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The role of social networks in providing resilience in travel disruption

Introduction

Travel disruption results in travellers not being where they had planned at the anticipated time. With its *'long- lived and exposed capital assets'* (Linnenluecke, Griffiths and Winn 2012), transport is particularly vulnerable to disruption from physical interruption of networks caused by natural causes, human action or negligence and vulnerability is increased with the longer distances being travelled and the growing inter-dependence and sophistication of transport systems.

The data for this paper come from the open comments in three surveys about travel disruption: the European flight ban during the volcanic ash cloud of 2010, the loss of road connections across the River Derwent through flood damage at Workington, Cumbria, UK in 2009-2010 and the severe winter weather in the UK in December 2010. These highlighted the role of social and family networks in providing personal resilience when travel is disrupted. The research was undertaken to understand how people adjust to changes in travel provision and gain insights about adaptations to more lasting changes to travel systems caused by Peak Oil or climate change mitigation measures.

Exploring the literature surrounding the highly contested term 'resilience' helped identify different qualities of resilience within travel disruption. The resilience referred to in much of the academic writing about transport systems would be classified as '*engineered*' resilience (Hollings 1996), whereby human controlled systems seek to return to an efficient equilibrium as quickly as possible following a shock. Social networks' help corresponds more to '*ecological*' resilience, the ability to cope with and to change after shocks, as observed in ecological systems (Hollings 1996). The social networks delivered information and practical assistance, but also helped 'absorb' the consequences of lost time, delayed return and extra expense. Their flexibility in response contrasts with the inflexibility demonstrated by many employers' practices.

Resilience

The term resilience has been criticised for being over-used and under-defined (see Adger, 2000; Grimm and Wissel, 1997; Norris et al. 2008; Rose 2009, 1; Walker and Cooper, 2011), but refers to a system's ability to cope with shocks. It can be seen as a property or a process: '*Being vs Becoming*' (Plodinec 2009, 2) and can include (see Bruneau et al. 2003) or exclude (see Rose 2003, 3) resisting shocks and change following a shock (see Walker et al. 2004).

Hollings' (1996) distinction between ecological and engineered systems describes the normal state as well as their resilience. Any stability of ecological systems is due to a dynamic inter-play of forces whereas engineered systems aim for a static equilibrium to maximise efficiency. This leads to different

manifestations of resilience. Resilience in ecological systems consists of the maintenance of *existence* of function and in engineered systems, the maintenance of *efficiency* of function, with an emphasis on resisting shocks and rapid recovery from them (Hollings 1996, original emphasis). Ecological systems are portrayed as nested and interlocking systems on different temporal and spatial scales, 'Panarchy' (Gunderson and Holling, 2002: Walker et al. 2004, 5) and the interaction of the different scales can moderate or accentuate the impact of disturbance. The degree of resilience depends on the scale/unit being studied.

However, observations from non-directed ecological systems are of little use unless humans can be proactive and adopt aspects of ecological systems to enhance their own resilience to a variety of threats (Rose, 2009, 3). To assess this requires criteria about the degree of acceptable change. Dovers and Handmer (1992, 270) describe three types of societal resilience:

1, *Resistance and maintenance: characterized by resistance to change. ... Threats identified, anticipatory mechanisms put in place. A society totally reliant on Type 1 responses may be poorly equipped to deal with unexpected shocks or thresholds of change.*
2, *Change at the margins: characterized by incremental change - change which does not challenge the basis of our societies, but which may lead to changes in emphasis at the margins. Where substantial change occurs, it usually serves the interests of the powerful elite, not necessarily those of the general population or the immediate environment, and rarely of the biosphere.*
3, *Openness and adaptability: vulnerability reduced through high flexibility, an ability to change basic operating assumptions, and thus institutional structures, and adopt new ones. An adaptable society would be open to the possibility of moving in a new direction quickly and relatively painlessly.*

They suggest that all three exist concurrently within societies, but that modern institutions increasingly show Type 1 characteristics, whereas individuals may be more mixed. In their view, only Type 3 institutions can adapt to uncertainty and switch focus from optimisation of resource-use to a more sustainable and resilient approach.

Many analyses of resilience of organisations or systems appear to premise Type 1 resilience, whereby the desired result is either resisting a shock or recovering from it to return to the previous status quo as quickly as possible, which closely resembles Hollings '*engineered*' systems (1996). For example, Bruneau et al. (2003) breakdown the components of resilience (below) and suggest it applies at four levels: technical, organisational, social and economic.

