ERC Consolidator Grant 2015
Research proposal [Part B2)]

Part B2: *The scientific proposal* (max. 15 pages)

Section a. State-of-the-art and objectives

Traditional historiography considers the 18th century as the time of the first relevant European presence in the Pacific. It has overlooked the existence and extent of earlier encounters between indigenous populations and Europeans in the 16th and 17th centuries. This multidisciplinary project investigates the impacts of this earlier European presence on local societies: not only direct contacts were established, but also indirect effects, mainly caused by the introduction of new species into the local environments, did shape the history of the region. Both direct and indirect relations will be analysed combining the study of written sources, archaeology, bioecological research and Network Analysis, to address this question: which were the consequences for local peoples of the European direct and indirect contacts in the Western Pacific in the 16th and 17th centuries?

The Pacific has not only received European influences since very early on; it has also made particular contributions to world history. It was one of the last areas to be settled by humans, and also to be incorporated into the Western colonial worldview, mainly through J. Cook's voyages. From the late 18th century Europe has been fascinated by the discovery and exploration of the South Seas, and the Pacific has been important in the formation of European modern science, literature and art (Boulay 2005). In this region, social-environmental coevolution has had a particular trajectory due to its island geography, and social contact and interaction can be better observed. Historical and anthropological studies on Oceania have flourished for centuries now, and basic notions on social organization have been extracted from the region and elaborated by philosophers (J. Rousseau) and anthropologists (M. Mauss, B. Malinowski, I. Goldmann, and M. Sahlins). Ultimately, these theoretical/empirical constructions have been extrapolated to other historical and geographical contexts, and in particular European prehistoric contexts have been often interpreted in Pacific terms. On the one hand, this demonstrates the relevance of deepening our understanding of Pacific history. On the other hand, the traditional historiography which connects the Pacific encounter solely with Cook neglects the scope and impact of earlier European encounters with the indigenous societies of the Pacific Islands, thus working on an incomplete image. But the extent of these encounters was certainly large (see map 1).

Early European expeditions into the Pacific undertaken by Dutch, Portuguese and especially Spanish ships and fleets (starting in 1519) in the 16th and 17th centuries are numerous (only the Spanish voyages number seventeen until 1606) and include voyages such as Ortiz de Retes' in 1545 to Papua New Guinea (PNG), or to Massim (PNG) in 1606, among others, that have so far remained largely invisible for research. These expeditions involved the foundation of colonies in the Philippines, Taiwan and Marianas, and failed attempts in Graciosa Bay, Santa Cruz island (Solomons) led by A. de Mendaña (in 1595-1596, after attempts in 1567-1569) and in Vanuatu by P. Fernández de Quirós (1605-1606). The launching of the Manila Galleon in 1565, carrying out two transoceanic journeys every year, is also a most important factor that led to many potential situations of contact, since the Galleon was an experimental endeavour during the first half of its life, and explored different routes looking for watering and provisioning islands.

However, archaeological investigation on the consequences of these events for local populations has been scarce and preliminary (Allen and Green 1972; Dickinson and Green 1973; Green 1973; Allen 1976; Bedford et al. 2009; Gibbs 2015), with the result that an important part of Pacific history remains hidden for Pacific and European peoples alike. This project contends that the thorough study of these European endeavours and the response of native peoples, never undertaken yet, will change current perspectives on the history of the Western Pacific by showing that the consequences of direct and indirect contact are more profound and widespread than has been accepted so far. As Spriggs (1997: 234) puts it:

"Could the depopulation of these areas [in the Solomons], extreme even in comparison with other areas of Island Melanesia, have begun with the impact of the Spanish themselves? Diseases common enough among Europeans not to merit comment in the accounts, may have been devastating when introduced to a population with no exposure and, therefore, no resistance to them. The Spanish did not stay long enough in the islands to observe the effects of any such introductions. They note that in all areas the local people appeared healthy and without any evident medical conditions. Later accounts of the late eighteenth and early nineteenth centuries paint a quite different picture in some areas, and the catastrophic effects of the introduction of diseases by passing ships is well documented for that era. (…) Future archaeological projects directed at (…) the areas visited by the Spaniards should allow us to establish

whether in fact the decline in population is a phenomenon begun in the sixteenth and early seventeenth centuries rather than the nineteenth century."

Objectives

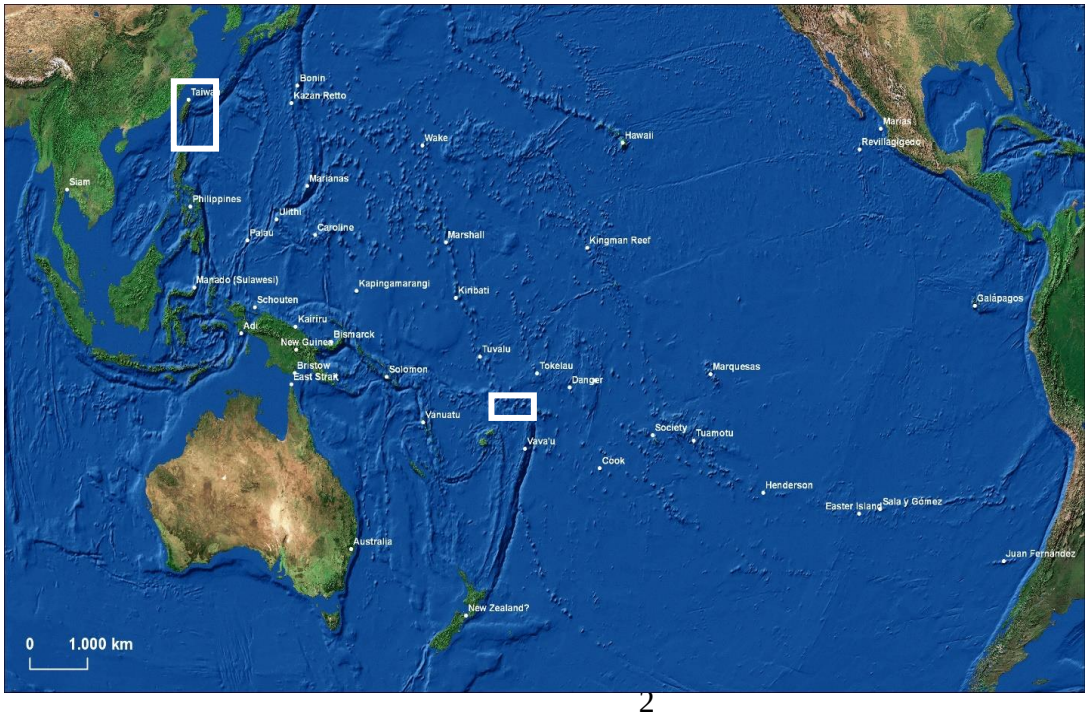
The project will rewrite the history of the European-Pacific encounter in its early stages by 1) bringing together, for the first time, all documentary sources pertinent to the early European presence in the Pacific; 2) studying direct contacts through two particularly well-suited archaeological case studies: Taiwan and Alofi (Wallis and Futuna), and paying attention to two foreign species commensal to the Europeans: sweet potato and pathogens; 3) studying indirect contacts using the emerging field of Network Analysis (Brandes et al. 2013) for constructing models of introduction and spread of those species; 4) combine data sources in an Information System with visualization and analytical capacity. This combination of goals allows us to study the effects of European direct and indirect contact on local populations in the 16th-17th centuries.

