Fundamental challenges in designing a collaborative travel app

Janet E. Dickinson[a], Tom Cherrett[b], Julia Hibbert[a], Chris Winstanley[c], Duncan Shingleton[d], Nigel Davies[c], Sarah Norgate[e], Chris Speed[d]

[a]Corresponding author. Bournemouth University, Talbot Campus, Poole, BH12 5BB, United Kingdon. Email: jdickinson@bournemouth.ac.uk. Tel: +44 (0)1202 965853
[b]University of Southampton, University Road, Southampton, SO17 1BJ, United Kingdom.
[c]Lancaster University, Bailrigg, Lancaster LA1 4YW, United Kingdom.
[d]Edinburgh University, Evolution House, 78 Westport, Edinburgh, EH1 2LE, United Kingdom.
[e]University of Salford, The Crescent, Salford, M5 4WT, United Kingdom

(Post refereeing version)

Abstract

The growing capabilities of smartphones have opened up new opportunities for travel coordination and transport is a fertile area for app development. One stream of development is apps that enable collaborative travel, either in the form of lift sharing or collaborative shopping, but despite growing interest from governmental agencies, there is little evidence of the efficacy of such apps. Based on trials of purpose built travel collaboration apps, deployed in tourism, urban and rural residential communities, and logistics, this paper analyses the fundamental challenges facing users adopting such travel apps. The findings suggest that transport practitioners, policy makers and app developers need to better understand the challenges associated with attracting users, the use of incentives and the types of communities most appropriate to implement collaborative travel concepts using such approaches. Also, how the users' sense of time pressure and the issues around reciprocal exchange can impact on their long-term success and wider adoption.

Keywords: collaborative travel; smartphone app; lift share; reciprocal travel

1. Introduction

Following the Smarter Choices – Changing the way we travel report (Cairns et al., 2004), the UK Government's 2011 Transport White Paper (Department for Transport, 2011) focused on the potential for effecting travel behaviour through 'nudging' individuals towards adopting more sustainable travel practices (Thaler and Sunstein, 2009). This encouraged local authorities to develop interventions, such as personalised travel planning and improved travel information, to encourage the adoption of more sustainable transport modes, currently being realised through initiatives such as the Local Sustainable Transport Fund (Department for Transport, 2011).

Car use, and vehicle use in logistics, is highly ingrained in society's travel practice. Yet, cars are an under-utilised resource with an average occupancy of 1.58 in the UK (Parliament UK, 2010). With higher vehicle occupancy, cars can achieve an environmental performance comparable to some modes of public transport in terms of greenhouse gas (GHG) emissions, especially as the emissions standards improve on modern cars (Atabani et al., 2011). Given cars are so ingrained in travel practice that is habitual and hard to change, there is a case for using them better, that is, working with the habits (Schwanen et al., 2012).

The growth of smartphones and the increasing Internet connectivity of many mobile devices, including vehicles (Speed and Shingleton 2012), present an emerging opportunity to tackle car dependence. The ubiquity of the smartphone enables people to access information about travel problems, visualise where others might be in their social network, share information and ultimately intercept with others to share vehicle capacity. App developers have recognised this potential and there has been a growth in a variety of apps that wayfind, track users, share travel information and provide real-time public transport information. This enables access to data resources that were once previously the domain of highway managers and devolves power to make transport decisions to individuals at a grassroots level.

In a period of austerity and disinvestment by the public sector in the UK and elsewhere, this transfer of responsibility from governmental agencies to individuals is attractive to policy makers as a cost effective means of addressing the externalities of travel. This has prompted interest in a range of collaborative travel apps by organisations keen to facilitate car share as well as app developers who recognise this potential of ubiquitous media. There are some notable success stories such as Waze, a community-based traffic and navigation app where drivers share real-time traffic information (Waze Mobile, 2014), however, systems such as these largely enable people to manage their individual car use better. An evidence base on the effectiveness of collaborative travel apps where space vehicle capacity is shared either to carry people (lift share) or items (for example, shopping) has yet to emerge and preliminary studies show barriers in the UK to user acceptance (Cruickshank et al., 2013). The generalised exchange embedded in collaborative travel apps that requires off-line presence to fulfil tasks is undertheorised and has the potential to develop new forms of economic value (Harvey et al., 2013). This is especially significant in the transport field given that the largest collaboration gains may come from sharing vehicles (Fremstad, 2014).

This paper reports on a project which designed, built and tested a series of purpose built travel collaboration apps across a range of domains: tourism; urban and rural communities; and logistics. The trials identify a number of barriers to user adoption. The aim of the paper is therefore to analyse the fundamental challenges in user adoption of collaborative travel apps.

1.1. Vehicle use practice

Over a period of time the car has become embedded in day-to-day life to such an extent that alternatives to the car are not just unattractive but in many instances unpractical. The car has not only altered travel practice but has fundamentally altered how society operates. New technology has also led to new car based practices. For instance, our shopping practice has

seen some interesting changes from the dedicated trip generating out-of-town shopping complexes of the 1980's and 90's to the 'click-and-collect' phenomenon of today, allowing retailers to avoid the potential headaches of failed home deliveries by having the customer come into-store via their own transport to collect purchases. In logistics, the growth in on-line sales has led to increased courier activity with smaller vehicles being used, carrying less-than-full loads and operating to fairly dynamic collection and delivery schedules. With the Consumer Contracts Regulations allowing 14 days for consumer's to change their mind on on-line purchases, reverse logistics in the retail sector has seen many 4th party logistics providers emerging, often contracted householders using their own vehicles, to return goods from consumers to suppliers. While logistics providers utilise optimisation techniques to maximise the efficiency of their vehicles under such circumstances, this is nearly always done in isolation and little collaboration and shared use of vehicles occurs between practitioners (McKinnon, 2009).