- *Robustness: strength, or the ability of elements, systems, and other units of analysis to withstand a given level of stress or demand without suffering degradation or loss of function*
- *Redundancy: the extent to which elements, systems, or other units of analysis exist that are substitutable, i.e., capable of satisfying functional requirements in the event of disruption, degradation, or loss of functionality*

- *Resourcefulness: the capacity to identify problems, establish priorities, and mobilize resources when conditions exist that threaten to disrupt some element, system, or other unit of analysis; resourcefulness can be further conceptualized as consisting of the ability to apply material (i.e., monetary, physical, technological, and informational) and human resources to meet established priorities and achieve goals*
- *Rapidity: the capacity to meet priorities and achieve goals in a timely manner in order to contain losses and avoid future disruption*

(Bruneau et al. 2003)

Transport and Disruption

While transport systems are obvious examples of engineered systems they form components of larger societal and social-environmental systems which are more 'ecological' in nature. As ecological systems, they influence and are influenced by a variety of other structures/systems including the distribution of population, natural resources, technology and capital and the organisation of political, industrial and social power. They also exist on different spatial and temporal scales; stretching from, and linking, local footpath to international flightpath networks, while reflecting past configurations and future aspirations of society's values and beliefs. Yet, while enabling mobility, engineered transport systems rarely suggest this changing and evolving co-existence of dynamic influences. As well as requiring considerable fixed infrastructure (Graham 2012), they rely on elements of stability (fuel and other supplies, patterns of demand and supply, etc.) for their establishment and development.

Modelling Disruption
Much of the academic literature about travel disruption concerns systematising or modelling approaches to disruption and evaluating or prioritising actions to prevent or reduce its impact. Most of the sources focus on the road network (see Berdica 2002, Jenelius 2009, 2010) including the potential to switch to other modes (see Ham et al. 2005, Masiero and Maggi 2012). This is often for one potential threat, such as flooding (Sohn 2006), snowfall (Wakabayashi 2007), weather extremes (Daziell and Nicholson 2001) tunnel closure or road crash (Masiero and Maggi 2012) or seismic activity (Daziell and Nicholson 2001; Ham et al. 2005; Wakabayashi 1997).

The potential impact depends on the probability of an event and the severity of the consequences (Berdica 2002) (see Figure 1). As Berdica explains, incidents at the extremes: high probability/severe consequences or low probability/mild consequences are either quickly addressed or unimportant, but it is harder to evaluate the impact of incidents combining varying degrees of severity and probability or '*the problem of measuring a network's maximum resilience level and simultaneously determining the optimal set of preparedness and recovery actions necessary to achieve this level under budget and level-of-service constraints*' (Miller-Hooks, Zhang, and Faturechi 2012, 1633).

Figure 1: Risk: Combining Probability and Severity of Consequences

There is no objective measure to assess risk (Berdica 2002): a focus on consequences detects more risk than one on probabilities and those considering personal risk give higher ratings than those addressing risk to others or society in general (Drottz-Sjöberg 1991). Berdica (2002) also distinguishes between actions to reduce the risk of failure (fail-safe) and to reduce the consequences in the event of failure (safe-fail).

However, assessing risk and potential remedies demands criteria to measure the relative impacts of disruption. Several are explicit in the modelling literature, they include:

- economic impact (Dalziell and Nicolson 2001: Desert Road, New Zealand; Masiero and Maggi 2012: direct and indirect costs for freight through Gotthard tunnel; Ham et al. 2005 increased cost of freight shipment through New Madrid Seismic Zone, USA)
- time costs (Jenelius et al 2010)
- time reliability (Berdica 2002; Wakabayashi 2007)
- vehicle travel time (Jenelius 2010)
- volume of flows affected (Jenelius 2009; Sohn 2005, Maryland, USA)
- equity (Jenelius 2010)
- vulnerability of individual users (Jenelius 2009)
- accessibility (Berdica 2002; Sohn 2005)

Previous Disruptions

Another branch of academic interest in disruption is the observation of travel behaviour following disruption, which again, mostly focusses on the road network. A common finding is that disruption 'settles down' to the new conditions after an initial disturbance (Clegg 2007 (road works in York, UK) Cairns, Atkins and Goodwin 2002; Gordon, Richardson and Davis 1998 (Northridge Earthquake, Los Angeles, USA, 1994) Zhu and Levinson 2008 and Zhu et al. 2010 (collapse of the 1-35W Bridge, Minneapolis, USA, 2007)). The

early volatility is caused by travellers searching for the new best option of route (Zhu et al. 2010), timing and mode and adjusting to the new conditions, but, by doing so, creating extra volatility. After earthquakes and other area-wide disasters, damage to transport systems, homes and other destinations takes a long time to repair which affects traffic flows, while temporary provision may evolve over several weeks ((Giuliano and Golob 1998: Northridge Earthquake, Los Angeles, USA, 1994). However, Chang and Nojima (2001) report that traffic volume increased in line with capacity restoration following the Kobe earthquake in 1995.

Another phenomenon 'disappearing traffic' is reported by Cairns, Atkins and Goodwin's (2002) study of 70 incidents of road capacity reduction (also reported by Clegg 2007, Guiver 2012). The decrease (up to 11%) occurs when individuals re-route, retime or reduce their car travel, sometimes changing mode. New users, making travel decisions in the context of the decreased capacity also replace previous regular users as a natural 'churn' (Cairns, Atkins and Goodwin 2002).

The fear invoked by acts of terrorism or aviation accidents can affect people differently. For example, Rubin et al. (2005) detected a greater propensity for reduced travel intentions among people who felt they, a relative or friend could have been injured and amongst Muslim respondents after the London bombings. Siomkios (2000) found frequent fliers and those with a previous high opinion of an airline were less likely to avoid it following an accident.

