Collaborative Travel Apps, Reciprocity and the Internet of Things

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Abstract

As cities become increasingly connected, both people and objects can connect to the Internet to transmit and receive information. This is the Internet of Things. Smartphone technology can help identify current and anticipate future patterns of behaviour and, with its social networking capabilities, allow users to imagine collaborative opportunities. This has led to the development of collaborative travel apps designed to enable activities like lift sharing. However, two projects working with community based travel collaboration apps identify significant challenges to people accessing forms of travel assistance due to the imperative of reciprocity.

Collaborative travel apps depend on users to offer help, but they also need users to ask for or accept help. This paper analyses the fundamental challenges of reciprocity as facilitated by these apps and considers how the near future Internet of Things might alter practices.

Trials of purpose built collaborative travel apps were conducted across four communities (a campsite, two rural villages and an urban fringe estate) during 2013 and 2014 involving 66 participants. Data were collected by in-depth interviews and all app activities (messages and transactions) were recorded through a linked database.

Offers of help dominated in contrast to requests for and acceptance of help. Feelings of indebtedness inhibit app use since they threaten a user's status, power and freedom of action with respect to the donor of help. Other transport issues of flexibility and control were also apparent. The paper discusses how indebtedness might be addressed during the design and implementation of such apps. Also, the emergence of the Internet of Things, with its more anticipatory systems, prompts a reappraisal of current Internet based collaborative communities which raises questions about the human regulation of reciprocal arrangements and presents opportunities for parties who are less able to reciprocate such as the ageing population.

Introduction

Cities are becoming more connected as we move beyond the people-to-people Internet to the Internet of Things (IoT) through which objects can share information about their location and current state with the network (Innovate UK, 2014). By 2020, Cisco Systems Inc (2014) has estimated that there will be 50 billion connected things. Transport has been one of the fields leading the way in the IoT. For example, buses connect to the Internet to reveal real time location information and in highways maintenance, gritting vehicles tweet when they have gritted a stretch of road. At the same time, the growing adoption by consumers of smartphones (73% own a smartphone as of June 2014) and smart devices that can communicate their state (for example, fridges and central heating systems) (Mintel 2014) is increasing our ability to access and share information on the move. This potential for people and things to communicate presents new opportunities to anticipate future travel patterns and to access transport more opportunistically.

Of particular interest to this paper are opportunities to collaborate with others to share spare vehicle capacity. While it is evident from traffic congestion that daily and seasonal travel routines coincide, as individuals, our trips can be more ad-hoc as we seek to accomplish a variety of tasks in a series of trip chains. This presents a fundamental challenge to car sharing as individuals seek to maintain control of their personal mobility and flexible opportunities. Therefore the ability to more fluidly anticipate connections with others in a shared network using smartphone technology appears to present a more flexible opportunity to use spare vehicle capacity that avoids binding individuals to set departure times and routes.

There are a growing number of travel apps that are beginning to exploit the opportunities to share location based data to enable users to lift-share and collect shopping for others (see, for example, Avego Driver and Bringbee). These are attractive to policy makers, at a time of dwindling public sector resources, keen to find cost effective ways to tackle transport issues and also represent an opportunity to empower communities as set out in the Localism Act 2011. However, research has identified a number of challenges to the implementation of collaborative travel apps, for example, achieving a critical mass of users, trust, freeloading and subjective time pressure (Dickinson et al., 2014). A fundamental challenge analysed here is the norm of reciprocity which constrains people's ability to ask for help due to a sense of indebtedness. The aim of this paper is therefore to analyse the challenges of posed by reciprocity as facilitated by these apps and consider how the near future IoT might alter practices.