The social embeddedness of the car presents a problem to national and local government such that initiatives that successfully reduce car dependence are seen as something of a Holy Grail. While car use has reached a level of saturation in recent years in developed countries like the UK, with travel distances remaining stable since 2002 (Banister, 2011; Metz, 2010), congestion and GHG emissions remain a concern. While the emissions standards of vehicles are improving, these improvements alone will fail to meet governmental targets for reduction of GHG emissions under the Climate Change Act 2008 (Hickman et al., 2010). A surprisingly large share of GHG emissions are attributed to trips of less than 10 miles (40% of the UK domestic transport GHG emissions) (Department for Transport, 2011). Many of these are routine work or leisure trips where there is scope to increase vehicle occupancy through collaboration.

The relative cost and poor success rate at addressing transport problems has led public agencies to seek new strategies. Given the embeddedness of the car in contemporary

lifestyles it makes sense to reappraise the way we use cars. To this end, rather than separate people from their cars, it is opportune to consider how spare vehicle capacity might be used more efficiently and collaboratively.

1.2. Smartphones, apps and collaborative travel initiatives

Given car occupancy remains well below vehicle capacity, lift share initiatives are seen as an attractive alternative by policy makers and organisations with sites highly dependent on cars for access. It is a strategy in which users are encouraged to control the context and their choices (Thaler and Sunstein, 2009) and fits the Government agenda of enabling choice (Department for Transport, 2011). There is no need for costly infrastructure, once established the responsibility for organisation is largely transferred to the user and the increasing costs of running a car can make lift sharing an attractive option. Software has been developed to help find lift share partners (for example, carsharedorset.com (Dorset County Council, 2014)) and lift share is seen as a cost effective solution to on-site parking problems, localised congestion and reducing GHG emissions. Travel collaboration is also established in leisure and tourism contexts, particularly lift share to UK music festivals (see, for example, Greener Festival, 2012) where acute traffic management problems arise. These schemes have had some success, but remain one-off activities for most participants. While leisure and tourism is considered less routine than the daily commute, there are distinct spatial and temporal travel patterns at tourism destinations and leisure facilities (Dickinson et al., 2013). Since car occupancy is 1.7 for leisure (visiting friends and relatives and local leisure trips) and 2 for holiday and daytrips (Department for Transport, 2014) there is scope for more lift share in this domain.

There are, however, several reasons why car share has failed to play a more prominent role. People's routines are not as predictable as they might seem and current car share initiatives

lack tools to deal with flexibility (Chen et al., 2011). For example, the need to divert off route to collect a child from an out-of-school activity or flexible working practices can pose organisational problems. Also, with an increasingly dispersed workforce, finding a suitable car share partner can be more difficult than anticipated. Car share initiatives have also proved difficult to operationalize in the UK due to the safety concerns of travelling with strangers (Cruikshank et al., 2013).

Collaborative logistics, on the other hand, are led by an organisational imperative to increase efficiency and range from agreements between two small companies to collaborative logistics networks (Lin et al., 2012). The savings in transport costs can be substantial (Lewis et al., 2010; IGD, 2009), reducing empty running vehicle kilometres and vehicle emissions (Lamb, 2012). The challenge lies in coordination and overcoming inherent competition.

The ubiquitous nature of smartphones makes them an ideal travel tool since they can be used on the move to access and share timely and spatially relevant information (Dickinson et al., 2014). The first wave of apps focused on travel information and route planning, however, more recently organisations have developed apps to facilitate more collaborative use of cars through lift share (for example, Avego Driver) or collaborative shopping (for example, Bringbee). These apps enable users to join a social network and make better use of their collective travel resources, thus potentially removing some car trips.

An overview of collaborative travel apps currently available indicates they operate according to different forms of exchange. Commercial economic exchange underpins many travel apps, even though some purport to have a 'community of users', for example, Uber. These lie outside the interest of this paper. Others operate according to negotiated exchange, which embeds an element of economic reward (Lampinen et al., 2013), such as Bringbee where users pay a small fee for delivery of items. Belk (2014) refers to this as 'pseudo-sharing'. In comparison, reciprocal exchange involves an often 'continuous act of reciprocity'

(Harvey et al., 2013) and typically operates in dyads where there are existing social ties, such as parents who take turns to drop children at school. Travel apps are unlikely to play a role in these contexts, though the person-to-person connectivity of smartphones makes them a useful facilitating tool. There are well established norms of reciprocity in this form of exchange and people seek to benefit others more than themselves and seek to avoid a state of indebtedness (Lampinen et al., 2013). To this end people often turn to the market to avoid indebtedness associated with asking for help (Harvey et al., 2013; Marcous, 2009), for instance, by taking a taxi instead of a lift.

As communities of place have given way to more relational communities (Wellman, 2001), the shift from reciprocal exchange in dyads to more communal sharing or generalised exchange presents opportunities for more asymmetric exchange. This is the main interest of this paper, where collaborative travel apps enable a user to broadcast a request to a wide network of other users and, should she receive help, she may never repay that debt of help directly to the user who helped. While there is growing interest in this form of exchange, there is much less research in this area and new theory is needed to understand unconditional and non-reciprocal gifts (Harvey et al., 2013). Research in Scandinavia indicates that the norms of reciprocity persist in generalised exchange (Lampinen et al., 2013).

Collaborative travel apps also offer various types of transport opportunities from occasional long-distance ride-share to ad-hoc local lifts, travel information exchange and collection of goods. In order to contextualise the range of collaborative travel apps a classification framework has been devised based on the form of exchange and type of sharing opportunities afforded (Figure 1). Collaborative travel apps based on generalised exchange are the focus of this paper.

[Figure 1. Here]

Smartphone technology has the potential to connect collaborators more spontaneously within a social network and thus has scope to overcome the problems of more static systems, however, studies in both the USA and UK suggest establishing norms for the use of such systems is a contemporary challenge (Fremstad, 2014; Harvey et al., 2013). To date there is only anecdotal evidence around the efficacy of these apps. It is not clear what these apps have achieved in relation to user uptake and ultimately the goal of reduced car use.