Differential impacts have been observed in the impact of the weather, with commuting routes (Datla and Sharma 2008), times (Al Hassan and Barker) and trips (Sabir et al. 2009b) less likely to be affected than routes predominantly used for recreational traffic and off-peak times. The most common response to bad weather is to revise timing or re-route rather than to switch modes (Khattak and de Palma's 1997: weather impacts on commuting in Brussels). Giuliano and Golob (1998) observed similar preferences after the Northridge Earthquake. Guiver (2012) and Jenelius (2010) also found that discretionary trips are likely to be abandoned if increased travel time for utility trips displaces other activities and travel.

The differential impact of public transport disruption (often researched during strikes) results from varied access to other modes (van Exel and Rietveld 2001). Extra cars, even where the modal share of public transport is low, can elongate rush hours (Coindet 1998: Paris transportation strike 1995; Lo and Hall 2006: Los Angeles transit strike, 2003; Tsapakis et al. 2012: London underground strike 2009), while those without access to cars, eg young people without licences (van Exel and Rietveld 2009), people not living close enough to walk or cycle (Coindet 1998) or without the potential to work from home (van Exel and Rietveld 2009) have fewer alternatives and may resort to taking a day's leave. Less time-tied Journeys may be postponed. (van Exel and Rietveld 2009).

Personal adaptations to reductions in travel provision include:
- Re-timing travel

- Re-routing
- Changing destination/origin
- Consolidation of trips, fewer trips
- Changing mode
- Changing tasks within households

(Cairns, Atkins and Goodwin 2002; Guiver, 2012; Zhu and Levinson 2008).

The response depends on characteristics of the journey (purpose, frequency, fixedness of time and destination) and the traveller, (access to alternative modes, and, sometimes, their feelings of susceptibility to attack or faith in the transport provider).

Reports of Disruptions

A severe disruption often prompts an enquiry and recommendations for improved performance in future disruptions. Several repeated themes emerge from these documents:

- needing more or better targeted resources to prevent/deal with disruption
- better communication within and between organisations
- improved and consistent information for travellers
- better care of and compensation for people stranded by the lack of transport

The justification of increased resources to address travel disruption is usually the costs of such disruption to the economy or the transport provider. Loss to the economy is estimated in lost production (£130m per day, 0.5% decrease in GDP for the last quarter of 2010) and welfare costs, people's loss of time (£150m per day in December 2010, cf £60m per normal day for traffic congestion (Department for Transport 2011)). IATA (2012) calculates that airlines lost US$1.8m revenue through the volcanic ash cloud and ATOC (2012) hopes to increase revenue by £100m-£130m by reducing disruption by 37%.

Remedies include improved:

- weather forecasting (House of Commons Transport Committee 2011: Scottish Government 2011: Transport Scotland 2012),
- equipment for clearing snow and ice (Department for Transport 2011: East Midland Trains 2011: Heathrow Winter Resilience Enquiry Panel 2011: Scottish Government 2011)
- larger salt stocks (Department for Transport 2011: Transport Scotland 2012)
- contingency plans (East Midland Trains 2011: Heathrow Winter Resilience Enquiry Panel 2011: House of Commons Transport Committee 2011)
- co-ordination between organisations (EU 2011; Gritting Panel Review Team 2009; Scottish Government 2011)

The main traveller needs identified are better and more timely information and better treatment when delayed. Information is needed before any disruption so

people know roles (eg whether they are expected to clear snow locally (City of Edinburgh[b] 2011), responsibilities (eg who to contact), and procedures (eg which routes are cleared first (City of Edinburgh[a] 2011; Scottish Government 2011). Providing information before people leave home can prevent them embarking on impossible journeys (Department for Transport 2010; Eurostar 2010; GfK NOP Social Research 2011; Heathrow Winter Resilience Enquiry Panel 2011: Arrup 2011; Passenger Focus 2011) help them make alternative plans, be properly equipped and have realistic expectations (Scottish Government 2011). Overloading of telephone lines, failure to update websites or contact travellers through mobiles or e-mail exacerbates travellers' anxieties and creates problems when they cannot travel (Eurostar 2010; Heathrow Winter Resilience Enquiry Panel 2011, Passenger Focus 2010).

Customised, relevant messages, including stating when the duration of disruption is unknown, are preferred to generic ones which tend to be mistrusted (Department for Transport 2010: GfK NOP Social Research 2011; Passenger Focus 2011) and the use of a variety of media (leaflets, notices, Twitter, websites, webcams texts and staff) is advocated. Travellers' information needs may vary (for example GfK NOP Social Research (2011) found commuters and regular travellers want route-specific information, whereas people less familiar with the route want more train-specific information and TravelWatch North West (2011) warns that some passengers are unfamiliar with the local geography).

Travellers also need staff to acknowledge passengers' plight, show them respect (Passenger Focus 2010) and endeavour to help them with alternative travel arrangements, accommodation, food and drink (Heathrow Airport Limited 2011; House of Commons Transport Committee 2011; SHM 2011) including looking out for vulnerable passengers, with wheelchairs, pushchairs and luggage (TravelWatch North West 2011). Failure to recognise rights to compensation causes further distress (European Consumers Centres' Network 2011; Heathrow Winter Resilience Enquiry Panel 2011).