Many historical sources refer to the entire Pacific and will be recorded as such: documents cannot be split and they focus on the entire area, since ships were axes connecting both shores of the ocean. This initial broad scope is necessary for not taking the risk of observing the region as a compartmentalized area, which is against the assumptions of this project (see below). For the study of direct and indirect contact the project is bound to the Western Pacific, broadly defined as the area west from Tonga, for obvious reasons: this region comprises the main scenario in which European activities can be studied at this stage and where the central research question of this project can be investigated: what were the consequences of the European endeavours in the Pacific in the 16th and 17th centuries?

Research areas

▪ *Research Area 1: historical documents*. The first method to address the question of the scope and potentially significant effects of European presence in the 16th-17th centuries starts with a thorough investigation of the historical sources. Although documents containing a wealth of detailed information about indigenous people and forms of contact abound in archives in the Netherlands, Portugal and Spain, they have never been systematically explored. Two academic traditions have conflated to invisibilize two centuries of history in the Pacific. On the one hand, historians have shown little interest in the 'natives'. Therefore, documents have not been sufficiently studied to extract information about the local people and the early contact. On the other hand, archaeologists and anthropologists have shown little interest for the study of this early historical period, and the language barrier may also have contributed to their overlooking the written sources.

The NAO project, for the first time, brings together historians from the various countries for a systematic study of the textual evidence provided in the various archives in a multidisciplinary perspective. This project will create a corpus of documentary data from Spanish, Portuguese and Dutch primary sources, first, to fix the scope of their activities, and second, to gather information about native populations. A preliminary exploration of these documents shows a wealth of ethnographic information that must be thoroughly searched and organized; this alternative research problem will drive the re-reading of these documents (see procedure in Section b).



Map 1:

Places recorded by Spanish expeditions until 1606. From Spanish documents, preliminary research.

Areas of fieldwork (see objectives) in rectangles.

▪ *Research Area 2: archaeology of direct contact, and introduced species.* In order to understand the immediate effects of early European presence on Pacific islands, we will study settings of direct contact with archaeological methods. This is an underexplored area, and very few excavations have been carried out so far. Moreover, these excavations have rendered little evidence in the sites where the Europeans settled in Graciosa Bay (Gibbs 2015) and Vanuatu (Bedford et al. 2009; Flexner and Spriggs ip). Here, some Spanish material (sherds from one Spanish *botija* or olive jar), probably from Quirós' expedition, has been found further north in the Banks Islands (Bedford et al. 2009: 78-84), but nothing on the original colony of Espíritu Santo. The materials in the Banks Islands had probably been incorporated into local trade networks and dispersed from Espíritu Santo, possibly as prestige goods given their exotic origins (Flexner et al. 2015). Thus, an originally weak material presence is further invisibilized by the local social practices.

NAO includes two archaeological projects that focus on two carefully chosen exceptional case studies in Taiwan and Alofi. In previous research campaigns both sites have been tested to be fit for the study of direct contact (see below). By shifting the focus from 'obvious' spots of archaeological research to other less known but productive study cases, the project will expand the knowledge on how direct contact developed, as well as its consequences.

Taiwan and Alofi have been scenarios of our previous research and we have attested contact and its material consequences, that can be studied through archaeology. The two places represent two extremes in terms of previous contact and exposure to foreign agents (Taiwan had been in touch with the continent throughout its history, whereas Alofi was not), and two different modalities of contact with Europeans: long-term colonial contact vs. short term visits to small islands. In Taiwan the Spanish colony of San Salvador de Kelang (in Keelung, site name HPD-B) was founded in 1624 and taken by the Dutch in 1642 until 1662. By contrast, Alofi received a visit by J. Le Maire and W. Schouten for 13 days in 1616, and apparently as a consequence, this 8 km-long island was abandoned and only used for agricultural purposes afterwards. This makes it a unique case for the study of demographic impacts in the Western Pacific.

Fieldwork will pay attention to every possible aspect of the record, to define archaeological markers of processes of direct contact, with an emphasis on 1) vegetation and diet changes in the 16th-17th centuries; and 2) changes in land use and study of human remains from burials as markers of demographic changes. These kinds of changes may be due to the introduction of new species by the Europeans, whose ecological and biological traces *do have* long-term effects that we can study. Indeed, studies based on the spread of commensal species as proxies to understand human movements in the Pacific have been one of the most interesting developments in the last decade in Pacific archaeology (see Seelenfreund et al. 2010: 2 for a summary of commensal species), together with studies on paleoecology (Prebble and Wilmshurst 2009), and human ecodynamics (e.g. works by P. Kirch). These studies aim in all cases to understand prehistoric human colonization of the Pacific islands (also a precedent of this ecologically focused research is N. Boivin's Sealink project to study the diffusion of plant species across the Indian Ocean during prehistory). NAO is the first step in the direction of applying a similar *ecologically-based archaeological* perspective to the study of the equally important topic of early European impacts in the Pacific in historical times and its repercussions through a particular emphasis on the direct and indirect introduction of two European commensal species into the local environments: we will look for the long-term effects created by the introduction of sweet potato and pathogens. Both elements together comprise a range of intentional and non-intentional human action, and were key vectors in the European-local interaction.

Sweet potato (*Ipomoea batatas* [L.] Lam.) is an American plant with a very high relevance for the history of the Pacific as a whole, as on-going debates about when and how it was introduced, demonstrate (see syntheses in e.g. Yen 1974, Ballard et al. 2005, Roullier et al. 2013). The most accepted perspective on this problem is the so-called 'tripartite hypothesis': sweet potato (Kumara lineage) was introduced into Polynesia by Polynesian voyagers returning from South America between 1000 and 1100 A.D., probably spreading into Hawai'i, Easter Island, and other islands and then into New Zealand, around 1150–1250 AD (the possibility of a westward dispersal towards Tonga, Samoa, and eastern Melanesia has also been suggested). The Spanish galleons introduced the Mesoamerican Camote to the Philippines around 1500 AD (Camote lineage), whereas Portuguese traders introduced to present-day eastern Indonesia the Batata from the Caribbean and Central America (Batata lineage). Two additional European introductions may also have contributed to its diffusion, one by Mendaña's voyage to the Marquesas and Solomon Islands in 1595 and another by Quiros in Vanuatu in 1606 (Roullier et al. 2013: 2205). The tripartite hypothesis is broadly accepted for Polynesia, but partially rejected by researchers working in the Western Pacific, in two regards: a) some of them point to a prehistoric introduction from Polynesia, with PNG as a poignant example: here, sediment and pollen indicators of increasing landscape clearance and degradation have been used as markers for the presence of sweet potato around 1300 AD (Haberle and Atkin 2005), b) some other authors reject

both a prehistoric and a Spanish introduction in the 16th century, to propose instead an introduction by Europeans in the early 1800s (e.g. Allen 2005).

