk perception, preparedness, and past experience with hazards, with a total of 7 Likert-type items responded on a 5-point rating scale (from 1, *strongly disagree*, to 5, *strongly agree*). Besides these three scales, Coastal Risk Awareness Scales include three other scales that evaluate psychological distance, trust in authorities, and externalization of responsibility. The Coastal Risk Awareness Scales have adequate internal consistency and show both convergent and divergent reliability. The questionnaire was intentionally short to prevent dropouts.

5.2.3 Participants and procedure

The questionnaire was distributed in April and May 2017 to residents and homeowners that live or own a house at Faro Beach for more than 10 years. Participants were recruited door-to-door by three enumerators trained to clarify any questions and to help participants when needed. In some cases, enumerators had to read the questionnaire to the participants, due to their low level of education, but did not influence participants' responses. An online version of the questionnaire was also prepared and publicized through social media, targeting homeowners that do not

⁶ See Appendices 1, 2 and 3, for the development and validation of the Coastal Awareness Scales, and the English and Portuguese (original) versions.

permanently live at Faro Beach but spend certain periods of time there. A total of 131 individuals completed the questionnaire (87 in paper, 44 online). Of these, 55.7% were female and 44.3% male, and their mean age was 50.5 ± 16.0 years (range 15-88 years). Most participants (72.5%) completed secondary education or lower. This sample of 131 individuals corresponds to approx. 50% of all Faro Beach residents.

5.2.4 Data analysis

The hypothesized relationships between latent variables were tested with partial least squares structural equations (PLS-SEM), using SmartPLS software (Ringle et al., 2015). PLS-SEM was chosen given its adequacy for exploratory studies, small samples, and non-normally distributed data (Hair et al., 2011). We followed the procedure described by Hair et al. (2019) to assess the measurement and structural models. In brief, the measurement or outer model that includes the reflective predictive relationships between each construct and its associated observed indicators (Hair et al., 2011) was firstly evaluated by analysing indicator reliability, defined as the proportion of indicator variance that is explained by the construct. Indicator loadings >0.7 are acceptable, between 0.7 and 0.4 can be deleted if their deletion increases composite reliability to values above the threshold, and loadings <0.4 should always be removed (Hair et al., 2011).

After the examination of the measurement model, the structural or inner model that shows the relationships between latent constructs was evaluated. The main criteria were the path coefficients and determination coefficients (R^2) of endogenous latent variables. The significance of each path coefficient was assessed using a bootstrapping procedure; nonsignificant paths or with a different sign than hypothesized do not support the proposed causal relationship. In addition, given that PLS-SEM approach is prediction-oriented, R^2 of endogenous latent variables should be high (Hair et al., 2011).

Internal consistency reliability, convergent validity, and discriminant validity were evaluated using Cronbach's alpha, composite reliability, average variance extracted, and the Fornell-Larcker criterion, as described below. Internal consistency was assessed with Cronbach's alpha; alpha values higher than 0.8 are indicative of good internal consistency (Nunnally & Bernstein, 1994). Convergent validity was assessed by computing the average variance extracted ($AVE \geq 0.5$) and composite reliability ($CR \geq 0.7$) (Hair et al., 2005). Discriminant validity is attained when the AVE of two given factors are higher than the determination coefficient between those two factors (or the square roots of both AVE are higher than the correlation coefficient) (Fornell & Larcker, 1981). The heterotrait-monotrait (HTMT) ratio ($HTMT < 0.9$) was also used as an indicator of discriminant validity (Henseler et al., 2015). In addition, descriptive statistics, namely mean and standard deviation, were computed to characterize the sample, and absolute values of skewness (< 2) and kurtosis (< 7) were used as indicators of normality (West et al., 1995). All statistical tests were considered at a 0.05 significance level. IBM SPSS Statistics v. 26 was used for these analyses.

5.3 Results

5.3.1 Descriptive analyses of risk perception and related constructs in Faro Beach population

In the sample of 131 Faro Beach residents, sense of place, risk perception, past experience, and preparedness presented high internal consistency (> 0.7). Skewness and kurtosis (< 2 and < 7) indicated no deviations from normality. Participants reported higher values for sense of place ($M = 4.03$, $SD = 0.55$), medium values for preparedness ($M = 2.75$, $SD = 0.97$) and past experience ($M = 3.12$, $SD = 1.11$), and lower values for risk perception ($M = 1.81$, $SD = 0.75$) (on a 5-point rating scale) (Table 5.1).

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Table 5.1 – Internal consistency (Cronbach’s alpha) and descriptive statistics (mean; standard deviation, SD; skewness; kurtosis) for the sense of place, risk perception, preparedness and related scales (n = 131).

	Alpha	Mean	SD	Skewness	Kurtosis
Sense of Place Scale	.747	4.03	.53	-.85	2.45
SoP place	.903	4.57	.59	-2.83	11.02
SoP people	.837	3.57	.68	.07	-.63
SoP time	.783	4.17	.87	-1.02	.57
SoP self	.831	3.81	.77	-.52	.14
Risk perception	.761	1.81	0.75	1.09	1.91
Past experience	.823	3.12	1.11	-0.26	-0.72
Psychological distance	.614	3.14	0.85	-0.10	-0.36
Preparedness	.714	2.75	0.97	0.35	-0.15
Trust in authorities	.655	2.86	0.93	0.05	-0.30
Externalisation	.442	3.82	0.89	-0.44	-0.30

5.3.2 Measurement model evaluation

The measurement model was evaluated in terms of reliability and validity (Table 5.2). The indicator loadings were all significant ($p < 0.001$), but some were lower than the threshold value of 0.7; these indicators were removed and a second PLS was conducted. Individual reliability was observed, with only three indicators with loadings between 0.639 and 0.681; given that these loadings were very close to the reference value and the removal of these indicators did not improve composite reliability, the three indicators were retained. Construct reliability and validity was verified, with Cronbach’s alpha between 0.713 and 0.883, and composite reliability higher than the threshold value of 0.7. Convergent validity was also verified, with the average variance extracted (AVE) for all constructs > 0.5 . In addition, bootstrapping t statistics suggest that all indicators were significantly measuring the latent variables at a 0.01% level (i.e., t values > 2.585 for two-tailed tests). Regarding discriminant

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validity (Table 5.3), the square roots of AVE for each latent construct were higher than the correlation between the constructs. Discriminant validity was also verified using the HTMT ratio criterion, with all values lower than the reference value of 0.9.

Table 5.2 – Measurement model. Alpha is Cronbach’s alpha, CR is composite reliability, AVE is average variance extracted, R represents a reverted item.

Latent variables and indicators	Loadings	Alpha	CR	AVE	<i>t</i>	<i>p</i> -value
<i>Risk perception</i>		0.771	0.770	0.527		
<i>I feel safe in the place where I live. (R)</i>	0.718				10.491	<0.001
<i>I feel safe living here. (R)</i>	0.719				10.821	<0.001
<i>Coastal risks may happen, but they don't have serious consequences. (R)</i>	0.741				9.265	<0.001
<i>Past experience</i>		0.819	0.837	0.725		
<i>I've seen houses destroyed or damaged due to storms/floods, etc. where I live.</i>	0.708				6.738	<0.001
<i>I've seen people losing their belongings due to storms/floods, etc. where I live.</i>	0.974				7.513	<0.001
<i>Preparedness</i>		0.713	0.730	0.580		
<i>In case of disaster, I'm ready to face it.</i>	0.867				8.018	<0.001
<i>If something serious happens where I live, I have a plan B.</i>	0.639				6.379	<0.001
<i>Sense of place</i>		0.883	0.886	0.526		
<i>I feel like everyone knows each other here.</i>	0.704				6.396	<0.001
<i>Here, we help each other.</i>	0.675				5.792	<0.001
<i>I feel more comfortable here than in any other place.</i>	0.726				7.748	<0.001
<i>I feel well integrated in this place.</i>	0.719				8.229	<0.001
<i>I feel that I fit in here.</i>	0.809				10.029	<0.001
<i>This place is the best place for what I like to do.</i>	0.755				7.358	<0.001
<i>I get more satisfaction out of being here than in any other place.</i>	0.681				6.481	<0.001

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Table 5.3 – Discriminant validity assessment. Correlation coefficients are shown in the lower left off-diagonal. Square roots of AVE are on the diagonal, in bold. HTMT ratio values are in parenthesis.

	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
<i>1. Sense of place</i>	0.725			
<i>2. Past experience</i>	-0.148 (0.151)	0.852		
<i>3. Risk perception</i>	-0.770 (0.770)	0.432 (0.441)	0.726	
<i>4. Preparedness</i>	0.336 (0.339)	-0.171 (0.174)	-0.587 (0.595)	0.726

5.3.4 Structural model evaluation

Regarding the structural model (Figure 5.2, Table 5.4), all hypothesized paths were statistically significant, with path coefficients ranging from .343 to .718 (in absolute values). However, two of the paths (H2 and H3) did not show the hypothesized sign. Therefore, the research hypothesis H1 (sense of place → risk perception) was supported, whereas hypothesis H2 (past experience → risk perception) and H3 (risk perception → preparedness) were rejected.

Table 5.4 – Structural model.

<i>hypotheses</i>	<i>path coefficient</i>	<i>t statistic</i>	<i>significance</i>	<i>interpretation</i>
H1 <i>SoP</i> → <i>RP</i>	-0.718	12.132	<0.001	Supported
H2 <i>PE</i> → <i>RP</i>	0.343	3.947	<0.001	Not supported
H3 <i>RP</i> → <i>PREP</i>	-0.590	5.785	<0.001	Not supported

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Figure 5.1 – Supported (solid line) and non-supported (dashed lines) hypotheses of the structural model, respective standardized estimates, and determination coefficients for predicted variables. All paths significant at 1% level.



5.4 Discussion

This study aimed to evaluate relationships between coastal risk perception, sense of place, and preparedness in a coastal population exposed to hazards. We hypothesized that both sense of place and experience with hazards were negatively associated to risk perception, whereas risk perception was positively correlated with preparedness. Results show that the emotional attachment to the place was indeed negatively correlated with risk perception, but the other hypotheses were wrong. Past experience with hazards was positively associated with risk perception, and risk perception was negatively associated with preparedness towards coastal disasters.

