The business of digital storytelling

Augmenting information systems with QR codes

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Abstract

Purpose – The aim of this paper is to present case study findings that explore the implementation and use of a low-cost digital technology platform to collect, process and disseminate information in business-to-consumer practices.

Design/methodology/approach – The research is interdisciplinary, drawing from a range of backgrounds, the epistemological approach is that of mixed methods, combining both qualitative and quantitative data collection and analysis techniques. Insights are drawn from what emerges from observations arising from the data, rather than starting with a hypothesis and designing the research to test this. The over arching research approach was "action research". Action research has at its basis the premise of conducting research "in practice". The "practice" on this occasion was a business practice, implemented in high street estate agents.

Findings – This approach to accessing information aids important decision-making in the buying and selling of homes. It allows for mobile augmentation technologies to facilitate a person's presence in the imagined spaces of the advertised properties "for sale". This has the potential to enable faster, more efficient means of searching for the "right" home to purchase.

Originality/value – This research makes a contribution to the literature by providing empirical evidence regarding the implementation and impact that quick read code digital technologies have on a high street SME. The research showed that statistically more properties were viewed than would have normally been the case, thus whilst not guaranteeing new business, the codes certainly attracted increased attention.

Keywords QR codes, Internet of things, Object hyperlinking, Tales of Things

Paper type Research paper

1. Introduction

This research is part of Tales of Things and Electronic Memories (TOTeM) a £1.39 million, three year, research project based around the "internet of things". Supported by the Digital Economy Research Councils UK, TOTeM opens up new ways of capturing people's stories through linking objects to the internet via "tagging" technologies such as quick read (QR) codes, which can be read by most consumer end mobile phone cameras. In this paper, the research focuses on the real world applications of such a system when applied to business environments. Case study findings explore the implementation and use of a low-cost digital technology platform to collect, process and disseminate information in business-to-consumer practices.

The term "mobile tagging" refers to the use of two-dimensional barcodes, also known as "graphical tags", which can be scanned by using the camera on an internet-enabled mobile phone to link to content online. One of the most commonly used two-dimensional barcodes is the QR code. Prompted by the need for barcodes to contain descriptions rather than identifiers, QR codes were developed by the Toyota subsidiary Denso-Wave (2012) in Japan to track objects around the manufacturing floor.

The use of QR codes is free from license. Denso-Wave (2012) still holds the registered trademark "QR code" and the patent rights on QR code, but has chosen not to exercise them. This freedom for others to use the technology has meant that QR codes have reached market saturation before other types of two-dimensional barcodes. These factors have made QR codes popular amongst mobile phone application software developers for a number of years (Ohbuchi *et al.*, 2004; Falas and Kashani, 2007).

Due to the ability of a QR code to contain more characters than a standard one-dimensional barcode, it can allow for "product description" as opposed to "product identification" (Chang *et al.*, 2007). At the time of writing, the scanning of a QR code can direct the user to a myriad of functionalities, such as browsing or bookmarking web sites; sending a text message or e-mail; dialing a telephone number; defining a location in Google or Bing Maps; providing Geographical Co-ordinates; linking to an iTunes App URL; linking to an Android Marketplace App URL; encoding the latest tweet of a Twitter user; posting on social network sites and displaying text (Erkan, 2012).

The prevalence of QR codes and the high level of accessibility for the general public were the two main reasons they were chosen as the default tagging mechanism in this research. This has reduced the need for any specialist hardware to generate or decode them – although the service that has been built for this research does have an infrastructure that can support a variety of tagging technologies including RFID.

1.1 Research aims and objectives

TOTeM spans five UK institutions – Brunel University, University of Edinburgh, University of Dundee, University of Salford and University College London (UCL) with each UK institution responsible for different areas of the research. Research at the University of Salford has focused on the business potentials of attaching information to objects using mobile tagging technologies.

This paper focuses on two case studies led by the Salford research team and is contextualised within the internet of things. In establishing an information system that

enables people to tag objects with information, the research examines the potentials of how a more people focused approach can provide new ways of looking at systems in the dissemination of information for business purposes.

