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Natural Disaster and International Development

Luke Strongman

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Abstract

Recovery from natural disaster has for many years been seen in objective terms as simply the time taken to replace damaged infrastructure. Increasingly, however, social scientists are describing the large part that human capital plays in the recovery from natural disaster in the form of 'resilience'. The purpose of the chapter is to delineate, from a social scientific perspective, the main factors involved in disaster rehabilitation from a necessarily superficial but nevertheless accurate and useful viewpoint. The main areas to be considered are infrastructural impacts, psychological impacts and communication factors. The chapter concludes by defining various perspectives that contribute to the quality of resilience that underscores the investment in human capital in post-disaster zones.

Keywords: natural disaster, infrastructure, psychology, social networks, psychological effects, communication, resilience

1. Introduction

A natural disaster is a major adverse event resulting from natural processes of the earth. Natural disasters may have the properties of being environmentally disruptive (war, earthquake, flood), a hazard (major but temporary disruption to environment) and/or socially focused (no major impact on land or infrastructure but on a human populous). The classic definition of a disaster is of an 'occurrence causing widespread disruption or distress'. As Lindell points out, a disaster may be characterised by three temporal periods—pre-impact, trans-impact and postimpact; however, some disasters have multiple or secondary impacts [1]. Furthermore, disasters are sometimes identified by a series of impact zones which display irregularities in effect. In general, society tends to have more knowledge about what has gone wrong in natural disasters than what goes right in recovery [2]. Even today, relatively little is known about how quickly an area affected by natural disaster may be rehabilitated and in what circumstances and under what conditions. As the World Bank reported in 2014:

During the 1980–2012 period, estimated total reported losses due to disasters amounted is US\$3.8 trillion.... Hydro-meteorological disasters accounted for 74% (US\$2.6 trillion) of total reported losses, 78% (18,200) of total disasters and 61% (1.4 million) of total lives lost. Looking ahead, climate change will have major implications on global ecosystems, agriculture and water supply, sea level rise and storm surges [3].

It can be argued that natural and human-made disasters that effect human populations are becoming more common worldwide due to a myriad of factors related to population growth and urbanisation. But in fact natural disasters are not becoming more prevalent; rather, there is increased reporting of them. In fact, as Lowrey et al. point out, of the 15,833 reported disasters worldwide from 1900 to 2006, over a third of these occurred between 2000 and 2006 [4]. Nevertheless, the prevalence of natural disasters themselves is unlikely to be much increasing, though the reporting of them is, but as Strömberg states, ‘... the average magnitude of the reported disasters has fallen’ [5]. While more than half the globe becomes urbanised, the prevalence of the effect of natural disasters is greater than previously experienced, although due to increased technical know-how in building and in healthcare, the effects of natural disasters may be decreasing.

It is possible that prior to modernisation, urbanisation and globalisation, many events that could have been assigned the status of natural disaster remained unreported due to their geographical remoteness or the lack of impact on large populated areas. It is therefore not strange that the incidence of natural disaster causing events is increasing, though the impact of them has become more measured. In this context rehabilitation from natural disaster is a topic that increasingly necessitates a multidisciplinary approach to social scientific analysis.

Traditionally it was assumed that disaster recovery would be predicated on the extent of damage within a natural disaster zone. As Lindell points out, disaster effects may be determined by three pre-impact conditions: ‘hazard exposure, physical vulnerability and social vulnerability—as well as three event-specific conditions—hazard event characteristics, improvised disaster responses and improvised disaster recovery’ [6]. It is no longer necessarily the case that as Dacy and Kunreuther state that ‘[i]t just seems reasonable to assume that the speed of recovery following a disaster will be determined primarily by the magnitude of the physical damage’ [7]. Rather, increasingly social networks and community resilience are shown to play a larger part in recovery from catastrophe than simply that measured by the restoration of infrastructure. The overcoming of catastrophe does not produce replacement communities; it produces reinvented, renewed and differently evolved communities. As Dynes has suggested, based on experiences of survivors in a number of disasters, social capital may be the basis for resilience as it provides information and resources at a critical moment [8]. However, as Aldrich relates, population density (the population per unit area) determines the rate of recovery, the greater the density the population conversely the more slowly it may recover due to the difficulty in providing permanent and temporary housing in the disaster period [9]. Consequently, rather than area damage, some social scientists have argued that population density—the population per unit area—alters the rate of recovery. Areas with greater population densities may recover more slowly because of the difficulty in providing temporary and permanent housing for displaced people during the post-disaster period. Nevertheless, there are behavioural typologies which do produce resilient and rehabilitated communities.