Collaborative travel and reciprocity

Collaborative travel can be categorised as a negotiated, reciprocal or generalised exchange. In a negotiated exchange there is an economic reward. For example, using the Bringbee app, a user can be paid to collect shopping for another user (Bringbee, 2014). In comparison, reciprocal exchange involves an often 'continuous act of reciprocity' (Harvey et al., 2013) with another person or persons in your social network. For example, parents taking it in turns to take their children to sport training. There are well established norms of reciprocity in this form of exchange and we seek to benefit others more than ourselves. Gouldner (1960) saw this as mechanism to avoid powerful individuals exploiting others and a contributor to stability in society. To reinforce this, a state of indebtedness is felt as a threat to an individual's status and power, thus people seek to avoid this (Greenburg and Shapiro 1971; Lampinen et al 2013). For instance, Sherry (1983 p157) suggests a gift, or in this instance a lift, can be "a vehicle of social obligation and political manoeuver" and he argues research should focus on the structure of the exchange process.

Previous research has shown that people often turn to the market to avoid indebtedness, the sense of loss of freedom and sense of humiliation (Harvey et al 2013; Marcous 2009). For instance, someone might choose to pay for a taxi rather than take a lift. Marcous (2009) suggests there may be some preference to seek help from more distant ties to avoid tensions in closer social networks. While early research on reciprocity recognised that some

people do not have the ability to reciprocate (for example, children, the elderly and people with certain disabilities (Gouldner 1960), Uehara (1995) and Marcous (2009) identified that even where such people are in need of help they are inclined to reject assistance. In these instances, when people receive help but are unable to offer tokens of thanks, Uehara (1995 p498) describes help as "'morally unavailable' to people" and identifies this is a significant area for research. This problem is apparent in travel where someone might forgo lifts due to the inability to reciprocate (Dickinson et al 2014).

With the advent of social networking systems, there has been a shift from reciprocal exchange in dyads to more communal sharing or generalised exchange. Collaborative travel apps where there is no economic reward represent this form of exchange which may be asymmetric as a user broadcasts 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. In particular there is a need for research where online exchanges lead to offline activity to facilitate the exchange, as in a travel collaboration app, and new theory is needed to understand unconditional and non-reciprocal gifts (Harvey et al 2013). In generalised exchange the norms of reciprocity persist. For instance, Lampinen et al (2013) found that people would rather give too much or withdraw from participation altogether in an online community exchange system and, in sharing events, the need to reciprocate is so strong that people need to be persuaded to take things for free (Albinsson and Perera 2012).

It is vital in reciprocal travel systems that users feel able to ask for help as help givers are otherwise not aware help is needed. Therefore, collaborative travel apps, which currently rely on a high degree of human agency, struggle to overcome the individual's desire to build credit in the exchange system. The outcome is a lopsided system where help givers dominate and few users accept or request help (Dickinson et al 2014). This is where the IoT presents new opportunities and Harvey et al (2013 p2) identify that "future research should attempt to understand how networked technologies can help to reduce the experience of interpersonal indebtedness that occurs in gift economies with different forms of property." This may be especially important in the transport field as the largest gains from collaboration may come from sharing private vehicles as this is such an underutilised resource (Fremstad 2014). At the present time, new models of economic exchange are emerging that provide alternative ways to access resources such as cars without ownership (Bardhi and Eckhardt 2012). Theory suggests it will take time for people to both develop appropriate norms for sharing privately owned vehicles and to like this form of sharing as preferences have emerged for personal vehicle ownership (Fremstad 2014).

Collaborative Travel Apps Study

Data for this paper are drawn from trials of purpose built collaborative travel apps conducted across four communities (a campsite, two rural villages and an urban fringe estate) during 2013 and 2014 involving 66 participants (Table 1).