Whilst these research questions pertained to the entire project, it is useful to state them at this point. The three research questions that the research aimed to fulfil were:

RQ1. How can we ensure that the latest QR code digital technologies are easily available for use by all parts of a community?

RQ2. What impact does the implementation of QR code digital technologies have on a high street SME?

RQ3. Can QR codes be used by estate agents' to improve the customer experience and differentiate the business?

The extent to which these questions were answered by the research outlined in this work is discussed at the close of the paper.

1.2 Research background and technologies

One of the main goals of the larger TOTeM research project was to build a narrative-based service, known as Tales of Things, for associating digital histories ("tales") to everyday objects ("things") via tagging in the spirit of the internet of things. The introduction of narrative into what was initially a system for tracking objects transforms it into a more powerful information rich system and the flexibility of QR codes allows information to be delivered to consumers through a range of media formats without the need for manual input.

This service consists of a web application in the form of a web site called Tales of Things, and a mobile client in the form of apps for iPhone and Android handsets. The architecture in Tales of Things consists of two principal components; a database-backed web application and bespoke mobile clients. The web application provides the interface for creating entries for new items ("things") and generating and printing the QR code, which can then be attached to the physical object. In terms of schema, a "thing" consisted of a title, description, photo and/or more "tales". The purpose of the tales is to allow a narrative to develop around the "thing". In addition to a title and text, tales can also contain more hyperlinks to associated resources, such as videos, photos or indeed anything with a navigable URL, including other Tales of Things objects. This allows a much richer "digital provenance" to be developed around the object than would be possible solely with textual tales.

Tales can be added via the web interface or for tagged objects "in the wild" via the mobile client for iPhone and Android handsets. The development of an app was an important part of the information system, as studies by Schmiedl *et al.* (2009) and Maurer *et al.* (2010) have examined use of mobile-optimised web sites, built for internet-enabled mobile phones to be able to navigate easily. These two studies showed that whilst an increasing number of companies are choosing to build mobile-optimised web sites their demand is likely to decrease, as the capabilities of mobile phones to view desktop web sites increases. These papers demonstrate the willingness of organisations' to engage internet users on a mobile platform, although Maurer *et al.* (2010) explains that this can often be at the expense of limiting the information or usability of the web site.

The time and expense of creating a mobile-optimised web site is only worthwhile if organisations can drive internet-traffic to their site. Traditional media, such as newspaper advertisements have been used to drive customers to web sites, but it is hard to quantify the impact of these forms of advertisement (Heath and Nairn, 2005). Direct links can be used to connect objects to the internet – making them part of the "internet of things". Smartphones such as Android account for 79 percent of the global market and iOS for 14.2 percent of the market (Gartner, 2013). These phones run sophisticated operating systems that allows external programmes and applications to be installed. Smartphone users can use applications, coupled with the phone's camera, to scan QR codes. The majority of QR code scanning applications are free to download, small in size and relatively simple to operate, lowering the barriers to entry for customers.

In this particular project, the app allows users to scan the QR code and connect to the information system via the mobile internet. One of the benefits of using a bespoke application is the close integration with the information system (Barthel *et al.*, 2013). Any QR codes generated from the information system and scanned using the application allows the user to read and write on to the information system's online database, through the application rather than through the smartphone's browser window. This allows for a closer integration with the smartphone's native operating system and facilitating the capture and upload of multimedia files for example. QR codes generated using the information system are fully readable by other QR code scanning applications, which launch the corresponding webpage hosted by the information system. Additional information can be added to scanned objects including text, images and videos, which updates the online database immediately.

The application provides the means to decode the QR code, and display the story associated with the object ("thing") to which the QR code is affixed. The application also has the added functionality of allowing mobile phone users to add their own contribution to the object's narrative by adding their own tale. As well as simple text, a tale can be supplemented with video captured from the smartphone's on-board camera – the video is uploaded to YouTube and a link embedded in the tale. Optionally geo-location information can be added to the tale from the smartphone's GPS sensor.