In Faro Beach case, place attachment was strongly negatively correlated to coastal risk perception, as observed in other populations exposed to different types of environmental risks. For instance, strongly attached people in Bucharest seemed to neglect or even reject seismic risk, (Armaş, 2006). In an earthquake-prone area in rural China, sense of place was also associated with lower risk perception (Xu et al., 2020). Strong emotional bonds between individuals and their place of residence may lead individuals to accept the risk as part of the environment, allowing people to maintain a feeling of control over events (Michel-Guillou et al., 2016). In addition, individuals

living in risk may develop strategies to minimize their risk perception, as a way to psychologically cope with the threat (Luís et al., 2016). This phenomenon, known as risk perception normalization, is especially common in individuals that expose themselves voluntarily to risks (Twigger-Ross & Breakwell, 1999), such as the residents of Faro Beach (Costas et al., 2015).

The effect of place attachment on risk perception is not straightforward and may depend on other variables, particularly the perceived risk probability and past experience with hazards. For high probability risks, place attachment may amplify risk perception, whereas for low probability risks, risk perception is attenuated (Bernardo, 2013). Personal experience with hazards may also increase or decrease risk perception, depending on how individuals interpret their experiences (Lindell & Perry, 2004; Wachinger et al., 2013). Faro Beach residents perceive storms and their effects, such as floods, erosion, overwash, and shoreline retreat, as highly likely or likely to occur (Domingues et al., 2018). These are, indeed, frequent events, with which most Faro Beach residents have had “positive” experiences (Domingues et al., 2018), i.e., no irreversible damages or casualties, which could result in an attenuation of their risk perception. However, results showed that past experience with risks was positively associated with risk perception, suggesting that the direct experience that residents have with hazards and risks (i.e., the individual experienced the event directly, rather than hearing or reading about it) may have contributed to an increase in risk perception given that individuals become aware of the potential for future risk by experiencing the threat (Wachinger et al., 2013).

A previous study on Faro Beach revealed medium to high levels of risk perception, despite high awareness and knowledge about risks, in a small sample of 77 residents (Domingues et al., 2018), whereas in the present study risk perception levels were lower. This discrepancy may be due to different sociodemographic characteristics of the samples, as we considered only long-term residents and homeowners in the present study, but also due to the existence of an incongruent way

of thinking called social and polyphasic (Michel-Guillou et al., 2016), and characterized by the coexistence of competing or contradictory meanings within the same individual or group (Batel & Devine-Wright, 2015). Similar results have been observed for other coastal populations at risk, such as for several coastal towns in Brittany, France, where residents feel safe living in a risky location, although they are aware and do not deny the risk (Michel-Guillou et al., 2016).

Whether high or low, and congruent or incongruent with the real risk, risk perception is a major variable that has been consistently addressed in relation to preparedness. Risk perception of Faro Beach residents was negatively associated with self-reported preparedness. Thus, even though risk perception is low, Faro Beach residents make some preparations to face a potential disaster, for instance, planting plants in the dunes to retain the sand, placing sand bags in front of the houses to prevent water from entering, or having a boat ready to escape the beach if storms hit (Costas et al., 2015). Unlike other hazards, storm-driven coastal hazards allow time for warning and better preparation efforts, but preparedness levels across coastal populations are consistently low (C. Guo et al., 2020). However, storms are “visible” hazards that are difficult to deny, contrasting with slow-onset events such as sea-level rise and other climate change-related hazards, for which preparedness levels are typically low (Song & Peng, 2017).

Why do residents prepare to deal with a potential disaster if they feel safe at the beach? The incongruence between risk perception and behaviour may be interpreted in different ways. First, residents may have not been truthful in their responses. Their risk perception may be higher than they report, but they devalue the risks because most residents do not want to relocate. By admitting that they are at risk, they would be validating coastal managers and policy-makers’ arguments for relocation. This response behaviour may be considered as a socially desirable responding (Holtgraves, 2004) – residents respond in a way that they perceive as socially desirable, and the desirable in the case of Faro Beach is to show no fear, to justify their unwillingness to

relocate. Second, residents may indeed feel at risk, but, through the process of risk normalisation (Luís et al., 2016), they unconsciously decrease their risk perception to psychologically cope with the threat.

Findings on the relationships between risk perception and preparedness for a variety of hazards are varied. Some studies observed that risk perception is associated with preparedness behaviours (Basolo et al., 2017; Meyer et al., 2018; Ozdemir & Yilmaz, 2011), whereas others found no effect of risk perception on preparedness (Lindell & Whitney, 2000; V. N. Martins et al., 2018; Paton et al., 2000), and still other studies suggested that risk perception mediate the effect of variables such as past experience, knowledge, and self-efficacy, on preparedness (see review (Bourque et al., 2013) and references therein). A recent meta-analysis on the influence of several motivational factors on hazard adaptation showed that the strongest predictors of different types of preparedness behaviours were self-efficacy, negative affect, outcome efficacy, and descriptive norms, whereas risk perception was strongly associated with individuals' intention to adapt (van Valkengoed & Steg, 2019).

Despite contradictory results, the notion that risk perception predicts preparedness behaviours is still persisting (Kirschenbaum, 2005). Thus, communication and education campaigns are usually geared at increasing risk perception of individuals and populations at risk, but this strategy may not produce the desired outcomes. First, risk perception may not have a causal effect on preparedness behaviours and may be dependent on the imminence of the threat (Martins et al., 2018). Second, more information may lead to the normalisation of risk, a way of psychologically coping with the threat by decreasing the subjective judgement on the severity of the risk (Luís et al., 2016). In addition, for many coastal populations, the main source of knowledge regarding coastal hazards is life experience itself, rather than environmental education campaigns, formal education, or public discussions (Domingues et al., 2018).

5.5 Conclusions

This study aimed to test relationships between sense of place, risk perception, and preparedness in a coastal population exposed to coastal hazards. The strongest, and negative, causal path was between sense of place and risk perception, suggesting that a high level of attachment to the place will contribute to a lower risk perception. Our study adds to the *mélange* of results found across the literature, suggesting that the relationships between place attachment, risk perception, and other variables is probably location and population-specific, i.e., other contextual and individual variables play direct, moderating, and/or mediating roles. In the specific case of Faro Beach, though, it is important to retain that residents' refusal to leave the Beach and relocate to safer grounds is rooted in a strong emotional connection to the place – one that more information and education cannot break.

Some limitations should be referred, the most relevant of which is the small sample for the application of the self-report questionnaire. However, this sample of 131 residents and homeowners corresponded to approx. 50% of the resident population at Faro Beach, so we can assume that it was a statistically representative sample. In addition, the use of partial least squares to test the relationships between latent variables is the most adequate for small samples. The possible effect of the social desirability bias on self-reported risk perception and preparedness is another factor that may hinder the interpretation of results.

Overall, this study adds to the growing body of knowledge on the determinants and consequents of risk perception in populations exposed to coastal hazards, providing new insights on the relationships between constructs, but also corroborating past research in other locations exposed to hazards. Results have a broad applicability, but they are particularly relevant for the management of Faro Beach. This urban settlement has been a significant source of tension among residents and managers, particularly because residents feels that their opinion is not considered. A psychological approach that validates the importance of affective variables in risk

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perception and preparedness may prove useful for the design and implementation of more sustainable coastal management plans.

Chapter 6

Measuring sense of place: a new place-people-time-self model

Measuring sense of place: a new place-people-time-self model

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Abstract

Research on people-place relationships remains a challenging endeavour for environmental psychologists. Many models of place attachment and sense of place have proliferated in the last decades, and a consensus on the conceptualisation and operationalisation of these constructs is yet to be reached. In this article, we aim to contribute to this discussion, by proposing a new model and measurement of sense of place as an overarching construct. We carried out three studies: the development of the new psychometric instrument through exploratory analysis (study 1); a confirmatory factor analysis (study 2); and a test-retest of the final Sense of Place Scale (study 3). Initially, we developed an instrument to measure place attachment, place identity, place dependence, sense of community, and rootedness as dimensions of sense of place. However, subsequent analysis suggested that sense of place is a second-order factor with four first-order factors: 'place', 'people', 'time', and 'self'. The 'place' dimension integrates emotional content associated with the place and can be loosely compared to the unidimensional place attachment in other models. The 'people' dimension corresponds to the sense of community construct, whereas the 'time' dimension reflects the importance of length of residence and intergenerational transmission. Finally, the 'self' dimension is more internally focused than the other dimensions, reflecting the role of the place for an individual's distinctiveness and self-esteem. Our 32-item Sense of Place Scale is thus a valid and reliable measure based on a quadripartite structure of the sense of place construct.

Keywords: place attachment; sense of place; scale development; length of residence; sense of community; exploratory analysis.

6.1 Introduction

6.1.1 Place attachment, a puzzling construct

Place attachment, the emotional bond between people and specific places (such as houses, neighbourhoods, cities, regions, countries, etc.), is a current topic in environmental psychology, and it has been so for the last 40 years. However, perusing the literature on place attachment can be a cumbersome endeavour. First, place attachment has been studied and theorized across disciplines, not only environmental psychology, but also sociology, human geography, cultural anthropology, urban studies, architecture and planning, economics, leisure sciences and tourism, among others (Lewicka, 2011). More recently, the concept of place attachment has been used in the environmental and natural sciences, particularly focusing on its role as predictor of conservation behaviours (e.g., Admiraal et al., 2017; Jones et al., 2018; Poe, Donatuto, & Satterfield, 2016). Second, a multitude of somewhat differing conceptualisations of place attachment and related constructs can be found in the literature. For instance, place attachment is frequently simply referred to as an affective bond between people and places, but Altman and Low (1992) provided a broader definition of the construct, suggesting an interplay between the emotional content and beliefs, knowledge, behaviours, and action in relation to the place. Third, expressions such as place attachment and sense of place are often used interchangeably, but different meanings can be allocated to each, as sense of place may be considered an overarching concept that includes place attachment and other place-related constructs (Jorgensen & Stedman, 2001). Fourth, the multitude of terminological and conceptual ambiguity is reflected in many different operationalisations of the constructs (Hidalgo, 2013). Hidalgo (2013) proposed a consensus regarding the measurement of place attachment by classifying the different available measures (also reviewed by Giuliani, 2003; Hernández, Hidalgo, & Ruiz, 2013; Lewicka, 2011) and integrating them in the well-

established person-place-process model of Scannell & Gifford (2010). Despite the standardization attempts, place attachment is still a puzzling construct to study.