Table 1. App trials

Trial app	Dates	Context	Users (n)
6STTravel	June 2013	Maiden Newton village community, Dorset	10
6STCampsite	July/August 2013	Tourism – Tom's Field Campsite, Dorset	37 over a rolling 5 week period
6STTravel	Dec 2013/Jan 2014	Martock village community, Somerset	8
LinkLocal	April/May 2014	Wester Hailes urban fringe community, Edinburgh	11

The apps were developed with the end users as part of the Sixth Sense Transport project (www.sixthsensetransport.com). The original app, 6STCampsite, was conceived for use by tourists at a campsite. The app captures users' location data and, through mining of these location feeds, data is fed back to the app which visualises past and potential future travel patterns of collective users using a map interface and a 'time slider' (see Figure 1).
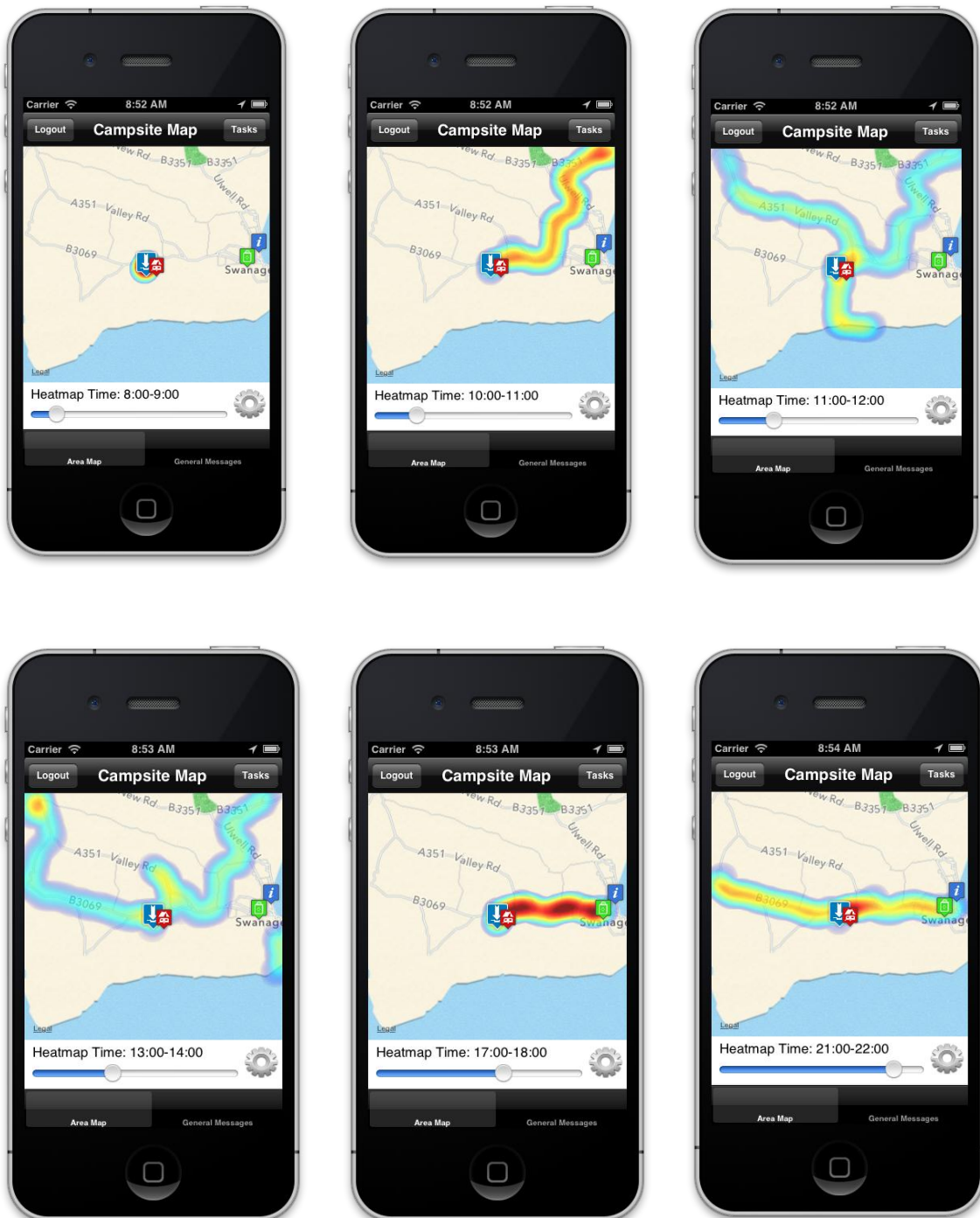