Mobile client users can also tag new things by scanning unassigned QR codes, which can be generated from the web site in advance. The mobile client communicates with the web application via a custom API using JavaScript Object Notation (JSON) which provides a more lightweight data exchange format compared with XML and is therefore more suited to mobile networks. Variants of the mobile client were written for the iOS (iPhone) and Android operating systems. The web application was built using the Django framework, supported by a Postgres database, thereby leveraging a robust and proven infrastructure.

At the time of writing the Tales of Things service had more than 2,500 registered users and in excess of 4,000 objects had been added. Items generated from the specific research case studies arising out of further TOTeM work have supplemented objects added by the public. However, this part of the study aimed to apply digital technologies to the commercial world to consider feasibility, value and impact to those business communities. The research questions stemmed from a need to apply new digital technologies to ensure social inclusion across all strata of society. There was a strong need to ensure that the latest technology was going to be available, be useful

and be used by all. One way to do this was to apply the tech through every day activities in high street shops. Estate agents were chosen as they were considered keen to explore new cutting edge technology, open to the public and yet included identifiable sets of users.

1.3 Contribution to knowledge

This research makes a contribution to the literature by providing empirical evidence regarding the implementation and impact that QR code digital technologies have on a high street SME. The research showed that statistically more properties were viewed than would have normally been the case, thus whilst not guaranteeing new business, the codes certainly attracted increased attention. The second contribution is that the work demonstrated the relative ease with which the latest QR code digital technologies are easily available to all sections of a community. The system was accessible by all mobile phone users, was quick to download and could scan a coded product within a few seconds. Within the two cases reported here, the codes were located in places where they had high visibility and were easily accessed by:

(1) the public walking past the store front and in case; and

(2) the newspaper readers in the comfort of their own home or similar.

The third contribution of the work is the demonstration of a new additional marketing route of an "established product" which was easy to implement by the business, easy to access by the customer and resulted in real potential of new business.

By choosing estate agents, the displays were available, freely, to all members of the public and had a small yet important impact on the community.

2. Theoretical contexts

2.1 Business context: real estate agents

A number of business contexts are applicable when using QR codes to inform consumers about products and services, however the potential for use in real estate is particularly interesting. The business of buying and selling houses is one that is stressful and highly emotionally charged from the consumer viewpoint, so information systems that provide people with clear and easy access to information that aids decision-making are valuable in this industry.

Although, the Tales of Things information system was originally used for adding stories to objects, it has been designed in such a way that makes it appropriate for providing consumers with a "mini-tour" of properties of sale delivered to their mobile phone. This is a highly valuable tool when one considers the scenario of driving past a property for sale which may be of interest, and having the facility to instantly scan a code on the sign which allows an insight as to whether that property is appropriate to the customer needs. The physicality of being in the location near the property, combined with a virtual presence inside a property provide the user with much greater sensory input than if they read the schedule on a brochure, for example it has been suggested that:

> […] we do not "interact" with the built environment; we are present in it. When that environment is augmented with pervasive technologies, we will not only be present in it, but potentially present in other places too and possibly co-present with other people who are not really there (Benyon, 2012).

Estate agents are intermediary businesses that publically list properties "for sale", in a variety of online and offline locations, and invite offers-to-buy that they relay to the vendor. Estate agents typically receive a percentage of the property's sold price for performing this intermediary role. The OFT market study concludes that estate agents should aim to charge approximately 1.6 percent commission on the house's sold price and should not receive payments dependent on the time a property is listed for sale. It is therefore beneficial for the estate agent to make the process of selling as quick and easy as possible, whilst maintaining a high price for the property.