Structural vulnerability	Extreme stresses	High wind, seismic shaking
Physical vulnerability	Susceptibility to biological changes—casualties	Impacts on anatomical structures and physiological functioning
Social vulnerability	Limitations in physical assets	Buildings, contents
	Psychological	Knowledge, skills and abilities
	Social	Community integration
	Economic	Financial savings
	Political	Public policy resources

Table 1. Factors of vulnerability in disaster impacts (after Lindell [1, 6, 42]).

According to Aldrich, four factors are thought to influence the rate of recovery from disaster zones resulting from earthquakes. These are the amount of damage, the population density of the affected area, the efficacy of human capital and the amount of available economic capital [2]. As Ross and Carter explain, '[t]he spontaneous activation of "social capital"—bonds within and between social groups—has been impressive, a solace to those affected, as well as a huge practical and economic benefit. Organised volunteers, such as from the Red Cross, were the foundation of evacuation centres' [10]. However, Aldrich also notes that 'social capital', namely, the 'networks, norms and social trust that facilitate coordination and cooperation for mutual benefit' [11], best predicted a population recovery. 'Human capital' is the ability of people to remain cooperative and resilient in communities and to work in a coordinated way together on sustainable relief. This is a requisite of community rehabilitation from earthquakes. Finally, Lindell suggests that '[p]hysical impacts can be reduced by hazard mitigation practices and emergency preparedness practices, whereas social impacts can be reduced by recovery preparedness practices' [6]. This requires extensive pre-impact planning (see **Table 1**).

2. Factors in society for consideration for international development

2.1. Building and infrastructure

Arguably, permanence may be sacrificed for flexibility in earthquake environments when infrastructure is considered. Since at least 1751 and the devastation of the earthquake at Port-au-Prince in the Caribbean Haiti, it has been known that timber structures (houses and buildings) are able to withstand earthquakes more easily due to their flexibility of construction design [12]. Even in contemporary cities which are earthquake prone, buildings of mid-height (ten levels or under) built on base isolators which separate the motion of the building from the land underneath, or that have counterweights which control the extent of 'sway', perform best in earthquakes. So while a sense of relative permanence in built materials is sacrificed, nevertheless, in domestic architecture timber constructions are able to withstand many of the violent movements associated with earthquakes. The domestic built environment of colonial settlements was largely accomplished in timber constructions—that being the readily available material in comparison to stone used in public structures. Such domestic infrastructure

could sustain rebuilding. But choice and style of rebuilding materials are not the only considerations in earthquake-zone rehabilitation.

2.2. Social networks

Motivation, empathy and communication play a tangible role in disaster rehabilitation as do resources required to rebuild infrastructure. Furthermore, social ties serve as informal insurance; people also network for financial, physical and logistical guidance. Networked communities are more politically active and better connected to overcome barriers to demand. Information sharing also increases with trust; however, embedded networks raise the cost of an 'exit' for individuals from a community (in terms of benefits forfeited). Furthermore, closely interlinked communities increase the probability that demands are articulated and obstacles are overcome. However, in communities with a comparatively higher level of social capital, individuals and groups can work towards a solution [13].

As the English Parliamentary Office of Science and Technology (2012) state:

Bangladesh is an example of a country where the spread of mobile phones and improved scientific understanding of natural hazards has helped reduce the number of deaths caused by annual flooding and more extreme hazards, such as cyclones. These advances have been exploited effectively through enhanced contingency planning and early warning systems. The mobile phone network does not reach everyone, but once the message is out, other solutions, like cyclists with megaphones, can be used [14].

Sebag-Montefiore noted that after the quake and tsunami in eastern Japan in 2012, the disaster provoked an 'unprecedented mobilisation of volunteers, public outcry following the Fukushima cover-up...the stirrings of new construction and architectural ambitions [and a] prevalent feeling among the young [to] pave the way to discard the stifling traditions of the past, including the patriarchal customs of provincial cities' [15]. This includes artistic and artisan responses such as mural paintings and the remaking of 22.5 million tons of tsunami debris into furniture (an enterprise also featured in the response to the Christchurch earthquakes of 2010 and 2011). Thus, recovery from loss is a key motivational factor, along with self and other community rehabilitations and new business opportunities that evolve from adapting dislocated environments into restructured ones. However, natural disaster environments can also serve as nodal points for learning.