Figure 1. App map interface showing heat map of a sample of 6STCampsite users over time

Users can contribute place specific information via the map interface and general information (see Figure 2). A messaging tool enables users to post offers and requests for help (see Figure 3) and through this enables a form of generalised exchange. Trial participants were encouraged to share travel information, lift-share and engage in collaborative shopping. In each trial the app community was limited to a village, housing estate or to tourists staying at a specific campsite (Tom's Field Campsite, Dorset). This situated the exchange within a limited social network where participants might expect a degree of shared interest and trust in the community (Filimonau et al 2013). The project quickly attracted the attention of local government and local communities keen to enable collaborative travel and the initial app designed at the campsite was re-designed as 6STTravel to be deployed in other communities. Subsequently, the project was extended to the 'Communities within Spaces of Flows' project at Wester Hailes in Edinburgh and the 6STTravel app was adapted to become LinkLocal. Linklocal includes all the features of the original app, but encompasses wider forms of collaboration (see Table 1 for trial details).
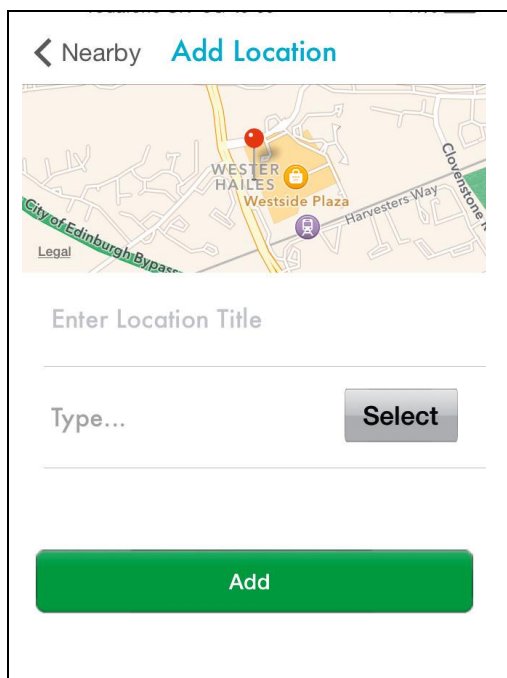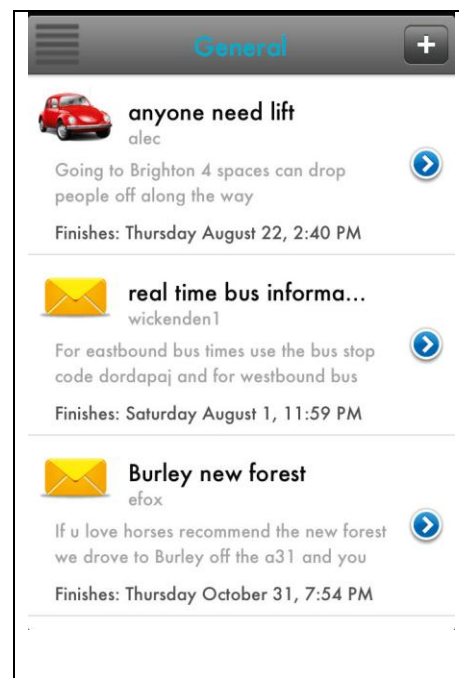
Figure 2. Adding a location to the app

Figure 3. Example of app message interface

Data were collected by in-depth interviews with a sample of participants (n= 25) and all app activities (messages and transactions) were recorded through a linked database.