The initial stage of this research identified the estate agents' business process of "listing a property for sale" and how this information is disseminated to potential customers. Specifically, the estate agents' use of offline advertisements, i.e. the window display and newspaper property listings were examined. The primary purpose of offline advertisements was identified to be a public notice of the availability of a property. The objective of an offline advertisement is to provide detailed information on the property, with only a brief overview of a property's characteristics often displayed. Interested parties are invited to seek out further information by contacting the estate agent or searching through the estate agents online database. Alternatively, customers could contact the estate agent to arrange a property viewing. There is no direct link provided on an offline property advertisement to the individual property's online presence, for the estate agents in our case study, which is the norm for the vast majority of estate agents in the UK.

2.2 Technological context: the internet of things

The Strategy Policy Unit (SPU) of the International Telecommunication Union (ITU) examined the ideas behind the internet of things in their 2005 report (ITU, 2005). In the ITU report, the idea of a "ubiquitous network society" arose where:

> [...] a new dimension has been added to the world of information and communication technologies: from anytime, any place connectivity for anyone, to a situation where we will now have connectivity for anything.

There is a technical and cultural shift that must continue to take place, to create a society where every device is "on" and every device is connected is some way to the internet (Leder *et al.*, 2010). For "any thing" to truly become a reality there needs to be a method of connecting a typically offline object with the online world. This connection can be achieved with technology that is already prevalent in today's society, namely through the use of a two-dimensional bar-coding systems or the use of radio frequency identification (RFID) tags.

The use of both mobile tagging and RFID technologies can be employed in logistical and distribution operations to assist in reducing distribution time, energy consumption and costs whilst increasing inefficiency and product availability (Arendarenko, 2009). Being able to record the time and location where object hyperlinks are scanned can help in creating unique information that enriches the material objects with an immaterial dataset. In some instances the objects can be seen merely as carriers, or Spimes, of the more valuable datasets where "they're virtual objects first and actual objects second" (Stirling, 2005). Geo-location and time stamp information can be incorporated into the two-dimensional barcodes, or used to update a database accessed through scanning the two-dimensional barcodes, to add real-time information (Chang *et al.*, 2007). This information is particularly useful for logistical operations and services.

Currently, most of these ways of linking things in the real world to digital content and online information databases are inaccessible to the average consumer, due to the need for additional technology that is not available at a mass-market level. Mobile tagging uses a technology that many people carry on their person, leveling out the required technological literacy and financial investment. Such democratisation of technology allows any user with a smartphone to access information about anything in the real world that can be tagged, be it an object, place, building, or brochure explaining a service.

In this research, the aim has been to extend the scope of information conveyed through mobile-tagging practices, to develop models that are more engaging to consumers and enrich peoples' lives. Rather than providing data, aimed purely at logistical purposes, there was a desire to break down the barriers between physical and virtual spaces and design an information system that could provide people with enhanced, or augmented understanding of the objects, places, products and services that surround them. In doing this, the technical team on the project developed an information system platform for collecting stories and attaching them to everyday objects using QR codes. Such a system, where objects become augmenters of information has resonance in two-dimensions. First for people as a means of hearing and recording history, stories and memories, and second as relevance for modern commerce as businesses incorporate the system to present customers with increased access to information, related to products, services and stock information.

In providing users with information delivered to their mobile devices, the results of the case studies indicate that the use of personal media matched to an individual's bespoke information needs, encourages interaction with two-dimensional barcodes as a viable interface to a narrative based information-gathering system. Possible reasons for this phenomena are suggested in relation to how users are able to adopt "co-presence" to navigate information spaces (Benyon, 2012) mediated by mobile media, where there is the potential for users to participate in richer experiences of products and services on offer.

2.3 Social contexts: affective technologies and presence

The ubiquity and relative affordability, in the Western world, of the iPhone and Android handsets means that mobile web browsing has become an integral tool that consumers use to gain instant information about what they are about to purchase, at the point of sale. The emergence of downloadable apps, customised for specific functions, enhances the ability for consumers to have accurate and up-to-date information at the press of a button.