2. App trials

[names of apps and charity shop have been made anonymous for review]

In order to explore how technology might assist people in the spatial and temporal coordination of travel collaboration, two apps were developed. In a business context, CharityApp allowed Registered CharityShopX's area managers, drivers, shop managers and volunteers to better visualise stock management and transport options both spatially and over time to show the current and projected paths of vehicles along with stock requests from the various parties. Of interest was how the staff and volunteers would use such a tool, what new collaborative partnerships between shops would evolve and what stresses would be placed on the drivers. In a community context, TravelApp, and its derivatives, CampsiteApp and TravelApp2, allowed a community of users to communicate and collaborate with one another, for example, sharing a lift to the doctors or getting help with the shopping. These apps, modified in small ways for different user groups, are collectively referred to in this paper as TravelApp.

Both CharityApp and TravelApp used a common database to record the temporal positions of users along with all messages posted via the respective message platforms. Feeding from

the database, a key feature of both apps was a heat map which allowed users to visualise the historic geo-location traces of others, so that a greater understanding could be gained of movement patterns between places, infrastructure and individuals across time and space (Figure 2). This gives a suggestion of collaborative opportunities, such as where people share the same route to work. Another common feature was the messaging platforms which allowed individuals to post information (requests, notices, offers) to infrastructure within the network (Figure 3). In the case of TravelApp, users could post shopping requests onto local shops which would be notified to others on entering the geo-fence defined around the location. With CharityApp, messages could be posted onto donation banks, shops and drivers' vehicles in a similar way, enabling the community to notify members of opportunities and issues in the area.

[insert Figure 2. TravelApp screen shot illustrating heatmap]
[insert Figure 3. TravelApp screen shot illustrating messaging tool]

In total, 5 trials took place during 2013-2014 (see Table 1) involving 84 participants. The Registered CharityShopX's trials involved paid and volunteer drivers, area managers and shop managers. Drivers used the app to record all stock transactions (deliveries and collections from shops and collections from donation banks) which were shared with the rest of the community via the messaging platform. All messages and transactions were recorded through a linked database and participants interviewed in a before-during-after measures design. Participants for the TravelApp trials were recruited through community based partners and local advertising with the exception of the campsite study where researchers worked with a campsite in Dorset to recruit tourists during their stay on-site. A sample of participants took part in in-depth interviews at the end of the trial. In all trials, participants were either loaned an iPhone with the app pre-installed or the app was loaded onto the participant's personal iPhone where this was available. Participants were asked to engage in collaborative travel activities for the duration of the trial, with lift share, collaborative shopping

and travel information sharing given as examples. Throughout the trials only two participants dropped out, one due to problems shifting from a Blackberry to iPhone platform (Dorset village trial) and one for unknown reasons from the Campsite trial.

[Table 1 here]

Data discussed here were derived from participant interviews and the app database. In addition, data from exploratory interviews with the campsite community during 2012 and a questionnaire survey (n=295) distributed at four campsites based on acceptance of the concept is also discussed.

3. Findings and Discussion

The collaborative travel app concept was generally viewed as a useful tool by the public and charity shop participants. For example, Julie (Somerset Village) suggested it was:

> "a great idea because it would cut down the carbon footprint, it would save on petrol and petrol's expensive, I think it's a great idea".

However, acceptance of the concept was not universal, for instance, only 44% of campsite tourists completing the questionnaire indicating a willingness to use the app. The various local government agencies, commercial and third sector organisations involved in trials were also keen to develop the concept. From their perspective it is community based and led, and cost effective relative to other transport solutions. For example, a charity shop manager identified that new contacts had been made to swap goods and a volunteer driver found:

> "It gives you good visibility of what you are achieving. Even though I've lived in Cambridge for 40 years, I didn't know Cambridge that well and the app has helped me do some planning so if I have 2-3 [collections] to do, so my time management

has got much better since we started using the app, because I can use time more efficiently and save Oxfam money, because I know the locations better".

However, the trails of the TravelApp, in particular, reveal a less positive picture. There was relatively little success with collaborative lifts and shopping, that would reduce car trips and make more optimal use of vehicle capacity, though information sharing proved useful in car trip decision making in the tourism domain. This questions the efficacy of collaborative travel apps. The CharityApp trial, on the other hand, identified a more successful outcome, though this was underpinned by an organisational imperative to utilise the app. The trial findings presented here are orientated around a series of themes that identify fundamental challenges to effectively implement smartphone enabled travel collaboration which emerged across the implementation domains.

3.1. Attracting and engaging users

It was a considerable challenge to attract users to the TravelApp trials, even with appropriate agency and community support as partners and user champions underestimate the difficulty of attracting users. The Somerset Village trial was intended to recruit 30 users, however, the housing association together with researchers struggled to attract 10 users. At the Edinburgh trial, a community champion was integral to the project team and researchers worked closely with several community based partners, yet recruitment remained elusive. Achieving critical mass is vital for collaborative products as they are prone to start-up problems and discontinuation (Markus, 1987; Suhonen et al., 2010). While there is no definitive data on the number of users needed to achieve critical mass for interactive media (Markus, 1987), it was clear that too few users resulted in a low level of activity. Given that a quarter of apps are used only once (Localytics, 2011), an isolated user of a collaborative travel app would find the system has no value. The app would be deleted.

Within a commercial environment, the organisation imperative generally makes app use mandatory. At the time of the research, the Registered CharityShopX's network was split into 32 regions, each under the jurisdiction of an area manager who would oversee a number of shops and donation banks being serviced by both paid and volunteer drivers. Several area managers expressed an interest in trialling the app but, from the three regions chosen (Cambridgeshire, Hertfordshire, Dorset), not all the shop managers participated due to personal choice and through access to the technology. From the trials, some key lessons were learned about participation and set-up:

i) Younger, smartphone enabled managers, with good social ties in their region were more likely to participate and actively engage with the app

ii) Area manager buy-in to the concept and promotion amongst the staff was vital to engagement

iii) For maximum impact, all managers and drivers in the region need to participate in the trial

Once a user base is established, poor app functionality was a prime reason for loss of engagement in both TravelApp and CharityApp trials, and is an inevitable feature of trials. In addition, the Registered CharityX and Campsite trials experienced technical problems related to poor 3G signals and lack of wifi in Registered CharityX's shops compromised Internet connectivity. The lack of an Android version meant some existing smartphone users had to borrow a project iPhone and carry two phones with them. This decreased engagement in the Registered CharityX's trial and illustrates how vital it is to build apps across multiple platforms. When user's participate using their personal phones, operating system software updates can be updated routinely by some and not by other participants which can have an impact on app functionality in some cases.