Olshansky outlines seven lessons learned from reconstructions following natural disasters. These are [16]:

- Economic and social networks are more resilient than buildings—recovery begins with people first.
- Taking time to plan to ensure full participation of stakeholders is necessary in reconstruction and is proportionate to speed of recovery.
- Bureaucracies tend to lack the flexibility for community-based organisations emerge.
- Areas with fewest resources get minimal attention from aid organisations.
- Relocation is resisted by citizens, but without citizen support, relocations often fail.

- Cities see some improvement after disasters but never as much as planners intend; improvement occurs over a longer-than-expected timescale.
- Setting funding priorities is a difficult part of recovery — money is always insufficient.

Consequently, recovery from natural disasters always takes longer than most initial planning indicates. Disasters radically alter community and societal equilibrium and create huge differentials in experiences which take a long time to readjust from.

2.3. Building and infrastructure: historical sources

Olshansky argues that lessons learned from the Kobe earthquake in Japan, in 1995, involve three main factors. These are, firstly, the development of a clear vision in post-disaster response; secondly, an emphasis on people (community, welfare, health and habitat) and, thirdly, thinking creatively about property — temporary and permanent housing facilities and new sustainable building designs and materials [17]. The maintenance of social networks is considered necessary. Relatedly, an historical example shows what can be accomplished by modernisation. A memorandum (termed the *Dissertação*) by Manuel da Maia who was responsible for the elaboration of proposals for the renovation of the lower area of Lisbon in the wake of the 1755 earthquake (and Reconstruction Plan of 1758) revealed a method for fair transfer of old properties into new ones with appropriate equivalent values. This was achieved by ‘dividing the total new surface area created within the Plan by the total value of the old properties’. The result was uniformity of architectural facades and increased modularity [18]. One of the central features of the rebuild was a Property Register established after the earthquake and fire, in which a record of the ownership and state of buildings was maintained — surveying the dimensions of ‘streets, squares, public and private building’ [18]. Thus, modernism was progressed in large part on quantification of infrastructure relative to value.

2.4. Building and infrastructure: modern examples

In Christchurch, Canterbury, New Zealand, following the devastating earthquakes of 2010 and 2011, the Canterbury Earthquake Recovery Authority (CERA) divided its response plan into four strategic areas of social, economic, natural and built but also leadership and integration applying to the other areas; the CERA Act defines ‘rebuilding’ as pertaining to physical resources and communities as well as ‘improvement’ and ‘enhancement’ of the latter in the recovery [19]. In the post-disaster environment, opportunities become apparent to incorporate new sustainable building practices into redevelopments and to adapt and reinvent environments from relocated materials. Building innovations might include ‘green’ building (or building in sympathy with the natural environment) and designing for maximum efficiency, for example, by practices which involve renewable energy sources or insulation and adoption of technological innovations such as building information modelling. Eversely has argued that evidence from Haiti after the devastating 2010 quake near Port-au-Prince, ‘... the single most important resource in the hours and days immediately following such events, relevant knowhow and practical help will become vital too’ [20]. According to Gill cited in Eversely, ‘[i]t also involves replacing or upgrading basic water and electricity infrastructure, providing immediate areas for markets and other informal trading and providing materials and on-site

advice for early self-help reconstruction by Haiti: replacement housing needs to be resilient to future disaster risks families and small communities. Finally it calls for a focus for continuing governance' [20]. Clearly, for developing communities, commerce, trade, durable physical resources and human capital and organisation are critically important. However, time is another all important factor—and the recognition of a cityscape that is both pre- and post-quake. As Jonathan Ling, chief executive of Fletcher Building Ltd., the company appointed by the government as project manager for the reconstruction of homes damaged in the September 4, 2010 and February 22, 2011, quake, much of the Christchurch rebuild said, 'There will not be a finite day on which this is finished'. 'There will be new buildings going up' in the central business district, Mr. Ling said, 'on empty blocks probably for 10, 15 or 20 years' [21]. Some of the uninhabited blocks will change owners numerous times before they are eventually built on.