Take for example, the Amazon app, produced by the online retailer Amazon.com. For example, a consumer could be out on a Saturday morning, shopping, and pick up an item from the shelf, say a child's toy, and with the app, scan the barcode on the package. If that item is in the Amazon database (and it is highly likely that it will be), the Amazon app will bring up the product, the Amazon price, and relevant customer reviews. In this way, a consumer can make an informed decision about whether what they physically have in their hand, in that shop, at that time, is a "good purchase" in terms of competitive pricing, and the efficacy of the product itself.

Google Inc., the market share leading search engine (Goldman, 2011), commissioned a report outlining how smartphones had become an integral part of users lives (IPSOS OTX MediaCT, 2011). The IPSOS OTX report showed that 81 percent of smartphone owners browsed the internet and 77 percent utilised internet-based

search engines. Smartphones were used at home (by 93 percent of users), during commuting (87 percent), whilst shopping (77 percent) and in restaurants (73 percent). 68 percent of users were found to visit a business web site as a result of their search, to obtain further information on their products or services.

This rise in the use of smartphones has led to the emergence of the term affective technologies, those technologies through which we mediate expression of emotion, and in turn become emotionally attached to (Lasen, 2004). In becoming emotionally attached to their mobile phones, people can be more emotionally invested in the content, or information that is delivered via them. Being constantly "switched-on" and emotionally involved has led to the emergence of the terms "life-mix" and "multi-lifing", coined in 2011, by Professor Sherry Turkle of MIT. Here there is a blending of one's life in the physical real world and that online. The distinction between the two becomes blurred, where a:

> [...] life mix is the mash-up of what you have on-and offline. Now we ask not of our satisfactions in life but of our life mix. We have moved from multi-tasking to multi-lifing (Turkle, 2011).

When one is multi-lifing, they can become present in a number of places at once, for example they can be physically in the "real world", walking in a park, but also engaged in conversation with someone in an online space via an app on their phone. This "being in two places at once" is known as the ability to adopt telepresence and is becoming increasingly important in technologically mediated landscapes where there is competition for people's attention. The International Society for Presence Research (2000) provides a clear definition of (tele)presence:

> Presence (a shortened version of the term "telepresence") is a psychological state or subjective perception in which even though part or all of an individual's current experience is generated by and/or filtered through human-made technology, part or all of the individual's perception fails to accurately acknowledge the role of the technology in the experience.

This could be seen as an extension of "mixed reality spaces" or "blended spaces", where objects in the real world are augmented with digital content or information accessed via tagging technologies. In terms of this research, the implications are that a user can physically be in one space, but via the use of the Tales of Things system can be virtually in the spaces for sale by the real estate agents in the case studies.

In this context, communications technologies provide a means of further mediating social presence, so that people forget the device between them and the system through which they are accessing information, encouraging businesses and organisations to adopt similar life mixing concepts to adopt mobile tagging practices, creating "object hyperlinks", which bridge the space between our lives in the real world and those online, as a platform for gathering, processing and distributing information.

Initial findings in this research, support this and indicate that people who already use smartphones in a multi-lifing scenario are more likely to engage with information systems that are easily delivered to their mobile phones. This is because they have already invested time and energy into learning how to use their device, they are likely to already be using the mobile web, and it is only an incremental step on the learning curve to learn how to use a new app.

3. Epistemological approach

As this research is interdisciplinary, drawing from a range of backgrounds, the epistemological approach is that of mixed methods, combining both qualitative and quantitative data collection and analysis techniques. Insights are drawn from what emerges from observations arising from the data, rather than starting with a hypothesis and designing the research to test this. The over arching research approach was "action research". Action research has at its basis the premise of conducting research "in practice". The "practice" on this occasion was a business practice, implemented in high street estate agents.

Whilst there are bodies of thought regarding whether action research is a research strategy or a theory of social science (Jonsson, 1991) for the purposes of this study action research was identified as the most appropriate approach to employ. Action research has only been used in the social science since the early part of the twentieth century and the "newness" seems relevant for use in a digital technological study. Whilst there are noted "dilemmas that lead to the subjugation of action research to participative case studies (Baskerville, 1997)" it was also posited that as "the epistemological nature of action research and case studies are different and make different assumptions about theory, both are valid research methods". By using both these methods we considered that we overcame the usual dilemmas and the methodology helped us to produce a rigorous set of results.