Beyond technological barriers, the main barrier to engagement across all trials lay in users identifying a need for the app. Many participants remained 'lurkers', choosing only to observe activity, though this can be vital to learn about a system and its norms (Suhonen et al., 2010). Where an on-line system is designed to enable real-world activities, too many users reluctant to take the first step to post a message can undermine exchanges. For example, Daniel (Somerset Village trial) suggested "if there were more people needing my help it would have perked me up". Similarly, Cathy (Registered CharityShopX trial) illustrates feelings of alienation in the logistics domain:

> "in order to create a community you need to send messages to that community and I thought that was going to happen to this, I thought I would have access to much more stuff or appeals from people for more stuff and it does not really come through at the moment, it makes me almost not want to switch it on sometimes, because there is not going to be anything new there".

Harding et al. (2013) also found users were poorly motivated to contribute material to a social travel information system and Suhonen et al. (2010) suggest on-line exchange systems make passive use more visible so other users realise the lurkers are using the system. Related to this, a more significant problem was users seeking help.

3.2 Giving and receiving travel help

The TravelApp trials recruited participants to engage in travel collaboration, with lift share and collaborative shopping being given as examples, however, very little activity of this type took place. Offers of help far exceeded requests for help and few people took up offers of help. To operate effectively collaborative systems need a reciprocal balance of people offering and seeking help. Theory indicates people have a desire to build credit in the social

exchange system prior to asking for help (Coleman, 1988). By giving help people can expect to receive help in the future (Plickert et al., 2007). However, this expectation is rooted in exchanges where community members know one another and the exchange is reciprocated through dyads. Collaborative travel apps work on the principal of generalised exchange, as the reciprocity is indirect. Someone who offers help may never directly receive help in return from the recipient. The norm to reciprocate is a central feature of all forms of social exchange (Lampinen et al., 2013).

Despite the relative anonymity enabled by the app when posting requests, psychologically there is an identity issue as people do not wish to be seen to be in need of assistance, or wish to expose themselves to feelings of indebtedness (Greenburg and Shapiro, 1971). Studies in other domains show these feelings can be profound and lead to feelings of humiliation such that people seek to escape indebtedness by resorting to the market (Marcous, 2009). For instance, a taxi might be booked as an alternative to a lift share. Julie (campsite tourist), a non-car owner, described her discomfort that her daughter was repeatedly given a lift home from a leisure activity and she was unable to reciprocate. Similarly, Elaine (Somerset Village, non-car owner) felt she was a poor candidate for the app trial as "it's not like I could repay the favour". In this respect, using the TravelApp is a 'double' behaviour change, not only must users engage with an app, but also with collaborative travel.

In addition, many participants took part in order to help others. For instance, Margaret (Edinburgh Community) stated: "there wasn't really anything that I needed anybody to do for me. I have a car and it was more if I could do anything for other people". The trial contexts therefore inadvertently brought together communities of 'helpers'. People enjoyed giving help and Suhonen et al. (2013) believe it is valuable to demonstrate this to those being helped in order to overcome the sense of indebtedness. The two later TravelApp trials specifically targeted contexts where the agencies involved considered there was a level of

social disadvantage and transport poverty where people would seek help (Somerset Village and Edinburgh Community). However, these trials reinforce that few were willing to ask for, or accept, help. Given the literature across North America and Europe on the problem of reciprocity, this is not a cultural condition specific to the UK.

A further explanation for offering help was the desire to take part, but a resistance to losing the freedom of personal car use. Some offers of help were very specific to individual routines and unlikely to prove attractive to many other participants. This is a constraint evident in other collaborative travel schemes (Parker et al., 2011). Some participants were also very open about their desire to maintain their personal car use. They would be willing to help others, but unwilling to put themselves at the risk of system failure. Even a community champion who stated he would ask for lifts once the trial was underway failed to do so. Requests for help were additionally limited in the campsite trial by the predominance of families. While family groups could readily ask for items of shopping, lift share was less feasible given the need for four or five spaces in a car.

Freecycle, an on-line social network for exchanging unwanted household items, has overcome the indebtedness problem by establishing a protocol where new users should offer items prior to posting a request. Since offers of help were not lacking in this trail, this suggests travel collaboration systems need protocols that overcome cultural norms of reciprocity, where users should ask for or accept help as well as offer help. Here information exchange may play a role as this was often the first step to engagement with the app and involves no further commitment. This was readily identified as a positive feature in the tourism domain where many users had limited knowledge of their surroundings and sought information. For example, a tourist posted a message to establish if the local steam train would carry cycles. Other tourism related travel information shared and requested included: traffic congestion; full car parks; local attractions; weather conditions; and special events that induced traffic problems. This is a valuable form of collaboration since it enables people to

avoid making aborted trips and is a feature of successful travel information sharing apps such as Waze. Information sharing is also a useful way to build credit in the system as it does not prompt reciprocation (Lampel and Bhalla, 2007). However, comparatively little travel information was shared in the other TravelApp trials in day-to-day life. Users indicated less time to engage with the app in this way in the home environment.

During the later stages of the campsite and the Edinburgh trials some collaborative activities were initiated by a researcher, who was part of the user community, who posted requests for items of shopping and lifts to generate activity. Aside from one failed lift request, these proved successful. There was also some limited evidence that exchanges were more successful in the two communities in greatest need (Somerset Village and Edinburgh community).