This long-lasting controversy is greatly due to the fact that the sweet potato cannot be detected in the fossil pollen record, but only through the analysis of carbonized macroremains or through the finding of its starches (see below, area of expertise of ACh, see Project cooperation partners). Thus, an early presence of the sweet potato in pre-Spanish times in the Western Pacific would reinforce the hypothesis of a Polynesian introduction from America into the Pacific, and its many implications, but it has not really been attested, and PNG appears as an isolated outlier. Moreover, different lines of evidence point to an introduction in the Western Pacific by the Portuguese and Spanish in the 16th-17th centuries into Indonesia and the Philippines (and maybe Solomon and Vanuatu): the triple scenario of the tripartite hypothesis has been recently confirmed by DNA analysis (Roullier et al. 2013), which points to a very sharp boundary between Polynesia and Island Melanesia, with a very restricted movement of sweet potato germplasm between East and West, without excluding the possibility that these movements happened in later times. Also, sweet potato was introduced by the Spanish and cultivated in the Marianas because it was amenable to long-term storage and was used to provision galleon ships, and indeed archaeological evidence of the sweet potato in the Marianas before Spanish contact is lacking, but it was identified in ceramic residues at a 17th century site in northern Guam (Bayman et al. 2012: 265). Moreover, accounts from the late 18th century gathered by the first European voyagers after Spanish and Dutch travels, testify to the presence of sweet potato in New Caledonia (Labillardière in 1793), and interestingly, in Milne Bay, PNG and Santa Cruz, Solomon Islands (D'Entrecasteaux in 1793), among others. Finally, the sweet potato expanded from the Philippines (Spanish) and Indonesia (Portuguese) into the adjacent areas very quickly, without European intervention: it was a staple in certain areas in China by 1563, and among other places, in Batanes it was a staple crop recorded by W. Dampier and the Spanish Dominican fathers by 1686 (PI's ongoing research).

Surprisingly, the Spanish documents have been used in the discussion of the introduction of the sweet potato only through secondary or third-hand sources and translations, e.g. Allen (2005): "No attempt is made [here] to examine the primary sources associated with the voyages of European explorers (…) as these have already received adequate treatment (Dixon 1932:42-3; Hornell 1946:48; Yen 1974:8)". Allen (2005) is one of the authors who don't accept the Spanish introduction of the sweet potato into Melanesia. However, Dixon (1932), for example, based himself on Markham (1904), a translation of Zaragoza (1876 and 1878). Neither Zaragoza nor Markham had a special interest in studying the sweet potato, a problem first brought up by Friederici (1929). Thus, Markham only records one mention to 'sweet potato', all other references to camote and batata (and 'boniato', the Spanish name) being lost in translation.

The specific reasons why Spanish chose sweet potato over potato, for example, are not exactly clear; in fact, it is not known how many plant species could have been temptatively introduced. This project uses sweet potato **as a proxy of European influence and a potential index of the presence of foreign plants**. The **expectation** is that, **if new plants were introduced, as already widely accepted for sweet potato**, **this introduction must be detected in the botanical sequence**. NAO is also the first endeavour to weave together different lines of evidence and sources and make a lasting contribution to the question of the Spanish introduction of the sweet potato in the 16th-17th centuries, and its further spread.

Pathogens. Disease transmission (through parasites and through humans) or virgin soil epidemics (meaning "rapid spread of pathogens among people whom they have never infected before" (Crosby 1986)) are factors of change in contact situations and a sensitive topic with huge implications in current political issues, Pacific archaeology and island history (see Kirch and Rallu 2007). There are many examples of drastic population changes in most archipelagos at the time of European contact: e.g. the figures in Guam (Marianas) at the arrival of the Spanish in 1668 estimate around 30.000 Chamorro natives in some 180 settlements; a Spanish census in 1710 mentioned around 3.500 individuals (Hezel 1982). Most of the known examples, for obvious reasons, date to the later contact in the 1800s. Not only epidemics, but also their secondary effects, such as sterility, can result in demographic changes in the long term.

This project proposes that the introduction of foreign diseases to the region at large must necessarily have taken place with the early European expeditions in the 16th-17th centuries. Different lines of evidence support this position: the most important European diseases to have spread in the Pacific, smallpox, measles, tuberculosis, and flu, were common cargo in the Iberian and Dutch ships, as the study of historical documents show. Population voids have been documented in the Solomons dated to an unspecified time after the Spanish colonial adventure, but never researched (see quotation by Spriggs 1997 above). The question of the effects of introduced diseases in Vanuatu has never been addressed, but its importance has been pointed out (eg. Flexner and Spriggs ip). Our case studies also provide strong evidence in this regard: in Alofi, a place with a total lack of exposure to previous foreign diseases, there was a Dutch visit in 1616, which lasted

13 days. The Dutch wrote that Futuna was populous and Alofi was populated, and statistical estimations have reached the conclusion that there were about 10000 people in the archipelago at that time. A little more than two centuries later, the first census made by the Marist Missionaries counted about 840 people for Futuna, and no inhabitants on Alofi. The most probable explanation is the introduction of diseases in 1616 (Sand 2003). Even in Taiwan, which was not isolated in the centuries prior to the European presence, epidemics did take place (e.g. in 1639, smallpox, in Borao et al. 2001: 303) and native mortality was very high at any time during the colonial period.

Even places which had no direct contact with Europeans seem to have undergone severe demographic collapses. Indeed, population stagnation or decline start to be recognised (Rallu 2007) not only in Marquesas (that was indeed contacted by Mendaña in 1567), but also in the Cooks, Easter Island, and Gambiers around 1600. Hawai'i sees a stop in population growth immediately followed by decline around 1600 (Rallu 2007: 20). These population trends cannot be explained as a convergent evolution of natural population growth and stabilization (as proposed by Rallu 2007) because these archipelagos were colonized at different times. Moreover, the probability distribution of dates obtained in the archaeological record after 1660 in New Zealand and Easter Island also drops sharply: much fewer dates are obtained after 1660, which has been interpreted as a bias of research, unrelated to human behaviour (Mara Mulrooney, SAA 2013, Honolulu, on *Interactive Pacific Island Radiocarbon Database*, Bishop Museum). The coincidence is striking, nonetheless: the pattern of apparent demographic problems during the 17th century appears to be widespread. In places such as New Caledonia demographic collapse involving thousands of people has been dated to the end of the 18th and beginnings of the 19th century simply because historical documents do not support a longer chronology (Sand et al. 2007a). These roughly 60 years of only sporadic contacts with Europeans seem to be a very short chronology to explain this demographic decay.

This project contends that longer chronologies should be considered in the face of severely catastrophic demographic collapses, especially when only sporadic contacts were involved. Were populations weakened by foreign diseases before the 18th century, leading to such catastrophic figures (see Kirch and Rallu 2007)? Remarkably, researchers attribute catastrophic consequences to sporadic and very short contacts at the end of the 18th and beginnings of the 19th century, whereas the same kind of interaction, even longer and more intense, during the 16th-17th centuries, do not receive the same consideration. The project will address this imbalance by approaching for the first time systematically the problem of the consequences of introduced diseases in the 16th-17th centuries in the Western Pacific. The **expectation** is that, if **a demographic impact even after brief contact is demonstrated** in our case in Alofi, as seen in the evidence, the **effects of widespread direct and indirect contacts in the 16th-17th centuries have to be reconsidered in this light**.

▪ *Research Area 3: Network Analysis.* As map 1 shows, the areas of activity of the Europeans were large, but most of the interactions did probably not imply direct contact. This represents the main limitation of documents: in spite of their invaluable insights for this research, we do not expect to find new documents pointing at unknown foundations of colonies, for example. Since researchers have fundamentally relied on this type of information to deduce contact, the generally accepted view remains that early European presence was a minor episode to understand history in the Pacific, centered around a low number of places, mostly with short temporal developments. While I assume that archives will not render more documents stating new colonization or conquest events, this does not mean that the impact was negligible, or that we should not try to understand it. We can indeed predict that there was an impact on most islands even if the colonization events were few, because mounting evidence shows that the Western Pacific was a dynamic interconnected region in which short- and long-distance navigation played an important role. After a breakdown of the Lapita networks created during the first settlement, archaeology and ethnohistory show a recomposition of these networks in the centuries preceding European presence, as attested by relatively recent evidence for Polynesian-Melanesian interactions and influential contacts among Vanuatu, Fiji, New Caledonia, Solomon Islands, among others (e.g. Spriggs 1997; Bedford 2006; Bedford and Spriggs 2008; Flexner et al. 2015).