6.1.2 Place attachment, identity, dependence, and sense of place

Place attachment has been loosely defined as an affective bond between people and specific places. Drawing from the attachment theory (Ainsworth & Bell, 1970; Bowlby, 1969), Hidalgo and Hernández (2001) suggested that the main distinctive characteristic of place attachment is the desire to maintain closeness to the object of attachment, redefining place attachment as a positive affective bond between an individual and a specific place, characterized by the desire to maintain closeness to that place. Scannell and Gifford (2010) proposed a person-place-process model that defines place attachment as a bond between an individual or a group and a place with specific social and physical characteristics, and is manifested through affective, cognitive, and behavioural processes.

Besides place attachment, two other concepts appear frequently in the people-place literature: place identity and place dependence. Earlier models considered these constructs as distinct conceptualisations of place attachment. Place dependence was first theorized as an individual's perceived strength of association between them and specific places (Stokols & Shumaker, 1981). It is considered a type of functional attachment, reflecting the importance of the place in providing conditions that sustain specific activities and goals (Stokols & Shumaker, 1981; Williams & Roggenbuck, 1989; Williams & Vaske, 2003).

Place identity was described as a substructure of the self-identity that includes cognitions about the physical world surrounding the individual (Proshansky et al., 1983). It is usually considered as a dimension at the same level as attachment or dependence, but it has also been conceptualized as a driver of place dependence and attachment, rather than an element that is formed at the same temporal plane (Kyle,

Jun, & Absher, 2014). Other scholars, however, have found that place identity develops after place attachment (Hernández et al., 2007). Twigger-Ross and Uzell (1996) operationalized place identity following Breakwell's four identity principles, namely distinctiveness, continuity, self-esteem, and self-efficacy (Breakwell, 1993). According to Twigger-Ross and Uzell (1996), distinctiveness is the desire to maintain personal uniqueness, summarizing a person's lifestyle; distinctiveness is evidenced when the individual uses an identification to distinguish them from people from other places. Continuity refers to the desire to preserve continuity of the self-concept; continuity can be divided into place-referent continuity, when the place becomes a marker for emotionally significant past events and actions, and place-congruent continuity, when the individual feels that a particular place fits with aspects of the self (Twigger-Ross & Uzell, 1996). Self-esteem refers to the fact that one's self-identity is linked to the places that are important for the individual; it is observed when the individuals have a positive feeling about themselves related to their place of attachment (Scannell & Gifford, 2014; Twigger-Ross & Uzell, 1996). Finally, self-efficacy refers to the ease that the individual may feel in carrying out their daily activities in the place; self-efficacy is maintained if the place facilitates or does not hinder a person's everyday lifestyle (Twigger-Ross & Uzell, 1996).

Sense of place is another expression that frequently appears in the environmental psychology and human geography literature, and it is usually considered a more general concept or umbrella term that may include other constructs (Shamai, 1991). Drawing from the tripartite framework of attitudes, Jorgensen and Stedman (2001) described sense of place as an attitude towards a spatial setting, encompassing place attachment, place identity, and place dependence, which correspond to the affective, cognitive, and conative components of attitudes, respectively. Sense of place appeared as a general dimension expressed through emotions, thoughts and behavioural beliefs of individuals, rather than a multidimensional construct comprising three univariate dimensions (attachment,

identity and dependence) (Jorgensen & Stedman, 2001). Although both place attachment and sense of place can be used as overarching, second-order factors, sense of place is more inclusive and allows for negative relationships with the place, while attachment implies a positive relationship (Trentelman, 2009). In addition, the term place attachment is more frequently used in studies conducted in recreational contexts with visitors/non-residents, whereas sense of place has been more used with individuals, usually residents, with an extensive history with the place in question (Kyle, Graefe, Manning, & Bacon, 2004). In our study, we retained Jorgensen and Stedman's (2001) conceptualisation of sense of place as an overarching construct that includes other dimensions such as place attachment, and allows for both positive and negative attitudes towards the place.

6.1.3 Other recurring constructs in the people-place literature

Many other constructs related to place attachment can be found in the literature, such as topophilia, community attachment, place congruence, or urban identity. Rootedness, community attachment, and sense of community are three of the most addressed variables in the context of place attachment research. Rootedness is a time-related concept described as a psychological state that results from long habitation at one locality (Tuan, 1980). It is associated with residence length, and it may be reinforced by memories, intergenerational transmission, and heritage (Kelly & Hosking, 2008; McAndrew, 1998; Michel-Guillou & Meur-Ferec, 2017; Poljanec-Borić et al., 2018). Lewicka (2013) suggested that rootedness might be equivalent to place attachment, as research consistently shows that place attachment is predicted by length of residence, strength of neighbourhood ties, and home ownership, i.e., factors that root a person in a place. The concept of rootedness has also been included in Hummon's (1992) typology of people-place relationships, which includes five different types of community attachment or sentiment. According to Hummon (1992), everyday rootedness and ideological rootedness are positive attachments to residence

place, whereas alienation, place relativity, and placelessness describe lack of attachment.

Sense of community reflects the connections to local social networks and the interactions between them (Kasarda & Janowitz, 1974); it can be considered one of four dimensions of place attachment, along with place identity, place dependence and nature bonding (Raymond et al., 2010). Another theoretical framework considers sense of community as a feeling of belonging and connectedness to a group, comprising four distinct elements, namely membership, influence, integration and fulfilment of needs, and shared emotional connection (McMillan & Chavis, 1986). Membership is the feeling of belonging or of sharing a sense of personal relatedness, and influence refers to the sense that the individual matters to the group and the group matters to its members; integration and fulfilment of needs expresses the feeling that members' needs will be met through the community, and the belief that members share history, common places, time together, and similar experiences defines the shared emotional connection (McMillan & Chavis, 1986).

6.1.4 Dimensions of place attachment

This wealth of concepts related to place attachment translates, as seen above, into different structures of this construct, namely 1) a unidimensional construct related with place identity and place dependence; 2) a multidimensional construct with three to five factors; or 3) a dimension of a more general concept, such as sense of place (see Hidalgo, 2013 and references therein). Despite the multitude of approaches to conceptualize and operationalize place attachment, systematic theories of place attachment are still largely missing. To fill that gap, Scannell and Gifford (2010) reviewed and synthesized the various definitions of place attachment into a three-dimensional organizing framework that considers person (individual or group level),

place (social and physical characteristics), and process (place attachment expressed as affect, cognition, or behaviour) as the primary dimensions of place attachment.

6.1.5 The present study: objectives and rationale

Hidalgo (2013) has advised that researchers in this field should halt the proliferation of proposals and attempt to reach a consensus on place attachment conceptualisation and operationalisation. However, we aim to contribute further to the discussion on the structure and measurement of place attachment, by developing and testing a new instrument to measure sense of place as an overarching multidimensional construct. Our rationale for doing so was to expand on Scannell and Gifford's (2010) tripartite framework of place attachment and Jorgensen and Stedman's (2001) tripartite model of sense of place, given that concepts such as sense of community and rootedness have not been well defined or operationalised in these models.

Our hypothetical model is based on Jorgensen and Stedman's (2001) model of sense of place, but we added rootedness and sense of community as dimensions on the same level as place attachment, place identity, and place dependence (Figure 6.1). The latter three dimensions can be considered as the affect, cognitive, and behaviour components of the process dimension in Scannell and Gifford's (2010) tripartite model. Sense of community and rootedness were added to express the place dimension in the tripartite model, in accordance with Riger and Lavrakas (1981), who suggested a social bonding dimension consisting of social ties, as well as a physical rootedness dimension predicted by length of residence and plans to stay. Therefore, in our study, rootedness is conceptualized as a time-related dimension influenced by residence length, memories, and intergenerational transmission (Michel-Guillou & Meur-Ferec, 2017), and sense of community as a feeling of belonging and connectedness to a group (McMillan & Chavis, 1986). Specific constructs that could be incorporated on Scannell

and Gifford's (2010) person dimension were not included in our model, so as not to over-represent it, as most indicators for each construct are already on the individual level, and some on the group level.

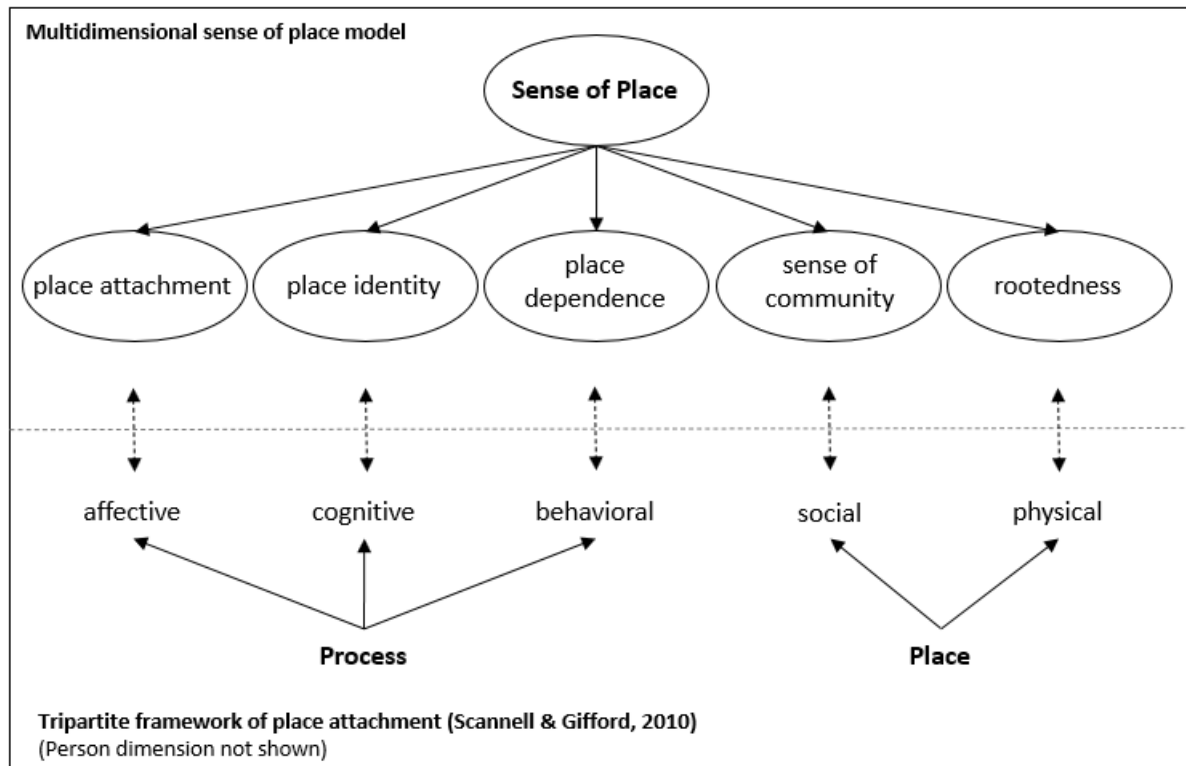


Figure 6.1 - Hypothetical multidimensional model of sense of place and comparison with the tripartite framework of place attachment proposed by Scannell and Gifford (2010).