In the Registered CharityShopX trial, reciprocation was more of an established norm for the organisation. Here the need for assistance did not present a personal identity issue since it was pursued with Registered CharityShopX's objectives in mind. Any request for help is for a third party which reduces indebtedness (Lampinen et al., 2013). Most managers recognised that some shops received far more donations than could be managed by one outlet and therefore a reciprocal response was not essential:

> "I am happy to give other shops spare stock for the greater good (of Registered CharityShopX). I understand that other shop managers who struggle to get stock are more precious about keeping what they have". (Lucy, Registered CharityShopX trial)

However, reciprocity issues were still apparent. For example, one manager, Cathy, stated "it should be a, 'I'm looking for X, and by the way, I've got Y to give in return'. You should have a swop mentality". This illustrates the norm to give as well as take, an issue reinforced by Lucy:

"I think that is really naughty of X, X won't take the unsorted stock, but wants specifics back, that just means that the time is spent in the shop having to sort through and give X specifics, it is not really how it works."

Both TravelApp and CharityApp trials indicate an app protocol should be established. In a commercial organisation rules can be contractually applied.

3.3 incentives

Small incentives, consisting of £10 vouchers to spend locally, were used during TravelApp recruitment and in the two later TravelApp trials to encourage on-going app use as a partial recompense for the time and effort involved. However, their value in recruitment and engagement is questionable. Participants almost universally agreed to take part before the incentive was mentioned. Although there is some limited evidence that incentives enhanced engagement with the app through generating a sense of debt to the project, there is also evidence incentives proved counter-productive. For example, in Edinburgh, the trial was based around a Time Bank group (people offer their time and skills in exchange for the skills of others) and participants felt incentives ran counter to the free giving of time to the community, for example:

"because of the £10… I think it put people off, the voucher bit … it's because ye dinnea like to, because the Time Bank's all about getting credit, doing stuff and getting credit, it's not about money." (Roy, Edinburgh Community)

Roy stated that this was true for at least two other participants: "G had it on his phone and E but none of us would reply to it. We would have normally if it wasn't for the £10."

Some apps on the market embed financial transactions using systems such as PayPal. Through these users offering lifts or collecting shopping can receive small payments to cover costs, a form of negotiated exchange. Our findings suggest this would have limited impact on incentivising transactions in a collaborative community, however, this might alleviate the receiver's feelings of indebtedness as Lampinen et al. (2013) suggests receivers seek to offer small tokens of appreciation.

Incentives were not included in the CharityApp since there was an organisational imperative to take part and an implicit incentive for volunteers to help the charity objectives.

3.4 Subjective time pressure

Message analysis illustrates how a collaborative travel app can devolve responsibility for organising sustainable travel to users (Table 2). Despite contextual differences, some similarities are apparent between the organisational and individual context. The Registered CharityShopX Cambridgeshire trial revealed significant differences between the timing of communications ($F_{(6,374)}$ = 5.68, p<0.001, Mse= 0.038). Significantly, 44% of messages were sent after 17:00 in the manager's own personal time. The CharityApp also transferred pressure to the van driver who, having his location constantly displayed to the members of the community, would receive more requests for servicing and errands which he would try to manage within his schedule. This led to some inefficiency in the supply chain with a tendency to 'back track' on the round. TravelApp was designed to enable fluid arrangements that enabled participants to take more control of time, however, similar to the van drivers, tourists identified new time pressures generated by the app, for example:

> "it started to make me plan and I just… I don't want to plan and that's probably where
> I found it difficult… when you want to put a message up to say 'we're going past the

Co-op on our way home from the beach, anyone shout if you need anything', then you're committed to going." (Joselyn, campsite tourist)

Given that people experience subjective time pressure associated with meeting a series of scheduled tasks in their daily lives (Dickinson et al., 2013), future systems need to consider how message alerts can be tailored to an individual's ability to respond.

[Table 2 here]

3.5 Community

The Registered CharityShopX trial opened up new collaborative opportunities where managers had little or no prior contact. For example:

"I didn't even have any contact with X prior to the app so that [new collaboration undertaken] is good. It was nice to swap tips and help each other out" (Jenny, Registered CharityShopX trial)

This was recognised as a benefit by most study participants across all domains, however, initial work in tourism identified some concerns since the temporary nature of the community and the lack of face-to-face contact does not affect the same one-to-one obligation normally encountered when requesting or offering help. 'Freeloading' was a particular concern, for example:

"…..if you felt exploited, I think there must be a line between what feels reasonable and unreasonable requests" (Luke, campsite tourist)

Participants indicated excess requests for help would put them off participation, a feature managed by guidelines in the on-line Freecycle community (Nelson and Rademacher, 2009)

Collaborative travel apps represent new forms of community that may not be easy for users to grasp (Harding et al., 2013). Many apps currently on the market assume users will join an unspecified social network. Collaborative travel apps therefore present obstacles as users need to bridge beyond their immediate social support network to the resources of unknown others. The apps deployed in these trails aimed to connect users with some pre-existing community, whether this was the campsite, rural village or workplace. This partially overcame the sense of 'distance' from other users and raises issues of 'presence', that is the degree of social contact and communication, virtual or real, and knowledge of other users that is needed to build enough trust for transactions to take place. Harding et al. (2013) found that lack of trust in travel information is a key reason to abandon systems. On-line auctions enhance trust by providing user feedback, however, this was resisted by potential users during the design phase as users realised they might ultimately meet other users they had rated leading to social awkwardness. There was some desire for face-to-face contact to build a degree of trust, though many users did not see this as essential and collaboration occurred without this. Those with existing social ties in the Registered CharityShopX trial collaborated more, however, the campsite trial suggested that existing social ties could limit engagement since people can initiate collaboration via other forms of communication (for example, email, text, phone calls, face-to-face meeting). In this respect, although the apps' messaging platform proved to be a good medium for communication, this did not totally replace traditional communication channels.