In this context, any impact effected on any part of this network should have a subsequent impact on the rest of the network. But since in this kind of indirect contact situations we cannot simply pinpoint archaeological grounds to carry out traditional archaeological fieldwork on *a priori* unknown parts of the regional network, we necessarily have to develop alternative ways to study this topic, and this project intends to do exactly that: the conceptualization of the study area as a network, and accordingly the use of Network Analysis, provides a unique way forward to develop an understanding of European influences. Thus, the consequences of the European presence in the region cannot be studied as an aggregate of disconnected contact events (expeditions and failed or successful colonization attempts), but through the study of the underlying patterns of connectedness. I contend that patterned local networks effectively shaped the way early contact events and their consequences made history. By focusing on the local connectedness that shaped the spread of foreign

elements, we move forward from the elusive study of events, difficult to pinpoint archaeologically on particular spots, to the study of the processes underlying this early contact, which conferred sense to otherwise particular events. These events became processes because natives absorbed them into their own local dynamics. Therefore, this project addresses the transformation of events into patterned processes of connectedness through the action of local peoples. The elaboration of models focusses on the ecological and cultural aspects that NAO observes as the most significant for understanding long-term changes caused by the early European contact in the Western Pacific: it will track the spread of sweet potato and pathogens, whose relevance has been described above.

▪ *Research Area 4: Information system.* One of the keys of NAO is the exhaustive gathering of different sets of data produced in the previous Research Areas, and its systematic organization. An adequate system of data handling is becoming key in any field as the Digital Humanities grow; it is especially important in NAO due to topic, and geographical, documentary and disciplinary scope, as detailed in Section b.

Section b. Methodology. Research Strategies (RS)

The project will create a synergy in the combination of Research Strategies in response to the assumptions and objectives stated above: RS 1) systematic research of documentary sources pertinent to the early European presence in the Pacific, RS 2) characterization of direct contact and introduced species through archaeology, RS 3) characterization of impacts caused by indirect contact through the creation of Network Analysis models of introduced species, RS 4) elaboration of an Information System.

RS 1) Systematic research of documentary sources pertinent to the early European presence in the Pacific

European archival materials convey all necessary information both on the endeavours (what, where, and when) developed by Europeans, and on the local populations they encountered. Surprisingly, Spanish, Portuguese and Dutch sources have been used to define the routes followed by the early expeditions, but not to extract the ethnographic information they provide.

We will systematically analyse Spanish, Portuguese (by PI and MLT, see Project cooperation partners) and Dutch documents (by KB), which together represent the whole spectrum of early European presence in Asia-Pacific. Navigational issues require specific analysis (by JVS, see Project cooperation partners). The goals are: a) organization of a cartographic repertoire of each expedition; b) revision of the ship routes published until now, which contain problematic identifications of itineraries and places. The study of published and non-published sources to fix the routes and the places touched/sighted by the expeditions (JVS) will allow us to accurately map European activity; c) systematization of the historiographical information about the expeditions carried out in the Pacific until the mid-17th century; d) systematization and analysis of ethnographic information conveyed by the documents. Also, special attention will be paid to the proxies of European presence chosen by this project: for sweet potato, NAO will analyse Spanish written documents of voyages and cargos in every expedition and colonization attempt such as Solomons and Vanuatu to review mentions to sweet potato and evaluation of methods of propagation from America. As for pathogens, historical documents will be used to assess the health state of the ship crews, and the consequences grasped by chroniclers, not uncommon, about the spread of disease. Later historical documents will be revised critically to find evidence of disease.

Neither of these objectives have ever been addressed to produce a holistic image of the European presence in the Pacific during the 16th-17th centuries. The PI and cooperation partners are already working in this direction.

We will focus on the main archives and types of documents produced roughly between 1519 (initial voyage by F. Magallanes) and 1662 (end of the European colony in Taiwan). These limits render an accessible number of documents to examine, most of them already transcribed.

The types of documents that will be analyzed are 1) chronicles and diaries, 2) log books, 3) maps, 4) edited sources for field case studies (for Taiwan mainly Borao et al. 2001, 2002; Blussé et al. 1999, Blussé and Everts 2000, 2006, 2010; for Alofi, W. Schouten and J. Le Maire's *De ontdekkingsreis van Jacob le Maire en Willem Cornelisz. Schouten in de jaren 1615-1617;* and J. Spilbergen and J. Le Maire's *Oost ende West-Indische spieghel, waer in beschreven werden de twee laetste navigatien, ghedaen inde jaeren 1614. 1615. 1616. 1617. ende 1618*).

The most important archives to visit are:

· *Spanish:* 1. Archivo General de Indias (Sevilla); 2. Archivo General de Simancas (Simancas, Valladolid); 3. Archivo del Museo Naval (Madrid)/Archivo General de la Marina "Álvaro de Bazán" (Viso del Marqués, Ciudad Real); 4. Biblioteca de la Real Academia de la Historia (Madrid); 5. Biblioteca Nacional de España (Madrid); 6. CSIC (microfilmed contents of the National Archive of the Philippines); 7. Biblioteca de los Agustinos Filipinos de

Valladolid; and other religious orders, such as Dominicans and Jesuits, which accompanied expeditions. These documents are little known yet.
· *Mexican:* 1. Archivo General de la Nación (México, D.F.); 2. Biblioteca Nacional de México (México, D.F.).
· *Portuguese:* 1. Biblioteca de la Sociedad Geográfica (Lisboa); 2. Biblioteca Nacional de Portugal (Lisboa); 3. Archivo de la Torre do Tombo (Lisboa); 4. Arquivo Histórico Ultramarino (Lisboa).
· *Dutch:* 1. TANAP (www.tanap.net); 2. National Archives of the Netherlands (Leiden/Amsterdam/The Haag).

In subsequent stages of the research, British, Filipino and Roman (Propaganda Fide) archives will also be visited for additional documents.

Methodology for the study of documents

The study of documents requires a systematic approach at different reading levels: i) Spanish, Portuguese and Dutch documents will provide direct data of European activities and their scope, as well as all possible ethnographic data about the natives; ii) the same documents will provide data on Chinese and other agents: whereas Spanish priests tend to note the presence of Chinese as they arrived at new places –they were considered as obstacles to the evangelization of the natives–, Chinese documents do not mention any territory to the East before the 17th century, and at that time only sparse references to Taiwan are to be found (GRS, see Project cooperation partners). However, my own work in Taiwan seems to point to the Chinese as catalysts of later European colonialism in specific spots. Filipinos and other groups who navigated regularly among different islands but did not leave written information by themselves can be also tracked down in Spanish and Portuguese documents; iii) a selection of documents from much later expeditions will be searched for estimates of population and references to previous contacts: populations contacted in the 18th century could have experienced previous contact episodes or their consequences, not recorded at the time but only in later episodes. Anthropological literature on "non-contacted" people (many consciously isolating themselves after first contact) can be a useful input in order to detect that possibility.