Our approach involved three studies with Portuguese samples. In study 1, we developed the Sense of Place Scale to measure the five proposed dimensions of sense of place (place attachment, place identity, place dependence, sense of community, and rootedness) and explored its dimensionality using principal component analysis. In study 2, we tested different measurement models based on the factorial structure obtained in study 1, using confirmatory factor analysis. Finally, in study 3 we assessed the test-retest reliability of the final Sense of Place Scale.

6.2 Study 1: dimensionality of the Sense of Place Scale

The first study aimed to develop a new instrument to measure sense of place, conceptualized as an overarching construct consisting of five dimensions: place attachment, place identity (distinctiveness, self-esteem, self-efficacy, place-referent continuity, place-congruent continuity), place dependence, sense of community (membership, influence, integration and fulfilment of needs, shared emotional connection), and rootedness (temporality, memories, heritage, and intergenerational transmission) (Figure 6.1). The factorial structure was investigated using factor analysis with varimax rotation.

6.2.1 Methods

6.2.1.1. *Instrument, participants, and procedure*

A 42-item scale in Portuguese was created to evaluate sense of place in non-specific places, *i.e.*, the questionnaire asked respondents to consider in their answers the place to which they feel an emotional connection, be it a neighbourhood, a location, or a city (see Appendices 4 and 54). Some questionnaire items were created for this study, whereas others were modified from previous research (Sakip et al., 2012; Stokburger-Sauer, 2011; Williams & Vaske, 2003). Replicate and positive/negative items were included to detect random answers and to prevent acquiescence bias. A back-translation procedure was used to adapt items into Portuguese. Item order was randomized and a 5-point rating scale ranging from 1 (strongly disagree) to 5 (strongly agree) was used. Participants were recruited through non-probability sampling techniques, using a snowball sample obtained through social media; no compensation was given to participants for their participation in the study. Participants responded to an online version of the questionnaire where responses to all items were mandatory. A total of 466 participants completed the online questionnaire; after removal of multivariate outliers (see next section), a final sample of 432 participants was obtained.

Of these, 94.9% are female and 5.1% male, with a mean age of 39.2 ± 8.6 years, ranging between 18 and 73 years old. More than 87% of respondents have higher education studies and the majority lives in Lisbon (35.4%), Porto (13.7%) and Setúbal (10.0%) districts (includes urban, suburban, and rural dwellers).

6.2.1.2 Data analyses

Before proceeding to factor analysis using the principal components method, several data screening methods were used to evaluate data's appropriateness for a factor analysis. Data normality was assessed by computing skewness and kurtosis for each scale of SoPS; absolute values higher than 2 for skewness and 7 for kurtosis are indicative of significant deviations from normality (West et al., 1995). Multivariate outliers were identified and subsequently removed using Mahalanobis distance. Descriptive statistics (mean, standard deviation, skewness, and kurtosis) were calculated for SoPS and each sub-scale. Scale reliability was evaluated using Cronbach's alpha; alpha coefficients higher than 0.80 indicate good reliability or internal consistency (Nunnally & Bernstein, 1994). Mean inter-item correlations (MIIC) were also calculated to assess homogeneity; MIIC between 0.20 and 0.40 suggest acceptable homogeneity (Briggs & Cheek, 1986).

A factor analysis was conducted to identify underlying dimensions from the data set. Factor rotation was used to help discriminate between factors; given that some components may not be correlated and to maximise the dispersion of loadings within factors (Field, 2009), an orthogonal rotation (varimax) that keeps factors independent was used. Before performing the PCA different criteria were used to evaluate item factorability, namely inter-item correlations, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity. Regarding inter-item correlations, all items should have at least one correlation $>.3$ with another item (Field, 2009); items that did not meet this criterion were removed. Kaiser's (1974) criteria for KMO values were used to assess data factorability; $KMO > 0.7$ was

considered good. Bartlett's tests the null hypothesis that the original correlation matrix is an identity matrix (Field, 2009), i.e., all correlations are zero, meaning that the variables are not related and factor analysis is not appropriate; therefore, Bartlett's test should be significant ($p < .05$) to proceed with factor extraction.

Further analyses included the examination of the diagonals of the anti-image correlation matrix (KMO for individual variables) and the communalities to assess if each item shared common variance with other items. Finally, different criteria (eigenvalue, percentage of variance explained, visual inspection of the scree plot, and interpretability) were taken into consideration to decide on the number of factors to retain. A parallel analysis was also conducted to evaluate the number of factors to be extracted, using Monte Carlo PCA for parallel analysis software (Watkins, 2006). All other analyses were performed with IBM SPSS Statistics v. 25.

6.2.2 Results

An initial data screening based on skewness and kurtosis of each sub-scale of SoPS suggested no deviations from normality. A total of 34 multivariate outliers were identified and removed from the data set, resulting in a final sample of 432 cases. The factorability of the 42 items of SoPS was then examined. Inspection of the correlation matrix showed that all 42 items correlated $>.3$ with at least another item. KMO was $.904$ and Bartlett's test of sphericity was significant ($X^2(946) = 13394.6, p < .001$). The diagonals of the anti-image correlation matrix were all $>.7$.

After a five-factor forced extraction based on the hypothetical model of sense of place with five dimensions (place attachment, place identity, place dependence, sense of community, rootedness), the communalities of seven of the forty-two items were $<.4$, indicating that these items did not share common variance with other items; these items were removed, and another extraction was forced. A thorough analysis of the rotated component matrix and factor interpretation suggested the removal of three

more items, either because loadings were small (<.5) or to aid interpretation of each factor. The items removed were the three items intended to measure the self-efficacy sub-dimension of place identity (e.g., “*My daily life here is easier than if I live elsewhere*”), two items for the place-referent continuity sub-dimension of place identity (e.g., “*I don’t care if I live here or elsewhere*”), two items of the integration and fulfilment of needs sub-dimension of sense of community (e.g., “*I don’t identify with the community that lives here*”), one item for place dependence (“*The things I do here I could also do with the same satisfaction elsewhere*”), and two items of rootedness, one for temporality (“*I don’t even know what it is like to live elsewhere*”) and one for memories (“*I don’t have good memories of this place*”).

A final four-factor structure with 32 items explained 61.57% of the total variance; items and respective factor loadings are presented in Table 6.1. However, this solution is different from the initially proposed structure of sense of place (Figure 6.1); four dimensions were identified as place, people, time, and self (Table 6.1). Items for distinctiveness and self-esteem sub-dimensions of place identity were included in the factor *self*, items for temporality and intergenerational transmission of rootedness were placed in the *time* factor, and items of sense of community were included in the *people* factor. The *place* factor is the largest and includes items of place attachment, place identity (continuity), place dependence, and rootedness (memories).

Descriptive statistics and internal reliability for the final, 32-item Sense of Place Scale are presented in Table 6.2 (the Portuguese items can be found in the Appendix 5). Overall, the scale and its sub-scales (people, place, time, self) presented high internal consistency, with Cronbach’s alpha >0.8. MIIC varied between 0.2 and 0.6, indicating that some scales exceeded the recommended upper limit of 0.4. Skewness and kurtosis absolute values (<2.00) indicated no deviations from normality.

Table 6.1 – Principal component analysis of the Sense of Place Scale (English version; the original Portuguese version is in Supplementary Material), with factor loadings for each item, eigenvalues and percentage of variance explained for each factor, and indication of the dimension and sub-dimension in which each item was initially included according to the proposed hypothetical five-factor model of sense of place (see Figure 6.1). R = reverted item.

Factor/item	Factor loading	Item previously included in
Place (eigenvalue = 10.06; variance explained = 31.43%) 1. I am very attached to this place. 2. This place is important to me. 3. I feel more comfortable here than in any other place. 4. I want to keep living here. 5. I feel well integrated in this place. 6. I feel that I fit in here. 7. I feel that this place is a part of me. 8. This place is the best place for what I like to do. 9. I get more satisfaction out of being here than in any other place. 10. I have good memories of this place. 11. This place brings me bad memories. R	.77 .74 .77 .79 .76 .81 .79 .70 .77 .62 .61	place attachment place attachment place attachment p. identity – continuity p. identity – continuity p. identity – continuity p. identity – continuity place dependence place dependence rootedness-memories rootedness-memories
People (eigenvalue = 4.32; variance explained = 13.50%) 12. I know the name of most of the people who live near me. 13. I feel like everyone knows each other here. 14. I don't know the name of most of the people who live near me. R 15. I value the opinion of my neighbors and community. 16. Whenever there are problems regarding this place, the neighbors/community join to solve the problems. 17. The community doesn't come together to try and solve the problems. R 18. I can trust the members of this community. 19. People here care about each other. 20. Here, we help each other. 21. In this community, it's every man for himself. R	.73 .63 .67 .60 .74 .78 .69 .69 .81 .82	SC – membership SC – membership SC – membership SC – influence SC – influence SC – influence SC – integrat. fulfil. needs SC – emotional connection SC – emotional connection SC – emotional connection
Time (eigenvalue = 2.99; variance explained = 9.36%) 22. I've been living here for a long time. 23. I feel life all my life was spent here. 24. I live here because my family (parents, grandparents) also live here. 25. Most of my family is from here. 26. Most of my family also lives here.	.71 .77 .88 .86 .86	rootedness – temporality rootedness – temporality rootedness – intergen. trans. rootedness – intergen. trans. rootedness – intergen. trans.
Self (eigenvalue = 2.33; variance explained = 7.29%) 27. I am more similar to the other people who live here, than people from other places. 28. People who live in other places are very different from me. 29. People who live here are more similar to me than people who live in other places. 30. When someone criticizes the place where I live, it feels like a personal insult. 31. When someone praises the place where I live, it feels like a personal compliment. 32. I really don't like when I hear someone criticizing the place where I live.	.76 .75 .82 .56 .46 .47	p. identity – distinctiveness p. identity – distinctiveness p. identity – distinctiveness p. identity – self-esteem p. identity – self-esteem p. identity – self-esteem