In the case of the CharityApp, working in a business setting, communication often involves more complex tasks and the exchange of subtle information which is more difficult to convey via SMS (Lee et al., 2007). As a result, collaborative transactions would often be started through the app, leading onto telephone and face-to-face communication which has been

observed in other settings (Suhonen et al., 2010). The app therefore initiated other forms of communication that would not have otherwise taken place. For instance, five managers in the Registered CharityShopX trial started their own Facebook group and, at the Dorset village, a participant set up a Facebook group to share experiences of the app and to provide a help forum for users.

Community champions can play a key role in recruiting participants and initiating activities, however, the role of community champions is complex. For instance, a well-meaning champion who posts lots of messages may overwhelm other users who disengage with the app. Conversely, an apparently enthusiastic community champion in one of the TravelApp trials failed to fulfil a key role in asking for lifts and it was clear that community champions can underestimate the commitment needed to initiate activities and become as frustrated as other users by lack of activity.

Champions should have a well-established connection to the community, be in a position to positively influence participants and should share similar characteristics to other participants. Champions need to understand the commitment required and roles and responsibilities should be agreed at the start, especially where champions are rewarded with financial or other forms of incentives which can be made contingent on completing certain tasks. Several champions will be more effective than a single champion and enthusiastic adopters can be recruited as additional champions during trials. Where researchers initiated activities, this proved particularly effective and such activity would be best driven by champions within the community.

A fundamental challenge is identifying appropriate communities or contexts in which to launch a collaborative travel app. Our evidence base suggests good opportunities lie in communities where transport access is a problem. Here the community is more likely to

identify with a need for the app. However, there remain questions about the strength of existing social ties that require further research.

4. Conclusion

The extension of our physical social networks through ubiquitous technology is changing the nature of communities revealing innovative sharing pathways which have shifted from reciprocal dyads to more communal forms of sharing mediated online, offline and in-between. Smartphone technology has provided a new substrate to enable forms of travel collaboration and has the potential to facilitate more seamless connections between individuals based on real-time location based data and anticipation of travel patterns based on historic data feeds. This overcomes some of the limitations of more static car share schemes which tie people to particular routines, routes and times. To date exploitation of this technology and data feeds has largely been top down and exploited by new industries to boost trade, for instance in the development of the Uber travel app. Collaborative travel apps that set out to co-create value bottom up in social systems, through generalised exchange and sharing across communities, are of inherent interest to policy makers, but have received little attention in research.

Community based collaborative travel apps have a potential role to play in the government's localism agenda (Localism Act, 2011) which seeks to empower the community to be self-reliant, particularly at time of dwindling public sector resources. They also present potential new mechanisms to support an ageing population with increasing accessibility needs (Musselwhite and Haddad, 2010). In this respect collaborative travel apps are new tools that can enable people to coordinate travel activities more effectively by working with the existing travel system. However, users do not always adopt tools as intended and there can be unintended consequences of use which may lead to less than sustainable transport

pathways. Therefore the policy challenge lies in directing users to positive rather than negative outcomes. There remains much to be understood about how new forms of social cohesion, citizen engagement and sharing communities might impact in the travel domain. Given that contemporary communities are emergent and organised around interpersonal relationships that can be independent of spatial constraints (Wellman, 2001) there are challenges for governance to facilitate community based collaborative travel that leads to the desired outcome of less car travel.

Through the design and implementations of collaborative travel apps we have analysed and identified several fundamental challenges in user adoption. To make a useful contribution to transport policy practitioners and app developers need to be aware of the following when designing or implementing a collaborative travel app.

1. *Attracting users and identifying user need*. Background work is needed to identify potential users and to promote the concept to the community. This should involve community champions, outline benefits to users and illustrate how it might meet their needs. A marketing strategy will help targets apps to appropriate users since participants without a need for the product will not engage. A critical mass of users is vital and providers should anticipate start-up problems. Collaborative travel apps will need to develop strategies to tackle discontinuation problems. Revealing passive app use, such as lurking, may be one strategy to boost user confidence.

2. *Helping and being helped.* Collaborative travel apps require a balance of helpers and those seeking help. Systems need to be designed to make it easy for people to ask for help. Opportunities to achieve this include: user champions providing opportunities for new users to respond to help requests to build credit in the system; a protocol to establish norms for reciprocal exchange, emphasising the need to ask for or accept help and to reassure users with concerns about 'freeloaders' and indebtedness; visualising successful exchanges to show users that this is the norm;

sharing information as a means to build credit; demonstrating how users who give help may also benefit.

3. *Incentives* need careful management and can be counter-productive. The role of incentives needs to be agreed with user groups in advance. Systems that better visualise exchanges and promote norms of user may better incentivise exchanges.

4. *Subjective time pressure* can be generated by app systems that involve users in off-line activities. Further work is needed to design mechanisms to tailor systems to individual needs to avoid additional time stress.

5. *Community.* New forms of community form from collaborative travel apps that seek to bridge users beyond traditional support networks. This raises questions about trust and the degree of social contact and communication needed to establish generalised reciprocity. Questions remain about the role of existing social ties and further research is needed. Community champions have a role to play and communities where there are transport access issues are likely to be most receptive.

These challenges identify a number of areas for further research, the most prominent of which is understanding how to manage the sense of indebtedness that currently inhibits app use. Looking to the near future, there are opportunities presented by the increasing connection of objects, including vehicles, to the Internet of Things. The Internet of Things, with its more anticipatory systems, will prompt a reappraisal of current Internet based collaborative communities. This presents opportunities for parties who are less able to reciprocate, such as the ageing population, and to alleviate subjective time pressure by revealing timely collaboration opportunities.

References

Atabani, A.E., Badruddina, I.A., Mekhilef, S., Silitonga, A.S. 2011. A review on global fuel economy standards, labels and technologies in the transportation sector. *Renewable and Sustainable Energy Reviews*, 15, 4586–4610.

Banister, D. 2011. The trilogy of distance, speed and time. *Journal of Transport Geography*, 19(4), 950-959.