The outputs of such documents are incorporated into policy and operationised by transport providers reconciling practicalities, priorities and resources. They appear as policies (see Heathrow Airport Ltd 2011; Network Rail 2012) to determine the provision for passengers, procedures during extraordinary conditions and hierarchies of routes/service to be maintained, such as gritting hierarchies (eg see Lancashire County Council (2012) with criteria based on traffic volumes and social need).

Travellers' Experiences and Social Networks
While suppliers have the agency to create plans, policies and provision, travellers' agency is limited. Jensen (2011) temporally stranded in the USA by the volcanic ash cloud reflects on his feelings of vulnerability when his assumed mobility was suddenly impaired. However, Barton (2011) describes mixed senses of agency during his journey home from Stavanger in a hired coach during the same disruption and explores the role of technology, language and transient co-present, as well as dispersed, social networks in securing information. Guiver

(2012) suggests that in their 'revised plans' travellers resign themselves to (or even make the most of) the factors they cannot influence and exercise their agency on the factors they can influence to improve their outcomes.

The role of social networks is scarcely mentioned in the transport disruption literature (an exception being Zhu et al. 2010 '*Social contacts such as family members, neighbors, and co-workers … increased slightly after the bridge collapse, possibly reflecting more positive search efforts*' (p 20)). This contrasts with research into disasters, which stresses the importance of social networks and 'social capital' (see Kaniasty and Norris 1995; Norris et al. 2007). For example, Riad, Norris and Ruback (1990) found residents with strong social ties were more likely to evacuate before a hurricane because they had greater expectations of material help (ride, accommodation, loans, etc.). Litman (2006) found many of those left behind in New Orleans before Hurricane Katrina were non-drivers, disadvantaged and lacking social capital.

Case Study Disruptions

The case studies concern three travel disruptions researched by the *[name deleted to maintain the integrity of the review process]* in 2010. Their causes, geographical scale, duration, the modes affected and the type of journey disrupted differ. While the Workington survey was launched several weeks after the resolution of the disruption, surveys were administered during the other two disruptions when respondents probably had a heightened awareness of the problems.

The Volcanic Ash Crisis

The eruption of the Icelandic volcano, Eyjafjallajökull, emitted an ash cloud deemed unsafe for aircraft to fly through, resulting in a temporary and shifting flight ban over much of Europe for six days in April and intermittently in May 2010. Its eventual duration was unknown to those unable to reach or leave their destinations and repatriation of all those stranded away took weeks. Surface modes provided alternatives for those travelling in or near Europe, although many were quickly overwhelmed by the extra demand. The main problems encountered were: getting information about flights and alternative transport or accommodation and missing commitments at home.

Workington Bridge Closures

The floods which hit Cumbria in north west England in November 2009 damaged or destroyed all the road and foot bridges linking the town of Workington with its hinterland north of the River Derwent. The only undamaged bridge carried the Cumbrian coast railway. Within a fortnight, a temporary station had been built north of the river and a free and frequent train shuttle service provided. A footbridge had also been erected to the east of the town, but it took five months to build a temporary road bridge to re-connect the area. Meanwhile people could either walk/cycle, use the train or drive upstream to the nearest open, but severely congested road bridge, an 18 mile detour. Several employers with bases on both sides of the river redeployed staff to work the side they lived on, while a temporary supermarket and doctors' surgeries were provided on the north side.

The situation mostly affected day-to-day travel, especially for people whose residence and work or education were on opposite sides of the river. The increased travel time for car-users reduced the time available for discretionary activities such as leisure and also desynchronised household arrangements.

Winter Weather 2010

On the climatic boundary between areas expecting snow and cold every year and those only experiencing them exceptionally, British transport providers have to juggle decisions about the resources devoted to infrequent conditions. The snow and low temperatures which hit in December 2010, the coldest December on record (Met Office 2012), were exceptional in their earliness, duration and severity. All modes were hit, with runways and motorways blocked, pavements treacherous with ice and many trains, coaches and buses delayed or cancelled. Rapid changes often made conditions unpredictable, even over short distances. As well as having to accommodate extra travel time, travellers faced physical risks, which they had to weigh up, sometimes without accurate information. Closures of schools and other services also disrupted routines.

Methodology

Both the volcanic ash and winter weather on-line surveys were instigated by the Institute of Transport and Tourism during the disruptions. They asked for details of affected trips, the information sought and obtained, alternative arrangements and consequences. Space was dedicated to respondents' comments, which form the basis of this paper.

Cumbria County Council commissioned the Workington Travel Survey, several weeks after the opening of the temporary road bridge ended the travel disruption. The household survey (with space for up to four members' details) asked about the number, purpose, mode and destination of journeys normally undertaken in a typical week by for three time periods: before, during and after road travel was disrupted. Table 1 gives details of the surveys.

The quotations used in this paper are as they were written/typed by the respondents including misspellings, grammatical and other errors. Explanations have been added in brackets where these might be useful and three dots (…) indicate where a portion of the quotation has been omitted.