Table 6.2 - Internal consistency (Cronbach's alpha), homogeneity (mean inter-item correlations, MIIC) and descriptive statistics (mean, standard deviation SD, skewness and kurtosis) for the Sense of Place Scale (SoP) and sub-scales (place, people, time, self), obtained in Study 1. n = 432.

scales	alpha	MIIC	mean	SD	skewness	kurtosis
SoP	.915	.267	3.10	0.60	-0.04	0.03
Place	.935	.567	3.63	0.82	-0.47	-0.31
People	.900	.488	2.81	0.76	0.05	-0.48
Time	.897	.629	2.85	1.26	0.28	-1.25
Self	.803	.402	2.82	0.75	-0.02	0.03

6.3 Study 2: confirmatory factor analysis

Study 2 aimed to test different measurement models of sense of place based on the 4-factor structure obtained in study 1, using confirmatory factor analysis with maximum likelihood estimation. Three measurement models were tested: model 1) four first-order factors (place, people, time, self) and one second-order factor (sense of place); model 2) four correlated first-order factors; and model 3) one first-order factor (sense of place). The three models were tested unconstrained (A) and modified according to modification indices (B).

6.3.1 Methods

6.3.1.1 Participants and procedure

The 32-item Sense of Place Scale (SoPS) obtained in study 1 was administered to a different sample of participants. The Oviedo Infrequency Scale was interspersed in the SoPS to detect and remove participants that may have responded randomly, pseudorandomly or dishonestly to the questionnaire (Fonseca-Pedrero et al., 2009). A

snowball sample was collected through social media and participants responded to an online version of the questionnaire, where responses to all items were mandatory. Paper-and-pencil questionnaires were also administered to University students. A total of 359 participants completed the questionnaire (161 online and 198 in paper); after removal of multivariate outliers ($n = 36$) and participants who responded randomly, pseudorandomly or dishonestly ($n = 2$), a final sample of 321 respondents was obtained. Of these, 72.6% are female and 27.4% male; 52.8% of respondents were between 18 and 35 years old, and 32.1% were between 36 and 50. More than 58% of respondents have higher education studies and the majority lives in Faro (47.5%) and Lisbon (16.1%) districts (includes urban, suburban, and rural dwellers).

6.3.1.2 Data analysis

Data screening to examine the shape of data distribution and the presence of multivariate outliers was conducted prior to the CFA. Skewness and kurtosis were calculated to evaluate normality, and multivariate outliers were identified and removed, as described in section 6.2.1.2. As CFA requires complete data sets, missing values (0.26%) in the paper questionnaires were estimated through multiple imputation using the expectation maximization algorithm (McLachlan & Krishnan, 1997).

Several fit indices were used to test model fit, namely the normed chi-square (X^2/df), the root mean square error of approximation (RMSEA), the standardized root mean square residual (SRMR), the comparative fit index (CFI), and the consistent akaike information criterion (CAIC). X^2/df between 1 and 5 (Jöreskog, 1970), $RMSEA < 0.06$ and $SRMR < 0.08$ (Hu & Bentler, 1999), and $CFI \geq 0.90$ (Carlson & Mulaik, 1993) are considered as indicators of good model fit. When comparing models, lower CAIC values reflect the better-fitting one (Schermelleh-Engel et al., 2003). In addition,

confidence intervals for RMSEA were computed to assess the precision of the estimates.

Finally, the factors' convergent related validity and discriminant validity were also assessed. The average variance extracted (AVE) and composite reliability (CR) were computed to evaluate convergent related validity, i.e., to assess if the items of each factor converge on that factor; $AVE \geq 0.5$ and $CR \geq 0.7$ are indicative of construct convergent related validity (Hair et al., 2005; Marôco et al., 2014). Discriminant validity was evaluated as proposed by Fornell and Larcker (1981), to assess if different factors evaluate different constructs; two constructs show discriminant validity if both AVE are higher than the determination coefficient between them. All analyses were performed with IBM SPSS Statistics v. 25 and AMOS v. 22.

6.3.2 Results

Skewness and kurtosis values suggested no deviations from normality. Fit indices for the three measurement models tested are presented in Table 6.3. Unconstrained models 1A, 2A and 3A presented unacceptable fit. Post-hoc modifications, based on the modification indices, were performed to obtain better fitting and parsimonious models. Model fit was improved by adding co-variances to pairs of errors in the same factor. For models 1B, 2B and 3B, seventeen, fifteen and forty-nine co-variances were added, respectively. These modifications improved fit indices for all models, but model 1B (Figure 6.2) presented the best fit, with X^2/df (2.362), SRMR 0(.0792), RMSEA (0.065) and CFI 0(.02) values within acceptable ranges. Fit indices for models 2B ($X^2/df = 2.502$, SRMR = 0.1042, RMSEA = 0.069, CFI = 0.892) and 3B ($X^2/df = 2.857$, SRMR = 0.1055, RMSEA = 0.076, CFI = .875) suggest a poorer fit. Comparison of CAIC values between the three models (model 1B = 1622.103; model 2B = 1684.053; model 3B = 1946.759) further indicate the model 1B is the most adequate.

Composite reliability for each of the four factors (place, people, time, self) was >0.8, and the average variance extracted was >0.5, suggesting a good convergent-related validity (Table 6.4). Comparison of AVE for each factor and determination coefficients between factors indicated divergent validity between all factors, given that AVE (range 0.43 - 0.67) was higher than R² (range 0.070 - 0.329, *n* = 321) for all cases.

Table 6.3 - Fit indices for different measurement models of the Sense of Place Scale. Model 1) four first-order factors (place, people, time, self), one second-order factor (sense of place); model 2) four correlated first-order factors; model 3) one first-order factor (sense of place). Model A) unconstrained, model B) modified according to modification indices. The better-fitting model is in bold.

Note: χ^2/df – chi-square/degrees of freedom; SRMR – standardized root mean square residual; RMSEA – root mean square error of approximation; CFI – comparative fit index; CAIC – consistent Akaike information criterion; 90% CI – 90% confidence interval

model	X ² /df	SRMR	RMSEA (90% CI)	CFI	CAIC
1A	3.923	.103	.096 (.091-.100)	.781	2266.398
1B	2.364	.079	.065 (.060-.070)	.902	1631.671
2A	3.935	.103	.096 (.091-.100)	.782	2276.214
2B	2.502	.104	.069 (.063-.074)	.892	1684.053
3A	7.623	.146	.144 (.139-.148)	.500	3971.430
3B	2.857	.106	.076 (.071-.081)	.875	1946.759

Table 6.4 – Composite reliability (CR) and average variance extracted (AVE) for each factor of SoPS.

Factor	CR	AVE
<i>place</i>	.93	.54
<i>people</i>	.91	.51
<i>time</i>	.91	.67
<i>self</i>	.81	.43

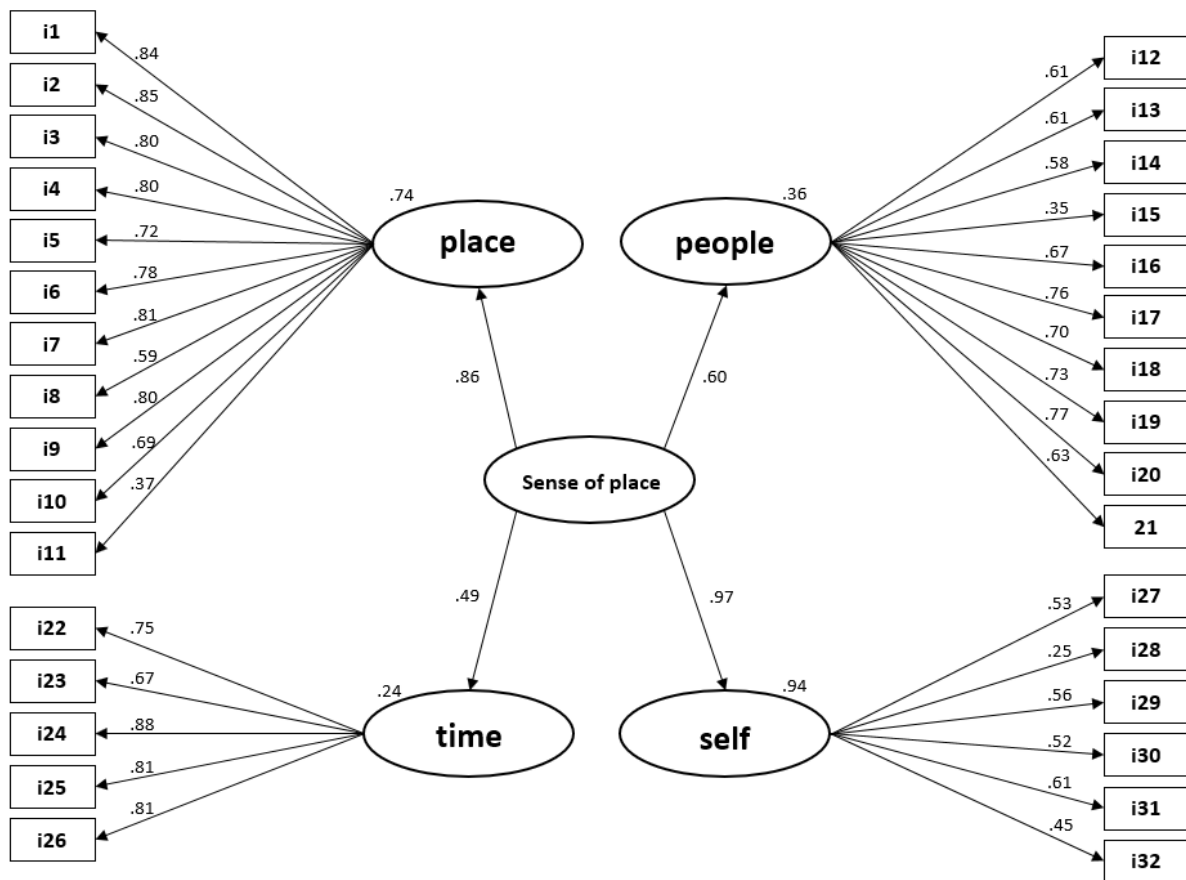


Figure 6.2 - Standardized estimates for the better-fitting model of sense of place (model 1B), consisting of four first-order factors (place, people, time, and self) and one higher-order factor (sense of place), obtained through confirmatory factor analysis.