Belk, R. 2014. Sharing Versus Pseudo-Sharing in Web 2.0. *Anthropologist*, 18(1), 7-23.

Cairns, S., Sloman, L., Newson, C., Anable, J., Kirkbride, A., Goodwin, P., 2004. Smarter Choices – Changing the Way We Travel. Retrieved 15 November 2014, from https://www.gov.uk/government/publications/smarter-choices-main-report-about-changing-the-way-we-travel

Chen, C.-M., Shallcross, D., Shih, Y.-C., Wu, Y.-C., Kuo, S.-P., Hsu, Y.-Y., Holderby, Y., Chou, W., 2011. Smart Ride Share with Flexible Route Matching. *13th International Conference on Advanced Communication Technology (ICACT)*, Feburary 13-16 2011*.*

Coleman, J. S., 1988. Social Capital in the Creation of Human Capital. *American Journal of Sociology 94 (Supplement: Organizations and Institutions: Sociological and Economic Approaches to the Analysis of Social Structure),* S95-S120.

Cruickshank, S., Cherrett, T., Waterson, B., Norgate, S., Davies, N., Speed, C., Dickinson, J., 2013. Will privacy concerns limit the ability of smart phone technologies to help foster collaborative school travel? *13-0525. 92nd Annual Meeting of the Transportation Research Board*, Washington, D.C., U.S.A., January 2013

Department for Transport, 2011. *Creating Growth, Cutting Carbon Making Sustainable Local Transport Happen*. Retrieved August 15 from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/3890/making-sustainable-local-transport-happen-whitepaper.pdf

Department for Transport, 2014. *Vehicle mileage and occupancy*. Retrieved Sept 10, 2014 from https://www.gov.uk/government/statistical-data-sets/nts09-vehicle-mileage-and-occupancy#table-nts0906

Dickinson, J.E., Filimonau, V., Cherrett, T., Davies, N., Norgate, S., Speed, C., Winstanley C., 2013. Understanding temporal rhythms and travel behaviour at destinations: potential ways to achieve more sustainable travel. *Journal of Sustainable Tourism,* 21(7), 1070-1090.

Dickinson, J.E., Ghali, K., Cherrett, T., Speed, C., Davies, N., Norgate, S., 2014. Tourism and the smartphone app: capabilities, emerging practice and scope in the travel domain. *Current Issues in Tourism,* 17(1), 84-101.

Dorset County Council, 2014. *Carsharedorset.com*. Retrieved August 15 from https://dorset.liftshare.com/

Fremstad, A, 2014. Gains from Sharing: Sticky Norms, Endogenous Preferences, and the Economics of Shareable Goods. *Economics Department Working Paper Series.* Paper 168. http://scholarworks.umass.edu/econ_workingpaper/168

Greenburg, M.S., Shapiro, S.P., 1971. Indebtedness: An Adverse Aspect of Asking for and Receiving Help. *Sociotnetry*, 34(2), 290-301.

Greener Festival, 2012. *Traffic congestion and travel.* Retrieved from: http://www.agreenerfestival.com/traffic-congestion-travel/

Harding, M., Finney, J., Davies, N., Hannon, J., 2013. Experiences with a Social Travel Information System. *UbiComp'13*, September 8–12, 2013, Zurich, Switzerland.

Harvey, J., Golightly, D., Smith, A., 2013. Researching gift economies online, offline and in-between. *DE 2013: Open Digital*, 4-6 Nov, Media City, Salford. Retrieved September 12, 2014, from http://de2013.org/wp-content/uploads/2013/10/de2013_submission_23.pdf

Hickman, R., Ashiru, O., Banister, D., 2010. Transport and climate change: Simulating the options for carbon reduction in London. *Transport Policy*, 17, 110–125.

IGD, 2009. How Nestlé and United Biscuits are working together to share resources. Retrieved September 14, 2013, from http://www.igd.com/Nestle_and_United_Biscuits_collaboration.

Lamb, J., 2012. How Collaboration Trimmed Truck Travel by 204m Miles. Retrieved August 14, 2014, from http://www.supplychainstandard.com/liChannelID/3/Articles/4018/How+collaboration+trimmed+truck+travel+by+204m+miles.html.

Lampel, J., Bhalla, A. 2007, The Role of Status Seeking in Online Communities: Giving the Gift of Experience. *Journal of Computer-Mediated Communication*, 12, 100–121.

Lampinen, A., Lehtinen, V., Cheshire, C., Suhonen, E., 2013. Indebtedness and reciprocity in local online exchange. *Proceedings of the 2013 conference on Computer supported cooperative work (CSCW '13)*. ACM, New York, NY, USA, 661-672. DOI=10.1145/2441776.2441850 http://doi.acm.org/10.1145/2441776.2441850

Lee, M., Cheung, C., Chen, Z., 2007. Understanding user acceptance of multimedia messaging services: An empirical study. *Journal of the American Society for Information Science and Technology*, 58, 2066–2077.

Lewis, A., Fell, M., Palmer, D., 2010. *Freight Consolidation Centre Study*. Department for Transport.

Lin, C., Lam C. H. Y., Wong, D.W.C., 2012. A web-based intelligent collaborative logistics management decision support system for enhancing the cost effectiveness of door-to-door delivery. *Technology Management for Emerging Technologies (PICMET)*, Vancouver, BC.

Localism Act 2011. Available from: http://www.legislation.gov.uk/ukpga/2011/20/contents/enacted

Localytics, 2011. *First Impressions Matter! 26% of Apps Downloaded in 2010 Were Used Just Once.* Retrieved February 12, 2012, from http://www.localytics.com/blog/2011/first-impressions-matter-26-percent-of-apps-downloaded-used-just-once/

Marcous, J.-S., 2009. Escaping the Gift Economy. *Journal of Consumer Research*, 36(4), 671-685.

Markus, M.L., 1987. Toward a "Critical Mass" Theory of Interactive Media: Universal Access, Interdependence and Diffusion. *Communication Research*, 14(4), 491-511.