To systematize information, documents will be coded (through databases) and their contents too (through qualitative data analysis). Coding allows us to recover data in the Information System (see RS 4), and to perform a systematic analysis through a set of categories/metadata encoded in the texts as they are 'read'/analysed (software: Atlas.ti). Both written and graphic documents can be analysed in this way, which promotes the equal handling of texts, maps and drawings. The categories encoded in the documents, although not completely fixed, are predefined (listed here in synthetic form): a) navigation routes, potential places where visual or real contact could have been established, colonies founded, potential areas of activity, b) plant and animal species transported in the ships, methods of transportation, c) health of the crew, diseases endured by sailors, d) estimates of populations in islands, e) reactions of natives to contact, oral history, phenotypic characteristics of natives (abundant references to red-haired peoples and European descendants), f) objects of exchange, theft, smuggling, g) environmental features and change, h) climatology and natural disasters, i) navigation techniques, j) social organization of natives, gender roles, changes during the contact period, k) existence of linguae francae, social roles of language.

Feasibility: the PI and a Postdoctoral researcher (SCR), both with archaeological background and training in paleography, and MLT, JVS, and a PhD Student (KB), with assistance from expert paleographist LZ, will deal with documents. Most repositories have been preliminarily researched by MLT, JVS, KB, GRS, FCh, LZ, and the PI, and we have a clear idea of the task. Results are in progress and will be included in the Information System at an early stage of this research. The qualitative data analysis has already been implemented by the applicant with documents from Taiwan and Batanes, pertinent to this research.

RS 2) Characterization of direct contact through archaeological fieldwork

Archaeological fieldwork will allow us to characterize the consequences of direct contact between Europeans and local populations in the early stages of the Modern Era through two case studies: Taiwan and Alofi (part of Wallis and Futuna) (see map 1).

The Taiwanese early colonial period is currently under study through our own research and work in Kiwulan and Tainan. Our excavations in HPD-B (Cruz Berrocal 2015) show a complete sequence of occupation from the Neolithic to the present. I will only dwell here on the following aspects: the Neolithic settlement, seasonal and recurring, underwent a gradual and slow transition into the Iron Age, with clear continuation in ways of life. This was radically disrupted by the Spanish: the settlement was dismantled to make conditioning works for the colonial needs, associated with big changes in the use of space and environment. A big European building has been uncovered, identified as the convent of the colony. Four burials have been recorded up to now in close spatial association with the building, one of them a child burial following the indigenous ritual, and three more burials of adults (one of them could be identified anatomically as

European), following a Christian rite. This cemetery can then point to a certain tolerance shown by the Fathers to indigenous rituals, or the possibility that different degrees of 'conversion' to Christianity could have co-existed, all of them possibilities that are not assessed by the texts. The introduction of diseases can be tracked on the burials in this cemetery, only partially excavated at this point, but also the introduction of new plant species: the Spanish built a garden next to the convent, as observed in the complete disruption of the natural pattern of clay deposition with a thick layer of organic soil.

This work in HPD-B is accompanied by current elaboration of a geodatabase of all archaeological sites in Taiwan (partially based on previous work by the Taiwanese Ministry of Culture), which gives us a good knowledge of the archaeology of the island and our site (by contrast, in the Philippines, an obvious potential case study, little is known yet and no site appropriate for NAO's goals has been spotted. Taiwan is thus a proxy for the Philippines, much more difficult to study).

Alofi was not isolated, but received influences from both Melanesia and Polynesia, which makes it an interesting case study for the investigation of introduced species. Previous work there includes E. Burrows ethnological work, P. Kirch's short excavations in 1974, and D. Frimigacci's ethno-archaeological project on Futuna and Alofi between 1984 and 1990 with a general survey, recording of oral traditions with associated genealogies, and a series of excavations (Sand 2003). A great number of archaeological data from this research project remain to be published in full, but a general chronology for the archipelago is now in place (Frimigacci 1990; Sand 2003): it was settled around 800 BC by Lapita groups who colonized all the fertile regions, leading to a massive process of erosion through slash-and-burn agriculture and the destruction of the native forest. The spread of the population can be followed through the expanding number of ceramic sites, and from the beginning of the second millennium AD the record shows the advent of more hierarchical political systems. Ethnographic political structures in Futuna are surprisingly fluid compared to the rigid chiefdoms known in the neighbouring archipelagos, which can be explained by the demographic collapse produced by Western diseases introduced in 1616 (Sand 2003) (see RA 2, Pathogens). Partial archaeological surveys already carried out on Alofi show a clear pattern of island abandonment also recorded in oral histories: Alofi is largely covered today with dense forests, while a large number of former villages and burial grounds are observed under the canopy. After abandonment, Alofi was used only as a gardening area. The island is thus an ideal location to study in detail the change in land use induced in the 17th century, as well as the hypothesized associated demographic collapse, and potential changes in vegetation.

The goals of this RS are the definition of archaeological markers of processes of direct contact, paying attention to **changes in material culture**, in the **subsistence** (and its markers: botanical and faunal remains), **new ways of life** on the part of colonizers (in Taiwan), and **environmental changes** (erosion and changes in the landscape apparently associated with European presence in Taiwan). An emphasis is placed on changes most likely due to the introduction of new species by the Europeans, and related to the particular study of the proxies of European presence:

1) **vegetation changes in the 16th-17th centuries**: since sweet potato is difficult to detect in the fossil pollen record, we will use relevant coring techniques and the analysis of microcharcoal, sediment, pollen and phytolith analyses, in order to analyse botanical sequences searching for changes in the 16-17th centuries: i) search for sediment and pollen indicators of increasing landscape clearance and degradation as indirect markers for the presence of sweet potato (as carried out in PNG, see Haberle and Atkin 2005); ii) search for other commensal species introduced around this time, prone to detection –the introduction of new species such as sweet potato did probably not happen alone: for example papaya and pineapple were also transported by Iberians from America to the rest of the world (Ferrão 2005). Archaeological intervention will also allow us to assess the possibility that sweet potato is associated with the expansion of dryland agriculture, especifically in Alofi, an interesting consequence of its introduction in Hawai'i, which entails an increase in production and population (Ladefoged et al. 2005: 369). The possibility of detecting the presence of sweet potato through its insect pests is archaeologically not proved yet.
2) **diet changes in the 16th-17th centuries**: we will analyse lithic processing tools and cookware, as well as human teeth: tooth calculus traps and protect starch grains, including sweet potato's, as well as phytoliths, from further destruction through its constant building.
3) **changes in land use**, including reshaping of agricultural practices and **study of burial practices and human remains**: we will provide an understanding of demographic impacts through the verification of the changes in land use hypothesized for the 17th century, and the burial practices, as well as human remains from burials dated to that period. Human remains from the time period exist in both Alofi and Taiwan. They can be examined in search for markers of infectious disease: the bone structure may change as a result of chronic or severe infection, including deformations, which may help pin down pathogens. Also, the examination of genetic remains of bacteria and viruses on human archaeological bones/teeth is a growing

field (e.g. Bouwman et al. 2012) very promising to detect potential diseases and epidemics. Likewise, genetic studies of archaeological remains can provide information about their history including infectious diseases survived by ancestors, which strongly express in the descendants the genes that allowed survival. In the Pacific this approach has not been implemented yet.