Findings

The re-arrangements of time-space plans caused by the travel disruptions varied. The flight-ban mostly involved one-off long journeys, whereas Workington respondents had to adjust their daily/weekly travel and activity routines for five months and extra travel times impacted on other daily activities. While the winter weather disrupted all types of journeys, most respondents described its impact on commuting. Its severity and duration varied according to location and changed rapidly over several weeks.

Table 1: Details of surveys

The main needs of travellers appear to be:
- information about the disruption and its likely impact on their journey and the alternatives open to them (routes, modes, destinations and accommodation)
- alternative transport and/or accommodation and subsistence during a prolonged stay away from home
- rearranging commitments missed because of extra travel time or not being able to be where they expected.

The open comments show help was provided with all of these by social and family networks. They either actively volunteered help or passively 'absorbed' time and money costs of the disruption through lost opportunities and activities.

Information

The need for information was highest for people affected by the volcanic ash cloud, including: knowing about the disruption, how it affected their plans and for finding alternative transport/accommodation. Just under half (48%) of the respondents had heard through a news report and 28% from a friend or relative, 13% were told by their airline. Several were disappointed that they had not been informed by the airline or tour operator before turning up for their flight

We had an email from sister in the USA "How are you guys going to get home?" then we listened to the French news on car radio, then went online.

My friend from the USA asked if I can travel back due to the volcano crisis. None of the airlines sent me a message-email at all.

On my way to the airport, I have already received information from my friend that the flight was cancelled (info via airline website), but the staff at the check-in desk had no clue.

Once alerted to the problem, they needed information about the effect on their travel plans, but with phone lines permanently engaged and websites crashing, achieving contact with airlines was difficult (Guiver and Jain 2011; Miller 2011). However, most respondents (64%) contacted their airlines, and a high proportion contacted friends or family (47%). Conflicting and inadequate information added to stranded passengers' frustration (see Miller 2011; 298).

Friends and family have been helpful. Airlines have not really been helpful -- but to some extent it is understandable since they knew little about when the ash cloud situation would subside and the airports would open again.

The communication problems were compounded for people without easy access to computers or broadband, ringing from abroad on mobiles or hotel phones or in different time zones. Family members and friends were recruited to research the situation and make contact with airlines, travel agents and surface transport providers.

Expedia in USA wouldn't deal with enquiry, told had to phone UK (premium rate) phone number. Partner called in UK, but kept being cut off after long periods on hold, then Expedia wouldn't deal with him as he hadn't booked the ticket...

Because I was in a remote part of Borneo communications were difficult - i had to rely on my husband to call me to update me on the situation - compunded by the time difference and my restrictions regarding when I could call (due to conference sessions)

Today I'm told by my Finnish friend that even though now the airport are open, more ashes are expected on the weekend ....   Getting info is very hard in a foreign country when you don't speak the language (cant understand TV radio), not staying at a hotel, being yourself in a friends house... I must rely totally on my friends here or my relatives in Hungary and friends in USA besides the websites.

My wife was at home and was continually trying to phone KLM or P&O ferries.

Very stressful for those who didnt have relatives at home to book things like we did.

With demand focussed on, and over-whelming, a relatively few organisations, dispersed personal networks were better able to respond and care about the plight of their members. These communications were possible through modern technology: e-mail, mobile phones and, to a lesser extent, Skype.

We have little evidence about how information was received in Workington. National and local media gave extensive coverage to the flooding at Cockermouth (upstream), the loss of the bridges and the death of a policeman who had been directing traffic away from a road bridge before it collapsed. The local radio, television and newspaper as well as Cumbria County Council's emergency on-line bulletins spread news about the latest arrangements for schools, hospitals and transport. Informal networks presumably played their role in disseminating information.

... one lady said that she didn't know she was on high flood alert until informed by her friend who happened to know someone in the Police.

Likewise, the winter weather featured in national news media, prompting people to check local weather forecasts before travelling. Several contacted transport agencies such as the Highways Agency, local bus operators or sought information on their websites. Personal contacts at the destination could also be helpful.

... was advised by colleagues in work to turn around and go home as roads were hazardous and parking impossible.

Alternative arrangements
The airlines attracted many derogatory comments and were the most difficult agency to contact, yet they were most likely to help people return home (23% of the respondents who contacted them). Friends and family were mostly likely to '*give useful information*' and many family members drove long distances to pick up their relatives.

My father drove me to Namur (B) trainstation, then I took two trains … and my wife picked me up in Lugano

Brother who lives in Paris drove 1,000 km Paris to Milan and collected us.

Hired car with driver and drove with two colleagues from Riga to Berlin (17 hours). Then trains … - Calais where my husband met me having brought car through tunnel

It was also clear that family and friends were prepared to help in the contingency

If we hadn't been able to get a flight that day I'd have been taken to Hull by an acquaintance, got the ferry to Rotterdam and then been picked up by mum.

We managed to get a lift from a family friend from Hull to Liverpool to collect the car

The other important material help delivered by social networks was providing accommodation for people unable to return home. Many continued to care for stranded guests, but many, often quite distant, members of social networks provided accommodation for stranded passengers. Some 'strandees' used the opportunity to spend time with relatives or appreciated their proximity to a suitable airport.