Key findings

As predicted by the theory, offers of help dominated in contrast to requests for and acceptance of help (see Table 2 for examples of help offers and requests). Feelings of indebtedness inhibit app use since they threaten a user's status, power and freedom of action with respect to the donor of help. For instance, Julie (campsite tourist) was very reluctant to ask for help: "I'm not very good at accepting help… you see that as a sign of weakness". These feelings persist in this form of generalised exchange where a help receiver will not be expected to directly reciprocate with the help giver. Also, in collaborative travel people are exchanging favours rather than goods. Suhonen et al (2010) argue that this presents a problem as favours lack a market value. The lift provider has to live up to the expectation to deliver the lift and this reduces the flexibility for the helper. In this respect

some participants were protective of their personal flexibility and found offering or accepting a lift represented a commitment that then became spatially and temporally defined. For instance, Richard (campsite tourist) described how the weather meant plans were last minute and it was therefore difficult to take other people into account. Cars provide mobile leisure spaces, "bubbles of privacy moving through public spaces" (Sheller, 2004, p. 44). It is difficult to break free from the flexibility provided by the car as the car has enabled new 'flexible socialities' and created new modes of movement rather than simply replacing public transport (Urry, 2007, p. 119). Certain requests for help, such as lift requests, would mean giving up comfort and flexibility of the personal car or the certainty of achieving the task.

While concerns about freeloading were not apparent in the trials this was a key issue raised in preliminary research with the campsite community and chimes with Lampinen et al (2013) who note fears about being cheated or getting an unfair deal. With respect to freeloading there was discussion of embedding virtual credit in the app, including some credit for first time users. However, in the design phase this was rapidly rejected as participants recognised that some users might not be able to offer help, for example, a backpacker visiting the campsite cannot give others a lift or collect shopping. Similarly, the suggestion of a user feedback mechanism was rejected as participants realised they could provide negative feedback and then meet that person as the system is localised and community based. As Lampinen et al (2013 p669) suggest "formalising the exchange of tokens of appreciation and/or linking such behaviour to one's online reputation or profile would be antithetical to the spirit of indirect exchange".

Table 2. Examples of help offers and requests

Examples of help offers	Examples of help requests
Lift offer for up to 7 people: Off to Dorchester this morning, just me and dog. Happy to offer lift there and back or drop/ collect people on route ie tank museum monkey world etc. (Adrian, Campsite tourist)	Is anyone at the beach? Is it sunny inland. So cold and fed up with the wind. Let me know if you have nice weather where you are. Thanks (Melissa, Campsite tourist)
Road closure: Following the road traffic accident involving a cyclist and pedestrian earlier today the Langton to Swanage road is still closed (Alec, Campsite tourist)	help! our camping gaz stopped halfway. does anyone have a gas bomb to lend a meal?? – Could we lend a gasbomb? We're on the little hillside. (Tom, Campsite tourist)
Shopping offer: Will be in Yeovil today, can collect any items of shopping (Simon, Martock)	Unable to get out today due to poorly child. Need more washing liquitabs/liquid. NOT PERSIL. Can pay up to £5.00. (Elaine, Martock)

These findings indicate a key consideration is how indebtedness might be addressed during the design and implementation of travel collaboration apps. Based on the data, theory and findings of studies in other types of exchange community, the following have emerged as strategies to address indebtedness:

User protocols to establish norms for reciprocal exchange and use of the system (Nelson and Rademacher 2009). Freecycle, a successful online community set up to exchange unwanted household items, has such a protocol. Its guidelines state users should make offers before posting requests and asks users to limit the number of wanted requests. This successfully maintains a constant supply of goods on offer. The key aims of travel collaboration are generally to reduce car use and improve transport access options for the community, though this might depend on the community using the app. A protocol might include guidelines that users make a commitment to ask for lifts as well as offer their spare vehicle capacity to others. Lampinien et al's (2013) study of an online exchange community

found people liked to give back to the community when they received something and this triggered new offers. Therefore it may be critical to engage people in receiving help to promote further exchanges. The careful framing of offers and requests is also important (Lampinen et al 2013), such as stating requirements to share fuel costs up front. Examples can be given in a protocol so users clarify details of the exchange to avoid embarrassment and misunderstanding.