6.4 Study 3: test-retest reliability of the Sense of Place Scale

Study 3 aimed to analyse the test-retest reliability and agreement of the 32-item Sense of Place Scale.

6.4.1 Methods

A 2-month test-retest design was used to evaluate the temporal stability of the 32-item Sense of Place Scale (obtained in study 1), assuming that participants would not remember their previous responses and that their level of emotional bonds with their place of attachment would not change in this time interval. Paper-and-pencil

questionnaires were administered to a convenience sample of University students in October and December 2017. On both sampling occasions, participants were asked to identify the questionnaire with a specific code, so that pairing of questionnaires would be possible. A total of 166 students completed the questionnaires at both moments. Participants were asked for how long they have been living in the place they referred to in the questionnaire, given that many are dislocated from their family home and living close to the University temporarily and for a short period of time. For the test-retest, we only considered participants that were living in a given place for 5 or more years. After removal of multivariate outliers (as described in section 6.2.1.2), a final sample of 97 participants was thus obtained; of these, 78.9% are female and 21.9% male, and the majority (94.3%) are between 18 and 35 years old. Approximately 55% of the participants reside in Faro district, and 71.9% are undergraduate students and 28.2% are graduate students.

Test-retest reliability and agreement were evaluated as suggested by Berchtold (2016). Pearson's correlation coefficient was used to evaluate reliability between the two moments of questionnaire administration, and Lin's concordance correlation coefficient (Lin, 1989) was used to evaluate agreement, for the whole SoPS and for each of the four dimensions (place, people, time, self). Analyses were performed with IBM SPSS Statistics v. 25.

6.4.2 Results

Test-retest reliability at 2 months for SoPS was good, with $r = 0.790$ ($p < 0.001$). Test-retest reliability for the four dimensions of SoPS were all significant ($p < 0.001$), and excellent for the *place* dimension (0.833), good for *people* (0.765) and *time* (0.646) dimensions, and moderate for the *self* dimension (0.544). Lin's concordance correlation coefficient for SoP was 0.813 for the whole scale, 0.833 for *place*, 0.768 for *people*, 0.710 for *time*, and 0.786 for *self*.

6.5 Discussion

In this study, we developed a new multidimensional model of sense of place, an overarching construct with four dimensions: place, people, time, and self. We also validated a 32-item self-report questionnaire to measure this construct and its quadripartite structure.

The *place* dimension had the highest explanatory power; this factor is comprised of eleven items that reflect different facets of the relationship between the individual and the place. Items 1 to 7 express the emotional attachment to the place and the desire to never leave it, in accordance with Hidalgo and Hernández's (2001) definition of place attachment as an affective bond characterized by the desire to maintain closeness to the place of attachment. Indeed, items 1-3 were intended to measure the emotional bond, whereas items 4-7 were meant to measure continuity as a sub-dimension of place identity. However, all items carry emotional content, globally expressing the affective bond between the individual and the place. Functional attachment is measured by item 8, which reflects the importance of the place in supporting important or desired activities and goals. Item 9, adapted from Williams and Vaske's (2003) place dependence questionnaire, was intended to measure place dependence, but this item seems to be more similar to items with emotional content (items 1-7) rather than expressing a functional attachment to the place. The attachment measured by items 1-9 is associated with the memories of the place, measured by items 10 and 11, as these items refer specifically to good/bad memories, hence bringing up emotional content. Inter-item correlations are high for the eleven items, further suggesting that the different theoretical concepts of attachment, dependence, and continuity are closely related and should form one dimension expressing the relationship between the individual and a specific place. Overall, this *place* dimension is equivalent to place attachment as an emotional bond between people and specific places.

Other models have considered place attachment as a unidimensional construct that expresses an emotional connection with the place. The components of this

connection, however, vary among authors. For instance, Lewicka (2005) included feelings of security in the place, missing the place, and being proud of the place in a unidimensional place attachment scale. Another unidimensional model of place attachment included general, social and physical attachments to the house, to the neighbourhood and to the city (Hidalgo & Hernández, 2001). Contrasting with these and other models that consider place attachment, place identity and place dependence as separate dimensions (Hammit et al., 2006; Jorgensen & Stedman, 2001; Raymond et al., 2010), our analysis suggests that place attachment, identity and dependence may exist as facets of a place-related dimension, rather than independent constructs.

The *people* dimension includes items that were intended to measure specific facets of sense of community, namely membership, influence, integration and fulfilment of needs, and shared emotional connection, according to McMillan and Chavis' (1986) model. Only two of the original twelve items were removed, as suggested by the principal component analysis. Other than that, the *people* factor coincides with the sense of community construct, reflecting a feeling of familiarity and closeness to the members of the community (items 12-14), a feeling of valorisation of the community (items 15-17), a feeling of trust between community members (item 18), and a sense of concern for community members (items 19-21).

Although many models of people-place relationships emphasize a bi-dimensional view of place attachment, with identity and dependence as dimensions, many others have included a social-cultural dimension that refers to the characteristics of the inhabitants of the place and how those people influence place attachment. For instance, Riger and Lavrakas (1981) have identified a sense of community comprised by social bonding between individuals and their neighbours, and behavioural rootedness, associated with length of residence. Raymond et al. (2010) included items to measure friend bonding/belongingness that reflect social ties between the individual and other people from the place. McMillan and Chavis' (1986) model of sense of community has provided a framework for the evaluation of this construct, either independently from place attachment or as a dimension of place attachment. For

instance, Peterson, Speer, and McMillan (2008) provided empirical support for a sense of community scale based on the multidimensional model of sense of community. Other studies have used scales based on this model to evaluate sense of community in specific settings (El-Ekhteyar & Furlan, 2016; Sakip et al., 2012). McMillan and Chavis' (1986) sense of community model is indeed very robust, expressing a well differentiated construct that, in our proposed model, can be considered as a dimension of sense of place.

The social context of place attachment has been conceptualized and operationalized in different ways; many models include rootedness and time-related variables as components of community attachment. However, our results suggest that a *time* dimension is separate from the community or *people* dimension. This temporal dimension is related not only to the length of residence at the place, expressed by items 22 and 23, but also to an intergenerational transmission, assessed by items 24-26. The importance of length of residence and intergenerational transmission for the development of place attachment has also been suggested by other scholars. For instance, Lin and Lockwood (2014) observed that locals and long-term non-local visitors of protected areas in Australia developed strong emotional bonds when their families had resided in or visited the areas for generations. Positive correlations between length of residence and place attachment and identity were found in Israeli cities' residents (Casakin et al., 2015), and in natives and non-natives of the Canary Islands (Hernández et al., 2007). A family bonding dimension was also considered by Raymond et al. (2010), reflecting the importance of intergenerational transmission for the development of place attachment; for instance, family bonding item "*I live in the Adelaide and Mount Lofty Ranges because my family is here*" is similar to our items 24-26. Other authors have considered length of residence as a predictor of place attachment (Anton & Lawrence, 2014; Karacor & Parlak, 2017; Scannell & Gifford, 2014) rather than its component; nonetheless, strong relationships between the two variables are repeatedly found (see review by Lewicka, 2011 and references therein).

Finally, the *self* dimension includes items intended to measure the distinctiveness and self-esteem sub-dimensions of place identity. The six items are more internally focused than items in the other dimensions, that reflect relationships with the place itself, the people in the place, and the time spent in the place. Items 27-29 compare the self with other people, reflecting the self's desire to be different from others; this emphasis on comparison between different types of people is labelled as place identification by Twigger-Ross and Uzell (1996). Items 30-32 reflect the self-esteem associated with the place, i.e., an individual's positive or negative feelings about themselves associated to the place, rather than a positive or negative evaluation of the place. These items mostly express a sense of pride for the place, identified as the self-esteem component of place identity (Twigger-Ross & Uzell, 1996). The continuity and self-efficacy components of place identity were also measured in the first SoP questionnaire (study 1), but these items were either removed or included in another SoP dimension. Indeed, the three items intended to measure self-efficacy were removed due to their low communalities, suggesting that the feeling of self-efficacy is not associated with attachment to a specific place. Items measuring continuity loaded on the *place* factor, given that these items refer to the relationships between the individual and the place, specifically the fit between the place and the individual, and the desire never to leave the place. These items seem more externally focused than distinctiveness and self-esteem items, hence their high loadings on the *place* factor.

The identification of an overarching sense of place construct with four dimensions has some important implications for place-people research, in agreement with other theoretical frameworks that consider sense of place an overarching or second-order factor. However, Jorgensen and Stedman (2001) concluded that a one-factor model (sense of place) was better fitting than their initial proposal of a three-factor structure (place attachment, place identity, place dependence) for sense of place. Conversely, our results suggest that sense of place is a second-order factor composed by four first-order factors (place, people, time, self). Analysis of convergent and

divergent validity confirmed the empirical distinctions between the four factors, highlighting their inter-independence.

People-place relationships is a highly interdisciplinary field of research, and a myriad of theoretical frameworks of place attachment are available throughout the literature, lacking, however, corresponding empirical advancements (Lewicka, 2011). Other constructs may be components of an overarching “sense of place”, and each may increase the explanatory power of people-place models. For instance, a “place discovered” variable that reflects an individual’s agency to become attached to the place, which is equivalent to Hummon’s (1992) ideological rootedness (Lewicka, 2013b), was not included in our instrument. Our proposal shows other limitations, of which the most striking is probably the strongly biased sample in terms of gender and education, with most respondents being female and highly educated. Nonetheless, the relationship between gender and education, and place attachment and related constructs, is not well established (e.g., Bonaiuto, Mao, Roberts, Psalti, & Ariccio, 2016; Lewicka, 2013b).