I was staying with a friend in Bergen, so I had no accommodation costs.

The only option for me right now is to wait for my airlines to resume their flights .. I didn't bring that much money with me as my trip was only for one week … I am just really fortunate that my cousin lives here in Frankfurt and she's so nice to "adopt" me while I'm stranded.

I travelled to Phoenix AZ to stay with friends.

I went to stay with my father who lived closer to another airport

Many Workington respondents regretted the loss of contact with friends and relations or the efforts required to maintain these contacts. Temporary accommodation was provided in at least one case by a relative.

As I was on placement in Workington, living in Seaton was not practical and it was difficult. Therefore I was forced to move and live with a relative in Workington.

Extended family were sometimes able to help with travel arrangements.

When the footbridge was opened we drove to the nearest point- myself to Toll Bar House and my daughter to Workington Police Station then walked to meet each other so that I could take my granddaughter to Seaton Junior School.

my daughter who lives at Whitehaven came to pick me up to spend the New Year with her and her family. … then brought me home … travelling 94 miles in total (4 more miles and we could have gone to Newcastle!).

I live in Workington and my grandson lives in Flimby and attends school on South of Workington so I was involved in picking him up at the train station and driving him to Southfield School Mon to Friday each week.

The winter weather respondents also found their social networks useful for material help when their travel plans were disrupted: coming to the rescue when they were stranded, providing emergency accommodation and helping with travel.

Had to leave car in work and start using the train instead. The trains were then cancelled and I was stranded. A family member then spent 2 hours stuch in traffic whilst trying to rescue me.

we were in a severe blizzard and I faced a four mile walk alone from the train station. Fortunately a neighbour borrowed a landrover and met me there

Had to stay with a friend in London was last onward train connections missed.

I stayed with family one night to avoid having to travel as it had taken me 4.5hours to get to work that morning.

Ended up getting the first train out and getting my partner to collect me from a station 6 miles from our house and left my car at usual station overnight.

Absorbing the Consequences of Travel Disruption
Travel disruption, delayed travel or longer travel time, results in not being where you expected at the anticipated time. The time loss/displacement was the most referred-to aspect of each of the disruptions. From the comments, it appears that social, family and home time is more resilient and flexible than employment time, which is frequently prioritised over other commitments. These get 'squeezed', foregone or re-arranged to make time for work. In Workington, the increase in travel time had to be planned into the daily routines for several months and resulted in a dramatic drop in the number of social and leisure trips (all trips fell by 33%, but for social trips it was 65% and leisure trips 51% while work trips only fell by 12%).

Work time.
Commuters affected by the winter weather and Workington travel disruptions had to allow more time for their journeys. They and employees delayed by the volcanic ash cloud mostly faced the choice of losing pay, flexi-time or annual leave and loss of 'time' was generally preferred to loss of pay.

I lost five working days of my Annual Leave Allowance as my Employer insisted I take it or no payment for those days. (Volcanic Ash Cloud)

*When the bridges went down it was very difficult to get into town from Flimby ....
We had to put holidays in at work while alternative travel arrangements were
made.* (Workington)

*With the exception of 01/12/2010 when the severe weather policy was invoked by
my employer, all other time lost has to be made up by using flexi-time or annual
leave.* (Winter Weather)

People whose work could be performed in different locations and/or times often
attempted to fulfil their commitments while stranded or from home during the
winter weather, although work commitments requiring co-presence with others
had to be re-organised. Several complained about the hours needed to catch up.

*I was working using my computer all days during the delay. Some hours were lost
in telephoning and internet booking, but otherwise I was working in the hotel room
and lobby or in the ferry cabin or on the train from early morning to late evening
every day, including the weekend.*

*I am sure that my employer will not be very happy and I will be subject to a lot of
teasing when I get back. I have tried to prevent some of that by buying the laptop
and doing some work.*

*I missed a face to face meeting but luckily a colleague who lived closer was able to
attend.*

*the delay to return to work has meant working 16 hour days since my return to
catch up with the work I had missed.*

People whose work requires their presence at specific times were unable to fulfil
that commitment. (Some employers were criticised for demanding unnecessary
attendance at the workplace.) Self-employed people were likely to lose paid
work, while public sector or large employers might use locums, eg supply
teachers, or expect colleagues to step in. Delayed travellers might agonise about
the burden their absence placed on employers, colleagues and/or clients and be
grateful to their colleagues. However, colleagues could be resentful.

*Mrs ... worked as a home carer in Seaton ... Because of bridge, lost work in Seaton
and now has a round in Workington. Has lost money and 1 days holiday because of
less hours worked on this round.*

*My employer insists on my travelling to work every day. I am a software developer.
Working at home would be easy, logical and would certainly be the solution when
the weather begins to get difficult.*

Self employed husband lost 3 days work. I had to take 2 days leave, unpaid.

*I missed an Emergency Call-Out for a customer whose system had broken down and
had to telephone a colleague in another business to attend to my customer's
property and carry out repair and earn the income as a result.*

My school had 10 teachers stranded but has paid us all. The school will suffer a 30% budget cut next year and can't afford to be spending money this way.