Three years following the Christchurch quakes, the inner-city landscape is denuded of building—over 1000 demolitions have taken place (1611 full or partial demolitions were scheduled in total). The atmosphere is one of floating shells of building amid the dissolving remnants of built space. Familiar landmarks remain, but they are sighted from unfamiliar angles. Thus, the imagined pace of a rebuilt Christchurch assumes its shape progressively, incrementally amid the barren spaces of urban renewal. Amid the hiatus in construction plans stands the Spartan and surprisingly uniform and unornamented remnants of a built cityscape. The predominant remaining buildings are 1970s concrete multistoreys (under ten storeys), indicating there must have been an engineering practice in reinforced concrete introduced during this era that made these buildings more resilient to the movement that causes earthquake damage. While the vast majority of community aid following disaster is based on infrastructure rehabilitation, social networks are also an important aspect of rebuilding and the nurturing of social networks develops trust and interconnectedness [22]. However, it is the social effect of the trauma of earthquake, or constant demolition, or the large rents in the fabric of the built form that has characterised Christchurch's citizen's everyday lives that also demands the most attention. Trauma is partly characterised as 'loss of communality' [23]. The effect of trauma on the psychology of the earthquake survivors cannot be underestimated and ameliorative processes are regarded to be 'restoring connectedness, social support and a sense of collective efficacy' [24]. If there is one concept that summarises the requisites for survival during and after natural disaster, it is resilience. As Smith et al. explain, '[r]esilience is the ability of an individual or group to carry on and solve problems so that survival of hard times is more likely' [25]. Furthermore, resilience is a protective factor that describes an ability to rebound, make improvements in physical or psychosocial conditions and to recover from loss or illness [26]. Resilient behaviours include motivational contributions to others' lives, strengthening of coping skills, improving knowledge about caring activities and encouragement with nurturing activities [27]. People with higher health ratings report lower depressive symptom scores but higher resilience scores [27]. This is consistent with people enjoying good health having a higher band of tolerance for minor negative health problems.

2.5. Psychological effects

As Somasundaram and Sivayokan observe, both natural and man-made disasters are recognised as causing a variety of 'psychological and psychiatric sequelae' [23]. Sometimes, people at risk from natural disaster don't prepare for its eventuality because to acknowledge the

need for preparation creates anxiety. Montgomery and Morris (n.d.) point out that people at risk have two choices—either to behave in ways that reduce risk or to discount the risk [28]. Thus, taking precautions to prepare for a disaster also needs people to manage their anxiety. Three orders of response are possible. These include adaptive and resilient coping responses, nonpathological distress and maladaptive behavioural patterns to diagnosable psychiatric disorders [23]. Collective traumatisation may result for large groups of effected people and ‘loss of community’ but is also best addressed by community interventions along the dimensions—economic development, social capital, information and communication and community competence [29]. However, after large-scale natural disasters, the effects of community disturbance may be prolonged. As Gordon and Fleming state, ‘In the third year after a disaster the immediate crisis has passed. International experience shows that in most cases people have confirmation of their personal situations—problems and opportunities—and can begin to heal’ [30]. In any context health is seen as ‘... complete physical, mental, familial, social, cultural, spiritual and ecological well-being and not merely an absence of disease or infirmity’ (WHO) (see **Figure 1**) [31] [24].