6.6 Conclusions

Proposing a new model of sense of place and a new instrument to measure this elusive construct is not a straightforward task. To conclude our article, we will use “the good, the bad and the ugly” framework to address the strengths and limitations of our model and instrument. Firstly, we begin with the good. Contrary to other place attachment/sense of place instruments, our Sense of Place Scale is not location-specific; therefore, this instrument has potential for a broad range of applications, as it can be used as is, or it can be adapted to specific locations. Our model also provides a new factorial structure of sense of place; by operationalising sense of place in terms of place, people, time, and self, we contribute to its validity as a psychological construct.

Secondly, the bad. Although model fit is within an acceptable range, it is not as good as we would like, and an adequate fit was only obtained with post-hoc modifications. In addition, acquiescence bias might be a problem in the application of the instrument, as most items are worded in the same direction. A cross-cultural validation is also necessary, particularly to corroborate our claim of a broad applicability of the SoP instrument.

Third and last is the ugly. We are aware that a myriad of conceptualisations and operationalisations of sense of place/place attachment are already in place. Despite the important contributions of our study to the arena of people-place research, it also adds more entropy to an already chaotic environment. Nevertheless, it may also spark further discussion on place attachment theory and provide avenues of future research.

Chapter 7

Final remarks

7.1 Main findings

Coastal zones are attractive places to live in, but the risks are high, as coasts are subjected to different kinds of hazards and potential risks. Coastal communities are quite often a challenge for managers and policymakers, given the lack of knowledge of authorities on the psychological processes that drive individuals' preparation for, and response to, coastal hazards. Therefore, understanding people's attitudes and behaviours in the face of risks is essential for maintaining communication channels and for an effective coastal management.

Faro Beach is one such example of a challenging case for coastal managers and policymakers. This region is highly vulnerable to coastal hazards; houses and roads have been destroyed due to storms, and yet residents, mainly fishermen and their families, feel safe living there and refuse to leave to safer grounds. The preceding chapters offered a psychological approach to Faro Beach residents' attitudes and behaviours towards coastal risks, focusing mainly on risk perception and place attachment.

Overall, residents seem to be aware of the risks they face by living at the beach; most residents have witnessed coastal hazards, but given that there were never casualties, they feel safe. Awareness and risk perception are different variables though – despite being aware of the risks, residents' risk perception towards coastal hazards seems rather low, based on residents' discourses. They clearly state that they feel safe at the beach and have no plans to relocate. This resistance to change is deeply rooted in their positive feelings towards the beach, reflecting their strong emotional attachment to the place and their perceptual bias, which contributes to the inflation of the place's qualities, i.e., the dangers become less apparent.

When analysing risk perception in Faro Beach residents from a quantitative approach, results are slightly different, suggesting moderate levels of risk perception. These differences may be attributed to the different approaches used. Risk perception

was firstly evaluated through semi-structured interviews to long-time residents of Faro Beach, and then a quantitative approach with a self-report questionnaire was applied to a more diverse sample of residents and homeowners that included residents with a much shorter residency time. Either way, be it low or moderate, risk perception in Faro Beach residents seems disconnected from the “real” risk people face, particularly in the winter, when storms and their effects have caused destruction of houses and roads.

At the root of residents’ feelings of security and unwillingness to leave the beach is a strong emotional connection to the place, informed by decades of residency and familial heritage. Most residents were born at the beach and/or have lived there for all their lives – relocating would imply a definite cut with their social ties. In addition, and contributing to their feelings of security, is the belief that bad things will not happen to them, given that, despite the material destruction, no fatalities were ever observed at the beach due to coastal hazards. Residents also perceive risks as distant in time, i.e., they believe that someday a disaster will happen at the beach, but only in the future. This optimism bias and psychological distance further prevent the adoption of preparedness behaviours to deal with a potential disaster. Other behavioural barriers are in place, such as mistrust in authorities and externalisation of responsibility. These are caused by the lack of communication between residents and authorities. Residents claim that the authorities do not hear them, do not ask for their opinion, and impose decisions on them.

The strong emotional connection to the place is a major variable associated with risk perception. A strong and negative relationship between sense of place (an umbrella term that includes place attachment) and risk perception was found, suggesting that the high level of attachment to the place contributes to a decrease in risk perception (but not necessarily a low risk perception). In contrast, past experience with hazards contributed to a higher risk perception, most likely because the experience is direct and personal, and thus residents are fully aware of the

consequences. Another significant and negative relationship was found between risk perception and preparedness; although residents feel rather safe at the beach, they still make some preparations to deal with potential risks, for instance, most of them have a boat that they can use to escape the beach if necessary.

Faro Beach harbours a heterogeneous community of individuals, which is reflected in sociodemographic differences for several variables. For instance, older residents perceive the risks as more distant in time than younger residents. In addition, residents with basic education or less reported to be less prepared to face a potential disaster and showed a higher psychological distance than more educated residents. People who consider themselves well informed about coastal hazards demonstrated a higher risk perception, but also a higher psychological distance. This group of well informed, older residents corresponds to the people living at the beach for longer, and it is mainly composed by fishermen and their families.

The attitudes and behaviours of Faro Beach residents towards coastal hazards have always been baffling to outside observers, particularly scientists and coastal managers. These stakeholders tend to believe that residents do not understand the risk to which they are exposed and, hence, their risk perception is low and incongruent with the actual risk. Scientists and managers believe that part of the solution to increase residents' risk perception in accordance with the "real" risk is to give them more information and education. This approach to risk communication is based on the flawed information deficit model. On one hand, residents' major source of information about coastal hazards and risks is life experience itself; on the other hand, more information may produce the opposite effect and lead to the normalisation of risk, i.e., a decrease in risk perception as a way to psychologically deal with the threat.

Finally, two new psychometric instruments were developed. The first is the Coastal Risk Awareness Scales, aimed at evaluating risk perception, past experience with hazards, psychological distance, preparedness, trust in authorities, and

externalisation of responsibility. These variables were chosen based on the results of the semi-structured interviews to Faro Beach residents and the items were drawn from their discourses. The final version has 17 Likert-type items to be responded on a 5-point rating scale, and the scales have adequate internal consistency and show both convergent and divergent reliability (see Appendices 1, 2, and 3). The second instrument aimed at measuring sense of place as an overarching construct. Exploratory and confirmatory factor analyses suggested that sense of place is a second-order factor with four first-order factors: place, people, time, and self. The final Sense of Place Scale has 32 Likert-type items responded on a 5-point rating scale (see also Appendices 4 and 5). Contrary to other instruments measuring risk perception and place attachment, both questionnaires are location-independent, so they can be used for a broad range of applications or adapted to specific locations.

7.2 Limitations and future research

While this thesis made significant and original contributions to coastal risk research and, overall, to the field of environmental psychology, several limitations apply. To start with, qualitative research should take into consideration the saturation principle, i.e., when more participants do not add any new or relevant data. The qualitative studies presented in Chapters 2 and 3 used small samples of individuals (4 and 8, respectively), but we considered that each sample was homogeneous in relation to the relevant characteristics of each group of stakeholders. Thus, while more participants would enrich the content analysis, the samples used were deemed adequate to extract relevant information. Qualitative approaches are often deemed as more subjective and hence less “scientific” than quantitative ones. Nevertheless, the richness of information obtained through semi-structured interviews makes the case for the use of this methodology in future research but striving for larger samples which can be obtained by using, for instance, focus groups instead of individual interviews.

Sample size was also a problem for the validation of the Coastal Risk Awareness Scales. Future work should include further validation through confirmatory factor analysis using a larger and more heterogeneous sample.

The self-reported nature of data presented in Chapters 4, 5, and 6 is an obvious limitation, given that respondents may be influenced by several bias, particularly the social desirability bias that leads respondents to give responses that they perceive as socially adequate. In addition, the enumerators had to read the questionnaire to some individuals, and then these individuals chose the appropriate response out loud, further increasing the possibility of social desirability. This limitation relates to the sociodemographic characteristics of the sample and would be difficult to eliminate in future studies. Online questionnaires, on the other hand, reach a more educated population (our online questionnaire targeted individuals that own a house at the beach but do not live there the whole year), but respondents may not be aware or may not be impacted by the issues under study.

Although the conceptual model proposed in Chapter 2 included eight variables, the model tested with partial least squares modelling (Chapter 5) included only four constructs. The results showed that sense of place and past experience with hazards explained 70% of the variability in risk perception, but risk perception explained less than 35% of preparedness. Therefore, a more comprehensive model of antecedents and consequents of risk perception should be tested with more robust samples, addressing the role of variables such as psychological distance, optimism bias, externalisation of responsibility, trust in authorities, etc.

Another major limitation is that the findings of this research (except Chapter 6) are limited in terms of generalizability, not only due to the small sample size, but also due to the specificities of the sample, composed by individuals residing at the same location. While relevant for discussions focused on Faro Beach, results may not be representative of other coastal populations at risk. However, this limited

generalizability of results can be considered the norm in coastal hazards research, given that each location has its own level of risk and residents differ in terms of length of residency, emotional attachment, cultural and social context, etc. Thus, the psychological dimensions of coastal hazards should be systematically addressed in different locations, using the same methodologies to allow comparisons between distinct populations exposed to risk.

7.3 Main implications

The findings of the present thesis have both managerial and theoretical implications. In terms of contributions to theory, the different studies provided a systematic approach that used both qualitative and quantitative methodologies to advance the conceptualisation and operationalisation of sense of place, risk perception, and related variables. A new conceptual model of antecedents and consequents of risk perception was developed and tested, offering avenues for future research. A new psychometric instrument to measure risk perception and associated variables was developed and validated, providing an additional tool to be used not only in research, but also in managerial activities. Finally, a new model of sense of place and a new psychometric instrument to measure sense of place were developed. The new model conceptualises sense of place as an overarching construct with four dimensions (place, people, time, self), differing from previous conceptualisations and thus adding more entropy to the chaotic arena of people-place research. None of these new instruments is location-specific, making them suitable for a broad range of applications. Overall, these studies provided a holistic vision of risk perception and place attachment in a coastal community exposed to coastal hazards and risks.

Despite the relevance of the theoretical contributions, the managerial ones are probably more significant and straightforward – knowledge on the psychological

aspects of coastal risks is an essential component of coastal management. Residents' risk perception is influenced by strong emotional bonds to the place; education and information are not a panacea to solve the problems of coastal populations and are not the solution to increase risk perceptions or preparedness of populations at risk. Systemic approaches that integrate sociological, economic, ecological, and psychological components are critical to increase the effectiveness and feasibility of management plans, particularly the implementation of disaster risk reduction measures.