Methodology for archaeological fieldwork

The fieldwork design is oriented towards the fulfilment of the above-mentioned objectives. The fieldwork consists of survey, excavation and analysis of material. In Taiwan we will continue excavations in HPD-B, expanding our activities to the surroundings of the site to understand landscape and botanical changes. In Alofi, the strategy will include first survey, helped by remote sensing mapping and spatial analysis, and it will comprise the entire island. Remote sensing survey techniques are particularly important in areas as heavily full of vegetation as Pacific islands, as they contribute to the "maximizing" of results using non-invasive methods. This methodology, including the use of high-resolution satellite imagery, has already been successfully used by the applicant on small-sized islands before (Cruz Berrocal et al. 2015). Detailed on-site cartography will also help estimate the size of the sites and population (Sand et al. 2007b, Cruz Berrocal et al. 2015). The survey will be followed by a more detailed exploration of the ground through a series of test pits, trenches, and corings, to sample the island archaeological and botanical sequence and define areas for potential excavation.

These methodological options are comprehensive enough to enable the objectives proposed above and the analytical programme outlined below; when needed, they will be adapted to include the option of searching for associated elements eventually hypothesized by the models (weeds and commensal species, etc.).

In Taiwan, fieldwork will be carried out during the first 4 years of the project. In Alofi, fieldwork will be developed during the 3 central years of the project.

Feasibility: Abundant archival information is available for both cases and ample archaeological data directly relevant to the topic has already been produced by the applicant and cooperation partner Christophe Sand, one of the most relevant archaeologists in the Pacific. This ensures the production of results early on. Procedures to acquire permits for fieldwork in both places are in progress or known and no obstacles are to be expected. Expenses for each field season cover transportation, per diems of expert teams in the field, and wages for workers. Processing of archaeological materials is developed in the field, as it is cheaper to have longer field seasons than to transport materials to our respective institutions. The field team is led by the PI in Taiwan, supported by collaboration with ChS in Alofi; a Postdoctoral researcher (SCR) will coordinate tasks. Other personnel (ESH, EC, see Project cooperation partners) is also involved in the field and in lab work (e.g. database management) when not in the field.

Analytical programme (in parenthesis, Project cooperation partners, experts in the respective fields):

1. Remote sensing (MSL): high-resolution imagery (Landsat-Modis, RADAR, DEM 25x25m, and LiDAR, if available) will be used for spatial analysis and survey preparation. Some can be obtained without cost from different agencies.
2. Geomorphological analysis for reconstruction of landscape history (MSL) in combination with archaeobotanical research.
3. Accurate AMS radiocarbon and fresh coral dating for the reconstruction of sequences (outsourced).
4. Anthropological examination of human remains for the identification of disease (FV).
5. Human DNA analysis for ethnicity and history of populations, including survival to infectious diseases in the past (AG).
6. DNA analysis of viruses and bacteria on human remains using disease specific marker genes (TB), for identification of disease.
7. Starch and other microfossil recovery (pollen and phytoliths) through the extraction of tooth calculus, and identification of potential changes in vegetation in the 16^{th}-17^{th} centuries by natural sediment coring and microfossil content analyses (ACh).
8. DNA analysis on sweet potato and other botanical remains for identification (outsourced).

RS 3) Characterization of impacts caused by indirect contact, using Network Analysis models

Network Analysis (NA) is a very promising area to solve archaeological problems (Brandes et al. 2013, Brughmans 2013). This project relies on the elaboration of Network Analysis mathematical models based on archaeological, historical, and bioecological data, to study the problem of studying indirect contact in the Pacific through the reconstruction of plausible histories of the spread of sweet potato and epidemics among the islands, without European intervention. The goals of the models are:

A) *sweet potato:* How did the introduction of sweet potato from particular colonial spots spread into the Western Pacific without European direct intervention? How do the patterns of connectedness in the region

account for this spread? Moreover, it is commonly assumed that sweet potato became a desirable plant for local peoples for a number of reasons and its introduction should not have involved traumatic changes. Can we assume that the introduction of a foreign species does not affect an island ecosystem? How many other species, still invisible for us, could have been introduced or removed without affecting the resilience of the system? A predictive ecological model can be unfolded in our analysis of botanical sequences in the field from this premise, to search for impacts in the 16th-17th centuries. Furthermore, the suggestion that sweet potato was introduced in very late times can also be tested in our models, both in the field and in the empirical/theoretical realm: how likely is it that given all lines of evidence outlined above, and the connectedness of the region, sweet potato did not spread over the Western Pacific during the 16th-17th centuries? This is a formal null hypothesis that we will accept or reject on the basis of our NA models.

B) *pathogens:* We will assess through the elaboration of models how the spread of diseases could have taken place, and most importantly, how likely it is that diseases introduced into particular areas did not affect other areas of the Western Pacific. How likely is it that the same diseases that in the 18th century caused catastrophic mortality even through short-contact events, did not produce the same results in the 16th-17th centuries? This is a formal null hypothesis that we will accept or reject with the help of our models.

The models reconstruct the general circulation and exchange among different archipelagos in the Western Pacific, based on existing archaeological, anthropological (e.g. Hage and Harary 2007) and environmental information and written ethnographic accounts, about connectedness –channels for transmission of plant species and diseases, both through humans and other animals: a) demographics, b) exchange undertaken by the natives, c) possibilities for navigation. These factors make possible and at the same time constrain the models, and this empirical base is useful to study both sweet potato and pathogens, provided that input about specific variables related to their life conditions are supplied. In the case of the sweet potato, specific variables about its physiology will be inputted into the models (ACh, see Project cooperation partners). In the case of pathogens, the relevant variables include: i) amount of people, ii) time length of the contact, iii) how many people moved, iv) incubation time, v) how disease is transmitted (through air, personal contact, and rats as vectors of disease: previous commensal models of spread for rats (e.g. Matisoo-Smith and Robins 2008) will also be useful), vi) expected rate of survival of the infected person (there is a paradox involved here, since the less lethal the infection is at the level of the individual, the more widespread the disease will become, and therefore, the more lethal for the population as a whole) (TB, see Project cooperation partners). Particular attention must be payed to vii) the environment in which the diseases were introduced, since the co-habitation of humans with species such as pig and fowl may have led to different episodes of infection and re-infection –some of the bacteria and viruses under focus can jump the species barrier. This scenario has never been taken into account in the Pacific. In addition, existing and any new information about those species in the study region will be included.

Once the models are implemented, different scenarios can be hypothesized to observe how and at which rate the circulation of the species and general exchange in the region may have occurred. The models act as small historical laboratories that simulate historical processes. They can also allow the exploration of alternative ecological markers (associated weeds, commensal species, etc.) that may be defined in the near future to extend our range of action in the field. In subsequent stages of this work, the models can become predictive devices to highlight promising places to do research.

Feasibility: Since this is a relatively underresearched area, the precedent set by Ulrik Brandes with his current project in the Caribbean (Nexus 1492), as well as the highly recognized research of Jordi Bascompte (see Project cooperation partners) in ecological networks, will greatly benefit this project. European proxies would have travelled along the same paths than local objects of exchange, so basic models of connectedness are useful for different purposes. The specific variables about physiology of the species are inputted by cooperation partners (JB, ACh, TB, FV, AG). The research will be directly led by the applicant.

RS 4) Elaboration of an Information System

This project will integrate in a relational Information System fragmentary sources of information generated by the Research Strategies explained above, which can be itemized as i) archives, ii) archaeological literature, iii) archaeological datasets already created for Alofi and Taiwan, plus those generated in the field, iv) existing and newly produced oral history, v) ecological and biological input obtained for the creation of models. Thus, by putting together fragmentary and varied sources, NAO will allow for the first time to record and visualize all the fundamental facts and processes pertaining to the early European presence in the Pacific around the 16th-17th centuries, creating synchronic and diachronic pictures out of dispersed data, allowing us to detect networks and missing links, to identify gaps in the data relevant to our specific

questions, and to imagine new ways in which we could fill those gaps. A preliminary data model and system prototype with limited data has already been implemented; larger amounts of work and research are needed to produce an adequate Information System, a work platform where any information introduced into it will be visualized in real time and be available for all cooperation partners, and eventually, as an open access resource. The NAO Information System will create a fundamental and innovative tool to consult, analyse, and visualize data on European early presence in the Pacific.