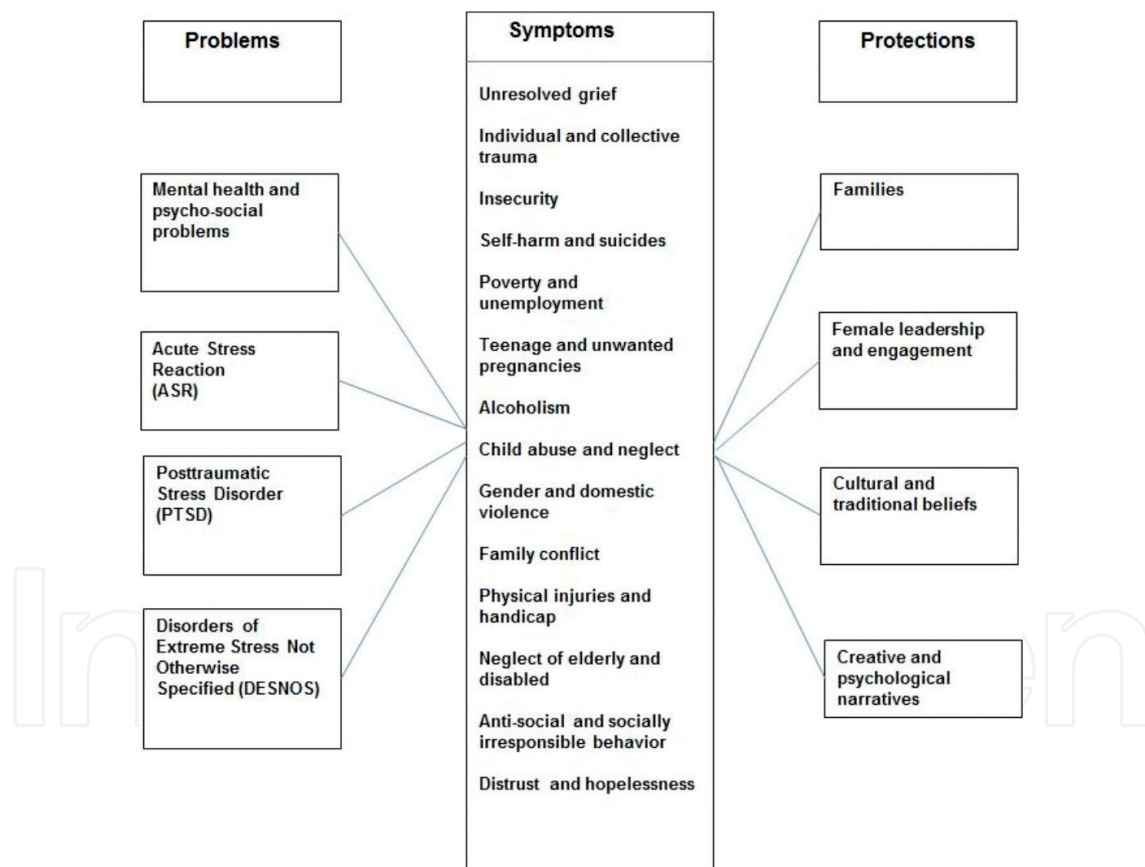


Figure 1. Problems, symptoms and protections of mental health issues in disaster zones.

Norris et al. identify higher rates of anxiety following disaster and depression. They identify five main effects in the post-disaster scenario. These are non-specific distress, health problems or concerns (somatic complaints and medical conditions, quality of sleep), chronic problems in living (interpersonal relationships, occupational stress and financial stress, ecological stress), psychosocial resource loss (perceived social support, social embeddedness, self-efficacy,

optimism) and problems specific to youth (clinginess, dependence, loss of sleep, aggressive behaviour, separation anxiety) [32]. As Weine points out, it is only comparatively recently that scholars have integrated 'social capital measures into a quantitative study of rehabilitation' [33]. Social capital is defined as the 'networks, norms and social trust that facilitate coordination and cooperation for mutual benefit' [11]. Quantitative study of rehabilitation has tended to focus on the restoration of infrastructural facilities and the capital input in so doing as opposed to the human causal linkages that bring such restoration into effect. Relatedly, areas with larger population density recover after disasters more slowly because of the difficulty in providing temporary housing. However, the traditional formula for the recovery rate is provided by Dacy and Kunreuther who argue that 'the speed of recovery following a disaster will be determined primarily by the magnitude of physical damage' [7]. It was thus thought that the amount of damage would determine the rate of recovery, but more recent research has turned instead to community regeneration through the resilience of social capital in post-crisis recovery [34]. As Weine also suggests, social ties form a kind of 'informal insurance' of ready-made support networks—providing information, financial and administrative support and guidance. Politically active communities can present demands and extract resources better. Trustworthy neighbours share information, prevent duping and looting and maintain the relative integrity of community relations [35]. Furthermore, embedded networks raise the costs of 'exit' for individuals—as networks carry latent effects which benefit individuals in a shared community. Such networked neighbourhood (rich in human capital) is more likely to articulate community needs to authorities and work together to overcome obstacles [36]. Thus, it stands to reason, if, following catastrophe efforts are made to strengthen social networks, leading to a better chance of recovery. There is a second reason why social capital is a constituent factor for community resilience and urban renewal and that is because it enables the mobilisation of information and resources at critical moments [37].