McKinnon, A., 2009. Innovation in Road Freight Transport: Achievements and Challenges. *The International Transport Forum/IMTT Seminar on Innovation in Road Transport: Opportunities for Improving Efficiency*. Lisbon, 2nd October 2009. Retieved September 16, 2014, from http://www.internationaltransportforum.org/Proceedings/Lisbon2009/1-McKinnon.pdf.

Metz, D., 2010. Saturation of demand for daily travel. *Transport Reviews,* 30(5), 659–674.

Musselwhite, C., Haddad, H. 2010. Mobility, accessibility and quality of later life. *Quality in Ageing and Older Adults, 11*(1), 25 – 37.

Nelson. M,R,, Rademacher, M.A., 2009. From trash to treasure: Freecycle.org as a case of generalized reciprocity. *Advances in Consumer Research,* 36, 905–906.

Parker, J., Walker, C., Johnson, R., 2011. What can we learn from car sharing experiences in the UK? *Proceedings of the ICE - Transport*, 164(3), 181 –188.

Parliament UK, 2010. *Supplementary memorandum from Liftshare (MRN 15A).* Retrieved February 12, 2012, from http://www.publications.parliament.uk/pa/cm200910/cmselect/cmtran/505/505we18.htm

Plickert, G., Côté, R.R., Wellman, B., 2007. It's not who you know, it's how you know them: Who exchanges what with whom. *Social Networks,* 29 405–429

Schwanen, T., Banister, D., Anable, T., 2012. Rethinking habits and their role in behaviour change: the case of low-carbon mobility. *Journal of Transport Geography*, 24, 522–532.

Speed, S., Shingleton, D., 2012. An internet of cars: connecting the flow of things to people, artefacts, environments and businesses. *Proceedings of the 6th ACM workshop on Next generation mobile computing for dynamic personalised travel planning (Sense*

Transport '12). ACM, New York, NY, USA, 11-12. DOI=10.1145/2307874.2307883

http://doi.acm.org/10.1145/2307874.2307883

Suhonen, E., Lampinen, A., Cheshire, C., Antin, J., 2010. Everyday favors: a case study of a local online gift exchange system. *Proceedings of the 16th ACM international conference on Supporting group work (GROUP '10).* ACM, New York, NY, USA, 11-20. DOI=10.1145/1880071.1880074 http://doi.acm.org/10.1145/1880071.1880074

Thaler, R.H., Sunstein, C.R., 2009. *Nudge: Improving Decisions About Health, Wealth and Happiness.* Penguin Books, Colchester.

Waze Mobile, 2014. *Get the best route, every day, with real–time help from other drivers.* Retrieved August 15, 2014 from https://www.waze.com/

Wellman, B. 2001. Physical Place and Cyberplace: The Rise of Personalized Networking. *International Journal of Urban and Regional Research*, 25.2, 227-252.

Table 1. App trials

Trial app	Dates and duration	Context	Users (n)
TravelApp	June 2013 2 weeks	Dorset Village	10
CampsiteApp	July/August 2013 5 weeks	Tourism – Dorset Campsite	37 over a rolling 5 week period
TravelApp	Dec 2013/Jan 2014 6 weeks	Somerset Village	8
TravelApp2	April/May 2014 7 weeks	Edinburgh urban fringe community	11
CharityApp	Mar-Sept 2013 Each trial lasted 3 months	CharityShopX Shop managers and drivers in Dorset, Cambridgeshire, Hertfordshire	18

Table 2. Registered CharityShopX Cambridgeshire community messages

Type of message	Percentage[*]
Requests for stock	11
Offers of stock	8
Information of stock collected and available for cascade by driver	21
General information and queries	19
Social chat	15
Confirmations that messages had been read and understood	20
Operating the app	6

*Percentage of 407 messages exchanged over 93 days by 10 participants

Form of exchange

Transport opportunities	Commercial exchange: collaborative travel organised for commercial gain	Negotiated exchange: collaborative travel which embeds an element of economic recompense for the provider but on a non-commercial basis	Generalised exchange: intra-community sharing where travel resources are offered and utilised freely across a community as non-reciprocal gifts
Long-distance travel			
Local travel			
Transport of goods/shopping			
Travel information			
Logistics			

Figure 1. Classification framework for collaborative travel apps
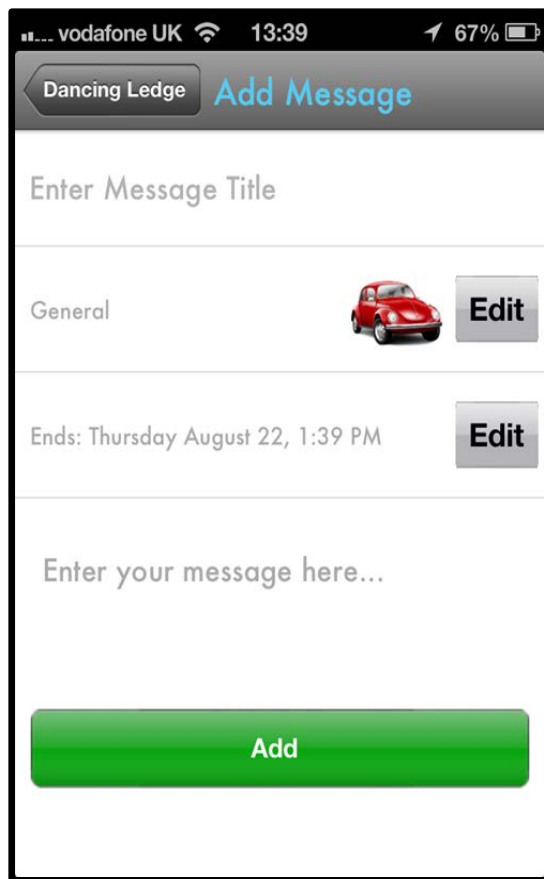
Figure 2. TravelApp screen shot illustrating heatmap

Figure 3. TravelApp screen shot illustrating messaging tool