Increased workload due to number of colleagues absent.

I made it in when other who could not spent time at home (;) a generous employer meant I worked harder than them!!

Because I was the only one of three staff who could get to work, I had to change shift patterns in order to provide cover at work.

Extended absence.

Arrangements for absence often involve family and friends looking after children, pets, houses, etc. The delayed return extended the commitment.

My mum had to travel to my house to help care for my other children.

my wife is having to manage the children and her job on her own, she has had to cancel a trip she was going to make (within Sweden) since I'm not there to take care of the children and my colleagues have had to cover for me which is of course extra work for them.

I have made arrangements for friends to look after horse and dog

Petcare - no-one to look after our cat - had to rely on neighbours.

Missed opportunities.

Delayed travel often entailed missing social occasions, important elements of belonging to and maintaining family, social and professional networks (Larsen, Urry and Axhausen 2006).

I missed giving my best man speech at my friend's wedding!

We missed the funeral of our Grandad

I could not drive my daughter back to University.

27 out of 56 guests at my wedding were missing.

We were able to visit our family after Xmas but we had missed our great-nephew's christening because of the weather and that could obviously not be repeated.

these 3 days were planned to be full of wedding preparation tasks and a little relaxation time before our big day - luckily suppliers, family and friends in Melbourne really stepped to the fore and helped out, and in the end all went smoothly.

In Workington regular, as well as occasional, social and family interactions were lost, creating a 'black time' according to one interviewee. It is evident that many respondents made extraordinary efforts to maintain face-to-face contacts and others deeply regretted not being able to.

... leisure activities restricted and sometimes cancelled. Isolation from family members.

All our children /grandchildren live on the other side of the river. When the footbridge was up we walked or used the train to go and see them. We hardly saw them at all until December.

Very pleased to use the temporary bridge and delighted to meet up with friends and family once more.

32 mile round trip had to be done every day as my 97 year old mother lives in Seaton. First night of the bridge closure I travelled 94 miles home up to Carlisle via Penrith. Glad to see the temporary bridge for time, petrol and money. Also peace of mind to get to Seaton quickly if needed.

I couldn't see my mother as it was a four hour round trip for ten miles.

The main effect was to break the habits of twenty years. Visits to grandchildren entailed 40 mile round trips. Visiting my late wife's memorial tree at Isel was difficult. … . Friends could not get to social events I attend.

I got out of routine of going to Church (must try to re-establish).

In order to keep at least some social and leisure activities up, we went but less often, as it meant a 37 mile round trip instead of 4, so much more expense, but less social life, causing places we would have visited - and people concerned - to lose out also, in revenue, friendship, organisation etc. … Felt isolated.

Financial Costs

Although the most immediate costs of travel disruption are temporal, there are inevitably financial costs: alternative travel and accommodation arrangements and lost earnings. Whose responsibility these were during the flight ban is still being contended in 2013 (see Eutopialaw 04/02/13). Passengers' experiences were very mixed, from those whose airline or tour operator took full responsibility to those who were left to pay for everything themselves. Even claiming for compensation involves time and hassle costs.

Financial problems - apart from the days lost, which is significant as I am a contractor, I have had to pay out for accommodation and living expenses for all these extra days abroad.   I am now in arrears with all my bills.

I wasn't amused at Teesside Airport charging me £85 in excess parking charges

Our return journey was delayed by 6 days. We were stuck in Edmonton, Canada where we were changing planes en route to Heathrow. … Air Canada refused to pay for accommodation or food.

Ryanair offered no help or advice whatsoever. Told us no help with accommodation/food, just offered return flight in a week or cancellation/refund

The advantage we had was that we booked through Thomas Cook on a package, so effectively it was an extended holiday. However, as i saw a lot of people in the resort stressed and no money to get home and flights been cancelled so having to folk (fork) out money to stay in hotel

... battling for my money takes time I haven't got (which is what the companies concerned are probably hoping for)

In Workington, the people who changed from car to walking or using the train had fewer costs. Those who continued to drive, not only faced extra fuel bills, but often needed extra repairs because of the increased distance and poor condition of the roads following the flooding. Less mention is made of costs incurred during the winter weather, although some people found buses more expensive than their usual modes. Money pre-paid for travel or events could be lost and accidents could result in costly repairs and increased insurance costs.

Round trip to Sellafield from Seaton should be 40 miles, when the bridges were down it was 56 miles. Petrol costs were boosted by £20 - £30 per week.

My miles per week doubled to get there and also the poor roads between Dearham and Maryport broke my steering which cost £319 to get fixed.

Earlier mornings and late nights to return. We used more fuel as two of us work full time. I also had an £800 repair bill to one of our cars due to stopping/starting (gears).

My normal transport (cycling) is free! I've had to pay out £32 already over the last 2 weeks

After waiting 8 hours eventually managed to speak to someone from national Express, realised no coaches were running and had to get a taxi to Swansea at a cost of £200.

I pay £185 for a monthly railcard from Sheffield to Leeds - I was unable to use this for much of the bad weather due to train cancellations.

Booked tickets to opera and the train. Lost about £300.