2.6. Communication factors

Lien et al. state that survival in post-disaster zones is most likely if people (trapped by building collapses in earthquakes) are rescued within 72 h [38]. Survival tolerance probably diminishes after 3 days. The question then becomes what are effective communication practices for post-disaster zones. As Quintanilla states, 'It is critically important that affected communities know how, when and where aid services can be accessed, what's going on around them and how they can connect with aid providers' [39]. The need for information increases and the availability and clarity of information decreases. In terms of hardware requirements for communication after natural disasters, in developed societies where information and computer technology (ICT) is prevalent, the environmental constraints for a disaster area may include temporary Internet links, unavailability of servers and limited or no Internet access. However, where broadband computing is available through relief or remaining facilities, communication is improved when devices with simple interfaces are used, Wi-Fi notebook formats are popular and where power generation is also available [40]. New technologies—mobile, SMS, social media—increase the ability to access quality information [41]. Reliability and trustworthiness of information is deemed critical. Information-sharing networks can quickly disseminate news, for example, via mobile phone texting or the Twitter service. In this context,

peoples' responses to disaster are not always that of panicked confusion; rather, there is an adaptive response termed normalcy bias that provokes 'confirmation' prior to remediation or protective action [42]. As Aldrich relates, '[i]f social networks prove to be an important part of the rebuilding process, then aid givers should allocate resources to ensure that social structures are not damaged in the evacuation and resettlement processes' [43]. In post-disaster environments, most people respond by texting or tweeting about uncertain or precarious conditions if they are in densely populated areas, while those in remote areas will communicate whether or not they are safe; as Longstaff and Yang state in an immediate post-disaster situation such as an earthquake, individuals and organisations require an ability to receive (and transmit) information in secure trustworthy routes (to report damage and rehabilitation needs) and in the absence of such systems, panic may ensue [44]. Therefore, information sharing through effective communication systems is a form of investment in social capital, or 'safety valve', which helps to strengthen community resilience. As Quintanilla suggests, '... communication itself is a form of aid' [45]. Secondary communication issues include mitigation of real threats companies might suffer to their operational abilities; these might include collapse of the share price, serious legal claims, loss of credit, possible bankruptcy, damage to the company's image or reputation, loss of employees and possible closure [46]. Mitigation is best achieved through planning. However, communication in a crisis needs clarity and conciseness; it needs logical progression, a focus on the facts and the avoidance of jargon [47].

3. Conclusion: resilience in disasters

History has shown that while natural disasters are by definition, devastating, survivors can rebuild their lives given the opportunity. In combination with the complex rebuilding of infrastructure in post-disaster zones, social scientists and human resource practitioners are increasingly advocating that a psychology of resilience is necessary for community rebuilding. Resilience is defined by Norris as 'A process linking a set of adaptive capacities to a positive trajectory of functioning and adaptation after a disturbance' [48]. Longstaff and Yang observe that resilience is the 'capacity of a system to absorb disturbance, undergo change' yet still functions in the same way [49]. Thus, resilience is the ability of a system to recover from setback with no major change in its form or functioning. Norris also defines five dimensions along which resilience may be enhanced by 'networked adaptive capacities'. These are, firstly, developing economic resources—reducing inequities; secondly, enhancing social capital through minimising harm through damage mitigation; thirdly, adaption and utilisation of pre-existing organisational networks; fourthly, protecting naturally occurring social supports and, fifthly, community planning [48]. Consequently, central planners engaged in community rehabilitation strategies should look to strengthen these community functions in post-catastrophe environments. Hence, resilience may refer to adaptive governance 'across spatial scales (local to national) and between sectors (government, community)'; it may refer to knowledge, communication and social learning; maintaining a positive outlook and drawing on social networks for support [10]. Surviving a natural catastrophe and rebuilding a community after it require the investment in human capital which has the quality of being able to be self-sustaining by exhibiting resilience.

Author details

Luke Strongman

Luke.Strongman@OpenPolytechnic.ac.nz

Social Sciences, Open Polytechnic of New Zealand, Lower Hutt, New Zealand

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