Improvements in communication are key for a successful coastal management, bridging the gap between stakeholders. Collaborative strategies should be favoured, instead of top-down policies based on informing and enforcing, as individuals are more likely to accept decisions if they feel that they are part of the decision process. Communication between stakeholders should be fostered, not only between residents and authorities, but also between authorities and scientists. If relevant scientific results and precise scientific recommendations are readily communicated to managers, more appropriate and scientifically sound policies can then be developed and accepted. In addition, if residents' suggestions and opinions are considered in decision-making processes, they will feel included. As a result, residents will not externalise the responsibility as much and their trust in authorities may improve. If residents feel that their opinion matters, their willingness to be involved will be higher – and residents' participation in the decision-making process is necessary for an effective coastal management. Overall, an active involvement of all stakeholders in discussions and decision-making processes, based on active communication, trust, and sharing of experiences, should be the goal.

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Appendices

Appendix 1 – Development and validation of the Coastal Risk Awareness Scales.

Development. The Coastal Risk Awareness Scales were developed to measure risk perception, preparedness and related constructs, namely psychological distance (threat perceived as distant in time), past experience with hazards and risks, trust in authorities, and externalisation of responsibility. The items were drawn from semi-structured interviews with Faro Beach residents (see Chapter 2). The first version was composed by 24 Likert-type items to be responded on a 5-point rating scale ranging from 1 (strongly disagree) to 5 (strongly agree). The final version (English version in Appendix 2; original Portuguese version in Appendix 3) has 17 items and adequate reliability.

Validation. Four items were removed due to low (<0.3) inter-item correlations and two other items were removed to aid interpretability. KMO (0.714) and Bartlett's test ($\chi^2(190) = 1113.5, p < 0.001$) were adequate. PCA extracted six factors that explained 68.7% of the total variance. Appendix 2 shows factor loadings for each item, and composite reliability, average variance extracted, eigenvalues, percentage of variance explained, and internal consistency (Cronbach's alpha) for each factor.

The final version of the Coastal Risk Awareness Scales is composed by 17 items and 6 scales (risk perception, past experience with hazards, psychological distance, preparedness, trust in authorities, and externalisation of responsibility). The internal consistency of the scales is adequate (>0.7), except for "externalisation of responsibility" (0.527). Composite reliability and average variance extracted suggest that the scales, except for "externalisation of responsibility", show both discriminant and convergent reliability, i.e., the different factors evaluate different constructs and the items of each factor converge on that factor.

Appendix 2 – Exploratory factor analysis of the Coastal Risk Awareness Scales (the original Portuguese version is in Appendix 3), with factor loadings for each item, and composite reliability (CR), average variance extracted (AVE), Cronbach’s alpha, eigenvalues and percentage of variance explained for each factor. R = reverted item.

<i>Factors/Items</i>	<i>Factor loadings</i>	<i>CR</i>	<i>AVE</i>	<i>Alpha</i>
<i>Risk perception</i> (<i>eigenvalue = 4.53; variance explained = 22.66%</i>)		.82	.61	.78
1. I feel safe in the place where I live. (R)	.822			
2. I feel safe living here. (R)	.677			
3. I don’t feel safe living here because of coastal hazards.	.833			
<i>Past experience with hazards</i> (<i>eigenvalue = 2.24; variance explained = 11.21%</i>)		.86	.68	.79
4. I’ve seen houses destroyed or damaged due to storms/floods, etc. where I live.	.871			
5. I’ve seen people losing their belongings due to storms/floods, etc. where I live.	.814			
6. I have no knowledge of houses destroyed or damaged due to storms/floods, etc. where I live. (R)	.781			
<i>Psychological distance (threat perceived as distant)</i> (<i>eigenvalue = 1.50; variance explained = 7.49%</i>)		.74	.49	.62
7. Coastal hazards may affect people and houses at any moment. (R)	.843			
8. Where I live, I’m not at risk and my house is not at risk.	.634			
9. At present, people who live here are already at risk. (R)	.595			
<i>Preparedness</i> (<i>eigenvalue = 1.11; variance explained = 5.57%</i>)		.82	.61	.73
10. If something serious happens where I live, I have a plan B.	.810			
11. If a disaster happens where I live, I have no plan to face it. (R)	.741			
12. In case of disaster, I’m ready to face it.	.785			
<i>Trust in authorities</i> (<i>eigenvalue = 2.64; variance explained = 13.22%</i>)		.80	.59	.69
13. I trust in authorities’ capacity to solve our problems.	.763			
14. I believe that the authorities are able to solve our problems.	.915			
15. The authorities cannot solve our problems. (R)	.579			
<i>Externalisation of responsibility</i> (<i>eigenvalue = 1.71; variance explained = 8.55%</i>)		1.22	.39	.53
16. Who has the obligation of solving our coastal problems are the authorities.	.504			
17. The authorities are responsible for the resolution of problems related to coastal hazards.	.719			

Appendix 3 – Portuguese (original) items of the final 17-item Coastal Risk Awareness Scales. R = inverted items.

<p>Percepção de Risco</p> <p>1. Sinto-me em segurança no sítio onde vivo. (R)</p> <p>2. Sinto-me seguro vivendo aqui. (R)</p> <p>3. Não me sinto seguro a viver aqui por causa dos riscos costeiros.</p>
<p>Experiência passada com riscos costeiros</p> <p>4. Já vi casas a serem destruídas ou a ficarem danificadas por causa de tempestades/inundações, etc. na zona onde vivo.</p> <p>5. Já vi pessoas a perderem os seus bens devido a tempestades/inundações, etc. na zona onde vivo.</p> <p>6. Não tenho conhecimento de casas destruídas ou danificadas devido a tempestades/inundações, etc. na zona onde vivo.</p>
<p>Distância psicológica (ameaça percebida como distante)</p> <p>7. Os riscos costeiros podem afetar as pessoas e as casas a qualquer momento. (R)</p> <p>8. Onde vivo, não estou em risco e a minha casa não está em risco.</p> <p>9. Neste momento, as pessoas que vivem aqui já estão em risco. (R)</p>
<p>Preparação</p> <p>10. Se acontecer algo de grave no sítio onde vivo, tenho um plano B.</p> <p>11. Se ocorrer um desastre no sítio onde vivo, não tenho nenhum plano para enfrentá-lo. (R)</p> <p>12. Em caso de desastre, estou preparado para enfrentá-lo.</p>
<p>Confiança nas autoridades</p> <p>13. Tenho confiança na capacidade das autoridades para resolverem os nossos problemas.</p> <p>14. Acredito que as autoridades conseguem resolver os nossos problemas.</p> <p>15. As autoridades não são capazes de resolver os nossos problemas. (R)</p>
<p>Externalização da responsabilidade</p> <p>16. Quem tem obrigação de resolver os problemas costeiros são as autoridades.</p> <p>17. As autoridades são responsáveis pela resolução dos problemas relacionados com os riscos costeiros.</p>

Appendix 4 – English version of the instructions to the Sense of Place Scale (Chapter 6).

The following sentences are related to the place where you live. Therefore, to answer this questionnaire, please consider where you live; it can be your city or village, your neighbourhood, or a specific location. Choose a place to which you feel an emotional connection.

Please, read each sentence carefully and choose the option that best reflects your opinion, using the following scale:

- 1 = strongly disagree
- 2 = disagree
- 3 = neither agree nor disagree
- 4 = agree
- 5 = strongly agree

Appendix 5 – Portuguese (original) items of the final 32-item Sense of Place Scale obtained in Chapter 6 (study 1) and questionnaire instructions. Reverted items are indicated with R.

As questões seguintes relacionam-se com o sítio onde vive. Assim, para responder a estas questões, considere o sítio onde vive; pode ser a sua cidade, bairro, ou uma zona da localidade, mas escolha um sítio ao qual se sinta emocionalmente ligado. Por favor, leia cada frase cuidadosamente e escolha a opção que melhor reflete a sua opinião, usando a escala seguinte:

- 1 = discordo fortemente 2 = discordo
 3 = não concordo nem discordo 4 = concordo
 5 = concordo fortemente

<p>Lugar</p> <ol style="list-style-type: none"> 1. Sinto-me muito ligado a este lugar. 2. Este sítio é muito importante para mim. 3. Sinto-me mais confortável aqui que noutros sítios. 4. Quero continuar a viver aqui. 5. Sinto-me bem integrado neste sítio. 6. Sinto que combino com este sítio. 7. Sinto que este lugar faz parte de mim. 8. Este sítio é o melhor sítio para fazer as coisas de que gosto. 9. Dá-me mais prazer estar aqui do que noutro sítio qualquer. 10. Tenho boas memórias deste sítio. 11. Este sítio traz-me más recordações. R
<p>Pessoas</p> <ol style="list-style-type: none"> 12. Conheço pelo nome a maioria das pessoas que vivem ao pé de mim. 13. Sinto que nos conhecemos todos aqui. 14. Não sei o nome da maioria das pessoas que vivem ao pé de mim. R 15. Valorizo a opinião dos meus vizinhos e da minha comunidade. 16. Quando temos problemas relativamente a este sítio, os vizinhos/comunidade juntam-se para os resolver. 17. A comunidade não se junta para resolver os problemas. R 18. Posso confiar nos membros desta comunidade. 19. As pessoas daqui preocupam-se umas com as outras. 20. Aqui, ajudamo-nos uns aos outros. 21. Nesta comunidade, é cada um por si. R
<p>Tempo</p> <ol style="list-style-type: none"> 22. Vivo aqui há muito tempo. 23. Sinto que toda a minha vida foi passada aqui. 24. Vivo aqui porque a minha família (pais, avós) já vivia aqui. 25. A maior parte da minha família é daqui. 26. A maior parte da minha família também vive aqui.
<p>Self</p> <ol style="list-style-type: none"> 27. Sou mais parecido com as outras pessoas que vivem aqui, do que com pessoas que vivem em locais diferentes. 28. As pessoas que vivem noutros sítios são muito diferentes de mim. 29. As pessoas que vivem neste sítio são mais parecidas comigo do que pessoas que vivem noutros locais. 30. Quando alguém critica o local onde vivo, sinto-me como se me estivessem a insultar. 31. Quando alguém elogia o local onde vivo, sinto-me como se fosse um elogio a mim próprio. 32. Não gosto nada quando ouço alguém a criticar o local onde vivo.