The properties of the Information System are synthesized as: i) a combination of databases, Geographic Information System, qualitative data analysis, and code writing at every stage to make datasets compatible and provide analytical capacity; ii) interoperability through the use of Dublin Core and ISO standards; iii) use of metadata or codes for every piece of data. All datasets will combine temporal and geographical metadata: visualization and recovery of data, regardless of their nature, will be performed through a GIS interface. Georreferentiation of information not accurately referenced (e.g. vague documentary references) can be solved in GIS through adscription of points, lines, or polygons. Chronological data, on the other hand, vary from concrete dates, *termini ante quem, post quem*, to statistical ranges (C14 dates); iv) multiscalarity. The Information System will comprise all information and relationships from a particular excavation spot, to the island, inter-island scale, and inter-archipelago scale; v) visualization, so far little used for complex archaeological and historical processes informed by heterogeneous data, such as the one studied here, but fundamental for 1) exploring large sets of data, 2) verifying our null hypotheses, and 3) creating Network Analysis models. One of the important research challenges faced by the project is how to visually represent the integrated data and their involved uncertainties. Spatio-temporal data are visualized using map and network displays, which are well understood today. However, how to visually integrate a wealth of additional information (e.g. descriptive texts, literature references, ecological and biological data) in an effective display, is a challenge. Besides network data analysis methods, the NAO Information System will also devise and integrate methods for mapping heterogeneous data in synchronic and diachronic representations, and for computing uncertainties in the data. Visualization needs also to be interactive, allowing not only to visualize the data available at a given point in time, but also, accommodate hypotheses and annotations of experts, leading to updates of the database and the creation of new datasets. Algorithms within the Information System should be able to check the interactively provided input for consistency, possibly deriving new hypotheses about the data. Finally, the system will allow vi) digital publication and universal access to data and research.

Since the data that will feed the NAO Information System have been explained above, I will only describe here the data set obtained from **archaeological literature**. Published information of early European presence in the region is not extremely abundant (see state-of-the-art). A special focus will be put on the Philippines, where this project opens up a whole new line of research because the historical period in the islands is very scarcely known so far. The *feasibility* of this task is granted by the fact that it has been ongoing in the last years as part of the applicant's broader work in the Pacific. Archaeological literature relating to the relevant aspects highlighted by the project in the Western Pacific is very accessible. The main effort required within the scope of NAO is the systematization of the sources. This task is moreover complementary with research for RS 2 and RS 3 and will be performed by the PI, a Postdoctoral researcher (SCR), EH, ChS, EC, KB.

Feasibility of the Information System: My previous experience in databases and GIS, and research already developed by cooperation partners (MT, MSL, JRA and Tobias Schreck, PI in EU FP7 project PRESIOUS) have led to this draft conception of the system. We have expertise in all these domains, and in some cases a double area of expertise that complements the needs of the project (KB has specific training and background in GIS work). Ongoing discussions throughout the project will involve all cooperation partners (advised by MT, SRH, MSL and ACS) to satisfy all possible data requirements from different disciplines. A PhD student will work specifically on data requirements for the Information System, and development of visualization tools within a Network Analysis paradigm.

Risk buffering

The combination of written sources, archaeological and analytical work, and the elaboration of models allow the project to buffer risks because i) it creates feed-back among the RS; ii) it contributes a variety of sources and methodologies, all of them complementary; iii) it counts on different empirical bases to generate data: for example, a multiple strategy to finding both sweet potato and pathogens has been implemented, ensuring that a lack of macroremains of sweet potato, for instance, is made up for with a complete botanical sequence where larger changes can be detected. Likewise archaeological fieldwork oriented to the recovery of human remains complements the study of land use, both of them having the same goals –the detection of demographic impacts; iv) it makes use of innovative methodologies such as Network Analysis to fill gaps in empirical data, and opens new avenues of research with its use of new analytical tools.

Scientific contributions and innovation

NAO observes Pacific islanders as actors of their own history on, at least, equal terms to Europeans. This challenges European narratives built around events –who arrived first when and where–, leaving explanations of history to a matter of temporal precedence of great deeds of one nationality of 'white men' over the others. Ultimately, the same paradigm drives this writing of history, embedded in a certain aura of daring and adventurous spirit. This project attempts therefore to confront somewhat outdated European historical narratives on the Pacific encounters by telling the stories of the peoples who weaved the tissue of life in the Pacific long before Europeans played a role in it.

The project will also work to uncover key processes that have been ignored up to now, because the potential consequences of direct and indirect contact in the 16^{th}-17^{th} centuries are regarded as anecdotal. However, these contacts may have played a major role in Oceanic history. Not only demographics are key to understanding history; investigating how local peoples behaved intentionally towards foreign elements introduced in the first encounter with Europeans will contribute to a better understanding of how this episode may have shaped later communication, behaviour and exchanges, a possibility that has not been recognized yet.

Also, by focusing on the introduction of foreign species, NAO will start to systematically tell the 'ecology of the first encounters' in the Pacific, making use of innovative approaches inspired by Network Analysis. By bringing together written sources, archaeological fieldwork, innovative analytical lab work, and mathematical models, we will open an unprecedented avenue to study a pervasive but difficult topic such as direct and indirect contact, relevant in the Pacific and in many other historical situations in different regions at the beginning of the Modern Period. In short, the project will create *basic knowledge*, enlarging our knowledge of the European cultural heritage outside its boundaries and working towards a deeper understanding of the impacts of newly introduced species into local environments with a long-term perspective, which can affect our current approches to this issue. It will also allow us to open new windows into the early history of globalization and will produce new knowledge about the past of Oceania and correctly place it in the world context.

The combination of different disciplines and work protocols and the integration of relatively disparate information into one coherent body of knowledge will be a very important contribution of this project. The articulation of different research programmes is a challenge in every scientific domain and entails risks, hence, the emphasis made on the implementation of an Information System that can deal with this challenge. This will be one major achievement of NAO in terms of *applied knowledge* of the project and inspire new solutions for the handling of data in historical and archaeological research, in line with K. Kristiansen (2014)'s proposition of a New Paradigm in archaeology, recognizable too in the integration of scientific analysis and interpretation carried out by this project.

This project will also have an impact in another respect: we have established connections with local institutions in Taiwan and French Polynesia, that will no doubt consolidate through this 5-year research, to create long-term interdisciplinary collaboration. But fieldwork necessarily entails very close cooperation with the local people too, as our logistics depend completely on them. We have experience in documenting their oral histories about particular archaeological remains, and attending lectures in local schools, to create awareness among the youngest generations for the protection of their heritage. Indigenous communities gain knowledge about their past along with us. My fieldwork among Fijian communities has persuaded me that this is of high interest to them. Being the focus of foreign research may contribute to create self-awareness and esteem among these communities.

Expected Scientific results:

This project is expected to yield the following results, none of which exist to date:

RS 1: 1) publication of an annotated bibliography of the historiographical production of early European expeditions into the Pacific in the three key languages: Portuguese, Dutch, and Spanish; 2) publication of a Historical Atlas of the early European voyages in Asia-Pacific (compilation of maps), as a book; 3) critical revision and update of information in European sources about sweet potato and population health.