User champions can play several roles in the adoption of a travel collaboration app. They can be instrumental in recruiting users and demonstrating the norms of the exchange system. This can be vital for new users to understand and accept the indirect nature of generalized exchange (Lampinen et al 2013). User champions can also play an important role in addressing problems of indebtedness by providing opportunities for new users to respond to help requests and thereby build credit in the system.

Visualising successful exchanges to the user group. One user described the app as a 'double behaviour change' as she needed to engage not only in collaborative travel, but also organise this through a smartphone app. This illustrates that people need to learn about the way the system operates (Lampinen et al 2013). For instance, Joselyn (a campsite tourist) explained how she posted some initial messages that timed out very quickly as she did not understand the time frame could be adjusted. Many social networks include 'lurkers' who observe activity but do not post messages, especially as they learn about the system (Suhonen et al 2010). Lurkers fulfil an important role in social networks as they provide an audience for others, however in an online exchange system that requires an offline presence to fulfil tasks, lurkers need to convert to active participants at some point. Collaborative travel systems require 'reciprocal interdependence' (Markus 1987) where users are influenced by other users and benefits are proportional to your network size. Users need to understand the system protocol and how to operate the device and a lack of reciprocity leads to a drop in use (Markus 1987). Visualising the exchange process and successful exchanges not only demonstrates that things are happening, but also explains the system to novice users.

Visualising the lurkers. Recent research on online exchange systems suggests that systems make both active and passive behaviour visible to all, so users realise the lurkers are viewing requests, even if they are not acting on them (Suhonen et al 2010).

Information sharing as a means to build credit. Data from the Sixth Sense study shows a mixed picture on information sharing. While the campsite tourists readily sought and shared travel information, this was less apparent in other trials. Campsite tourists had more time on their hands and enjoyed this activity, while users in their day-to-day lives felt there was less time for this. This is evident in travel information tools like Waze, which depend on relatively few active contributors of information, and Harding et al.'s (2013) trial of a travel information sharing system identified that some users lacked motivation to contribute. Despite this mixed picture, other studies indicate that some users thrive on information giving and do this as a form of status seeking behaviour (Lampel and Bhalla 2007). Travel information seeking and sharing was considered a relatively easy activity by participants as it requires no further commitment on their part. It can therefore be a useful first step to other forms of travel collaboration.

Demonstrating how help providers may also benefit. Data from Sixth Sense and other studies (Lampinen et al 2013; Suhonen et al 2010) finds that help givers enjoy the experience and receivers play an important role for providers of gifts and favours. For example, Margaret (Wester Hailes participant) described how she felt happy getting things for other people. There is therefore value in a system that highlights the rewarding nature of the exchange experience for providers of help (Suhonen et al 2010) to reduce the sense of imbalance. This could be achieved by promoting positive user experiences.

Making the exchange process easy. The transition from an online commitment to exchange resources and the offline implementation of that exchange can be difficult for users to organise. For instance, agreeing to share a lift is just the first step in negotiating when, where and whether any costs will be shared. This can put users off and research in other exchange systems suggests designing systems to minimise the effort involved will help users engage

(Lampinen et al 2013). Therefore collaborative travel apps need to consider all aspects of the exchange and both remind and enable users to specify appropriate details.

The near future Internet of Things

The emergence of the IoT, with its more anticipatory systems, prompts a reappraisal of current Internet based collaborative communities. Current systems draw on users locations to prompt location relevant exchanges, however, to a large extent they rely on the people-to-people Internet and there is a high degree of human agency required to successfully organise collaborative travel. As the Internet of Things begins to make connections between networks of objects and people it will have greater capacity to anticipate when people or objects need to be moved, where they need to go and who or what might get them there. This presents new research challenges.