I had a car accident and have lost my no claims bonus.

Although the consequences of time lost were often spelt out, there were few references to the implications of the extra expense. One woman, however, explained the consequences of the increased the costs of moving due to the winter weather.

... it cost me £175 to move rather than £70-£90. This means no christmas presents for a few people and no trip to see my boyfriend for new year who is living abroad.

Discussion

It seems clear that family and social networks provided information, and material support to travellers affected by travel disruption, increasing their personal resilience. This means that travel disruption affects many more people than the travellers (see Guiver and Jain 2011). What is rarely conveyed by the comments, although implied, is that the personalised help provided by members

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of the traveller's social and family networks also expressed their care and concern for the traveller, possibly strengthening those ties.

This is not to say that transport providers did not help their users. In fact the literature suggests that lessons learnt from previous events probably prevent many disruptions and minimise their impact when they occur. Although, often backgrounded in the comments, other agents such as airlines, tour companies, travel agents, Network Rail, train companies, the Highways Agency, local, regional and national governments are referred to as active, if not always effective. Most of these agencies are involved in a professional role, helping travellers in their role as customers of the service or residents of the area.

Social networks appear to have plugged gaps not filled by the professional agencies and cushioned the impacts of the disruption. Such help can also be provided for other 'disruptions to plans' such as: accidents, illness, bereavement, redundancy. The targeted flexibility demonstrated by family and social networks, enhanced by being able to communicate in real time, complements the more 'macro' actions of organisations dedicated to maintaining transport systems.

When looking for insights into more long-term transport change, the transport systems appear to represent Hollings' (1996) engineered systems and Dover and Handmer's (1992) Type 1 resilience dedicated to and effectively reproducing the current 'equilibrium' as exhibited by the criteria for judging the impact of disruption. The resilience of the social networks, meanwhile, appears to resemble ecological rather than engineered resilience and exhibit more of the '*openness and adaptability*' of Dover and Handmer's (1992) Type 3 resilience within the limited spheres they influence. Some respondents indicated that the experience had changed or re-enforced a perspective that sometimes accepting disruption was preferable to battling with nature.

I really learned a lot with this trip, and the main things are that the world is supported by very fragile things, and when we think we are on vacations we can't forget that the planet earth never goes on vacations.

I will be using trains even more and allow more time to travel, or I won't go.

I was already considering not flying again, but this has emphasised to me the absurd nature of the way we travel. I much prefer slower travel, such as train, car, or boat

We need to decide how much we are prepared to spend on protecting travel from bad weather. As climate change will increase the cost we need to recognise the need for other solutions such as home working.

If organisations and employers accepted that things may have to just stop for a few days, there would be less chaos! Allow the children to enjoy the snow and their time off school. Allow adults the time off to spend time with their children rather than employers demanding that they try to get into work. People would be more willing to help their neighbours if they had the time to do it!

teaches people that patience and that they can't have everything and go everywhere they wish at any time - we can't always dominate nature

Nature is greater than any of us and weather disrupts life and always has.

Thus, while some individuals were prepared to reconsider their travel and life-styles after the disruption, it appears that the resilience of transport systems is focussed on restoring the pre-disruption norm, exemplified by Workington. Here, more sustainable modes of travel were abandoned for car travel once the temporary road bridge opened partly because of the withdrawal of alternatives.

Wasted opportunity to improve public transport- people with cars would have stayed on buses and trains if times were better for workers.
now bridge is up, trains barely match up at all, so back to using car when would be willing to use the train.
if this (bus) *service had carried on I am sure a lot of cars would still be off the road.*

The resilience demonstrated by individuals and their social networks appears more open to re-aligning to different, possibly more sustainable, ways of thinking and acting than institutions working with embedded priorities to continue the status quo. Both the research and the academic literature about previous disruptions reveal a quick adaptation to the new context, both through changes to individual travel patterns and through the 'churn' (Cairns, Atkins and Goodwin 2002) of travellers, although different journey types and travellers may be differentially affected.

The literature about modelling, reports about previous disruptions and many of the comments about employers suggest more determination to reproduce current values (time-savings, productivity and mobility) and to resist, rather than adapt, to any changes in the context. Shove (2010 p) encourages us '*to be explicit about the extent to which state and other actors configure the fabric and the texture of daily life*' and it is clear that, despite the rhetoric of individual choice, structures: infrastructure, institutions and their practices exert considerable power over how we live. Social networks provide some of the 'give' to allow us to fulfil expectations, when other factors intervene.

Conclusions

The open comments from respondents to surveys about three travel disruptions suggest that family and social networks enhance personal resilience when disruption prevents someone being where they had planned to be at the anticipated time. These networks provided: information, especially when central sources were overwhelmed with requests, material help such as accommodation, lifts and care of children, pets, houses while the traveller was absent and 'absorbed' extra time needed to travel or catch up on lost work hours.

While temporary disruptions may not be indicative of reactions to long-term or permanent changes to travel, the study suggests that transport systems and other institutions aim for resistance more than resilience, by enshrining current values in their operations. Although individuals and their social networks may be

more open to change travel and other behaviours in the light of their experiences, they mostly lack the agency to do this.

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