RS 2: 1) production and publication of data on the first comparative archaeological history of colonialism in the Pacific; 2) generation of new data about plant circulation and use and early European presence and impact in the Pacific, as well as food and agriculture changes, and dissemination in conferences specialized in the Pacific, in prehistoric and historical archaeology, paleoecology and archaeobotany. Since our approach is generalist and landscape-based many different aspects of the archaeology of the islands will be studied.

RS 3: 1) generation of basic science through contributions to the development of network approaches in Pacific archaeology through the implementation of models accessible through the Information System; 2)

publications in specialized journals to transfer methods for other potential case studies of the ecology of first encounters.

RS 4: 1) innovation through an Information System for research and publications purposes, including specific visualization tools to navigate complex historical phenomena; 2) exhaustive publication of the ethnographic references for the Pacific; 3) generation of thematic cartography, based on high-resolution imagery and thematic maps; 4) granting of free access to databases generated during field and lab work, through the Information System.

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Project cooperation partners (* marks partners hired by the project; PhD=Doctoral student; PD=Postdoc researcher)

In order to ensure the success of the project, several experts from different disciplines have agreed to support it:

Inf. Syst.	*Jesús Ropero Amor	JRA	IT expert, in charge of computing applications and design of the IS.
	*Dr. María Sebastián López	MSL	Universidad de Zaragoza. MA in Geographical Information Systems, responsible for GIS in the master studies. Associated with the Laboratory of Geomorphology.
	*Enrique Capdevila	EC	MA in Geographical Information Systems.
	Prof. Dr. Tobias Schreck	TS	Universität Konstanz. Expert in visualization and representation of scientific data. PI of PRESIOUS (http://www.presious.eu/) and CONSENSUS (http://www.consensus-project.eu/).
Advis	Dr. Monika Therrien	MT	Fundación Erigaie, Colombia. Historical archaeologist with long experience on data integration.
	Prof. Dr. Stefan Hauser	SRH	Universität Konstanz. Historical archaeologist with long experience on satellite image interpretation, survey, and especially integration of written and material sources.

	Dr. Ana Crespo Solana	ACS	CCHS, CSIC, Madrid. Historian, expert in the application of GIS to research in maritime history. PI of ForSEADiscovery (http://forseadiscovery.eu/)
	Dr. Fang Chen Chen	FCh	National Taipei University of Education. An expert in the history of the Spanish period in Taiwan.
	Guillermo Ruiz Stovel	GRS	University of California, LA. Expert on Chinese sources and Chinese diaspora to the East.
Archives	Dr. Miguel Luque Talaván	MLT	Universidad Complutense. Expert in the Spanish history of the Philippines and the Pacific, and its archival sources.
Archives	Jorge Villar Serrano	JVS	Vicedirector, Museo Naval Cartagena. Professor of navigation (Spanish Navy), expert on naval history.
Archives	PhD *Karsten Bracker	KB	Archaeologist and expert in VOC and Dutch navigation and documents.
Archives	*Dr. Leonor Zozaya	LZ	Universidade de Coimbra. Paleographist, expert in Spanish and Portuguese archival research
NA	Prof. Dr. Ulrik Brandes	UB	Universität Konstanz. Computer scientist, expert in Network Analysis. PI of Nexus1492 (http://www.nexus1492.eu/).
NA	Prof. Dr. Jordi Bascompte	JB	Universität Zurich. National Science Prize, Spain, 2011. Ecologist, expert in ecological networks.
Archaeology	Dr. Christophe Sand	ChS	Director, Institute of Archaeology of New Caledonia and the Pacific. Expert in Polynesian archaeology with a long experience in New Caledonia, Fiji and Polynesian outliers.
Archaeology	Dr. Chenghwa Tsang	ChT	Academia Sinica. Expert on Taiwanese archaeology, collaborator with the PI.
Archaeology	PD *Dr. Susana Consuegra Rodríguez	SCR	Archaeologist, collaborator with the PI's previous projects in Taiwan and Fiji. Trained in paleography, will also perform tasks in archives and transcription.
Archaeology	*Elena Serrano Herrera	ESH	Archaeologist, collaborator with the PI's projects in Taiwan.
Analyses	Dr. Thomas Böttcher	TB	Universität Konstanz. Microbiologist, expert on bacteria and infectious diseases
Analyses	Dr. Alex Chevalier	ACh	Royal Belgian Institute of Natural Sciences. Americanist archaeobotanist, expert in starches and phytoliths.
Analyses	Dr. Antonio González	AG	Universidad Complutense. Geneticist with a long experience in the Pacific.
Analyses	Dr. Frederique Valentin	FV	CNRS. Physical anthropologist. Currently the most relevant expert on human remains in the Pacific.

Schedule and list of tasks

I will coordinate and take part in every Research Strategy as specified under *Feasibility*. I will also synthesize all datasets into a coherent explanation for NAO's research questions. This research will constitute my Habilitation.

		2016		2017				2018				2019				2020				2021	
	Year quarter	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**
	Project meetings: decision making, progress assessment	X				X				X				X				X			
RS 1	Definition of routes and contact areas (JVS, KB)	X	X	X																	
RS 1	Archival research (JVS, MLT, KB, PI, GRS, LZ)	X	X	X	X	X	X	X	X												
RS 1	Study and qualitative analysis (MLT, PI, JVS, KB)	X	X	X	X	X	X	X	X	X	X	X	X								
RS 1	Systematization of information (MLT, PI, JVS, KB)									X	X	X	X	X	X	X	X	X	X	X	X
RS2:Taiwan	Excavation, analysis of artefacts (PI, ChT, SCR, ACh, ESH)			X			X				X				X						
RS2:Taiwan	Further elaboration of DB sites (PI, SCR, LYT)	X	X	X	X	X	X	X	X	X	X	X	X								
RS2:Taiwan	Sampling of soil/botanics (PI, ACh, SCR, ESH, LYT)						X				X				X						
RS 2: Alofi	Establishing local network (ChS)			X																	
RS 2: Alofi	Survey (ChS, PI, SCR, ESH)							X													
RS 2: Alofi	Excavation, analysis of artefacts (ChS, PI, SCR, ACh, ESH, FV)											X				X					
RS 2: Alofi	Sampling of soil/botanics (ChS, ACh, SCR, ESH, PI)											X				X					
Analyses	DNA of viruses and bacteria (TB)												X				X				
Analyses	Remote Sensing, spatial analyses (MSL, EC, KB)					X				X				X							
Analyses	Archaeobotanical analyses (Ach)								X				X				X				
Analyses	Anthropological analyses (FV, AG)								X				X				X				
RS 3	Data gathering (PI, SCR, ChS, KB, ESH, ACh, JB, TB, MSL)	X	X	X	X	X	X														
RS 3	Elaboration of models, testing (UB, JB, TB, ACh, FV, AG, ChS, PI)					X	X	X	X	X	X	X	X	X	X	X	X	X			
RS 4	Elaboration of data model (PI, JRA, MSL, UB, JB, TS, EC)	X	X																		
RS 4	Development of visualization tools (TS, JRA, MSL, EC, PI)			X	X	X	X	X	X	X	X	X	X	X	X	X	X				
RS 4	Code writing, software integration, data feeding (PI, MSL, JRA)			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
	Final publication and PI's Habilitation																		X	X	X