There are opportunities to bring balance to collaborative travel systems. First, the IoT, in anticipating connections, brings a capacity to automatically generate requests for help circumventing the need to ask for help and bringing balance to a system dominated by offers of help. Second, the IoT presents new opportunities to empower people to ask for help by visualising that help is readily available. In this way, the IoT reduces indebtedness through enabling users to see they are not making excessive demands on help givers and recovers the ability to ask. This is likely to be of most value to those less able to reciprocate, such as the ageing population, who are typically constrained from asking for help and has the potential to create new forms of community support and civic participation as well as new economic models for the provision of services. However, Lampinen et al (2013) have identified that people still feel uncomfortable with a lack of reciprocation even if the help given was unsolicited. In this respect IoT systems may add to people's sense of indebtedness and reduce their capacity to determine when help is absolutely essential or can be foregone. Additional issues are likely to be wrongly anticipated help and a user's sense of subjection if suggestions of help opportunities are repeatedly presented to them by the system, adding to feelings of humiliation (Marcous 2009) and suspicion of help given in this way.

More anticipating systems will be able to manage aspects of the collaborative travel process, such as when and where exchanges take place. This will reduce the need for users to clarify details and renegotiate details if plans change, in theory making the exchange process more fluid. However, this has the potential to induce scheduling stress as spontaneous opportunities for exchange arise, especially for individuals who have monochronic time tendencies to do one thing at a time (Lindquist and Kaufman-Scarborough 2007). Therefore system derived outcomes may be less than optimal for users.

The potential to develop new economic models of community support and civic participation also needs to be carefully assessed with the potential to increase inequality as some users will be more skilled and able to access resources in this way (Padley 2013). Those potentially excluded include segments of the population that might usefully benefit from these systems, especially as smartphone and Internet use declines with age (Mintel 2014). However, a future ageing population is likely to be more engaged with these systems and there is evidence that touch screen devices, such as smartphones and tablet computers, are more readily accessed by older users compared to other hardware (Jochems et al 2013). Research therefore needs to address the needs of excluded groups and how can they be IoT enabled.

While there is not the scope to discuss the issues here, there are ethical, safety and privacy challenges presented by IoT enabled travel collaboration. Travel collaboration systems in any form present privacy challenges related to sharing of personal details, safety concerns of interactions with strangers and insurance concerns in the instance of an accident. However, tracking of users, users' things, such as cars or shopping, or users' use of things to anticipate need raise new privacy concerns related to collection, storage and use of this data. Many existing smartphone apps include terms and conditions that enable the system to collect personal information about use and the user, which users readily accept but are

unlikely to be aware of what they are revealing. In contrast, IoT travel collaboration systems are likely to make this more overtly evident to a user. Research therefore needs to address issues of human acceptance and tackle the complex ethical issues presented by these systems.

Above all, developments in this field raises questions about the human regulation of reciprocal arrangements as opportunities for collaboration start being suggested by the IoT rather than being initiated by people. There is a need to understand the form and extent of reciprocity needed to make exchanges sustainable and acceptable to people.

Conclusion

In the design and implementation of collaborative travel apps, the norm to reciprocate exchanges presents a fundamental challenge to engaging users. The need to build credit in the exchange system leads to lopsided systems where offers of help dominate and users are reluctant to ask for or accept help. While other issues also contribute to this unbalanced arrangement, this paper has focus on the desire to avoid indebtedness. Analysis of data from a study which designed and tested collaborative travel apps suggests a number of strategies could be implemented to help redress the reciprocal balance: user protocols; user champions; visualising successful exchanges and lurking behaviour; information sharing; demonstrating how help providers benefit; and making the exchange process easy.

In the near future the IoT offers the possibility that collaborative travel systems might anticipate people's need for help. This marks a shift from people-to-people to people-to-people and things systems which would be less dependent on human agency to set up exchanges and ask for help. The IoT therefore raises new research questions about travel collaboration systems. These include which segments of the population might usefully benefit from these systems? Which groups might be excluded and how can they be IoT enabled? What might be the new economic models of community support and civic participation? How might the IoT change the human regulation of collaborative travel? What barriers stand in the way of human acceptance of IoT enabled collaborative travel systems?

Acknowledgements

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