Action learning is, at its roots, about the collection of empirical evidence, and this study was clearly about collecting factual information in order to prove the usefulness of new technology to the client and the business.

The theoretical decisions and framework for the research were that the epistemological stance was inter-pretavist; the approach was quantitative and the research instrument was action centred research. This section identifies the epistemological approach to all the case studies and justifies the choice of an interpretive approach.

The context of the research is important, as it is original work that shows whether new digital technology can really be applied in a setting that attempts to be socially inclusive. An additional motivation for the work was to evidence if digital technology could be used to enhance business processes and to make an organization more successful (by increasing customer base) or stronger (by introducing new processes). The research was therefore centred on a desire to improve by testing, in the marketplace, the new technology. As we initially set out to collect numerical data we did consider taking a purely positivist quantitative approach as this is often seen as a more "normal" and favoured approach in an IS setting (Orlikowski and Baroudi, 1991). However, the interpretive approach allowed us to take into account context, human behaviour, emotions and feelings. In addition by taking this path we are able to build theory based on the data collected. The interpretive approach allows for the different social contexts of the case studies to be taken into account. At its most basic level the interpretive approach allows for discussion and questioning of assumptions.

Concern with the measurement of variables is particularly pertinent to this research as the impact of the QR code technology can be documented by considering a set of variables, e.g. no. of scans, time of scans, for each of the case studies. As the goal of the interpretive researcher is about sharing the perspective of the groups, it was considered that this could best be achieved by collecting data in the field "remotely". Quantitative methods, rather than qualitative, are useful in providing statistics and

proving hypotheses by analysis of numbers. However, whilst this research was action centred, its primary purpose was to collect hard data and so a quantative approach was chosen as the first lens. Yet, as the data also included almost anecdotal and story like data, from the customers and the agents, there was a need to employ a further qualitative lens. In this sense we were able to overcome the main positivist criticisms of action research as proposed by Lock *et al.* (1997) regarding low control of the environment (as the software collected the statistical data automatically); contingency of the research findings (as we situated the study in two different environments) and personal over-involvement (as we produced "hard data" as well as more anecdotal material regarding the business).

Prior to consideration of the finer details of the research design, as one of the research questions was concerned with "digital technologies that are easily available for use by all parts of a community" it is useful to place a framework on the type of societal study that was undertaken. All sociological studies in general can be characterised as micro or macro studies of society. These studies can be identified as research which examines the way in which society functions as a whole known as macro formal research (Radcliffe-Brown, 1948; Sahlins and Service, 1960; Harris, 1979); macro substantive research, which can be defined as a detailed careful study of one or more society (Beatti, 1965); micro formal – an examination of smaller more local communities (Goffman, 1959; Glaser and Strauss, 1971) and finally micro substantive studies of particular organisations (Becker, 1953; Strong, 1979; Werthman, 1963). The research in this study was classified as micro substantive as it fits the framework regarding a study of two organizations of the same industry.

Complementing action-research as a main framework for this research, the researchers have taken a phenomenological approach in analysing and making sense of the data, where "phenomenologists believe that truth and understanding of life can emerge from people's life experiences" (Byrne, 2001). This research follows the Heideggerian approach to phenomenology, where the context in which the participants are operating is of key importance to interpretation of experiences and shared meanings. This has been combined with action-research case studies so that people's experiences in the form of qualitative data such as the interviews/actions with estate agents and anecdotal feedback with clients are used to inform the quantitative data from the scan counts and times that have been collected through the Tales of Things system.

4. Methods
4.1 Research design
The research methodology was action centred research as this was the best fit in terms of giving valid results across the sector whilst the codes were placed in two sets of different locations. Two case studies were designed to evaluate the effectiveness of using QR codes as a tool for estate agents to disseminate property information to customers, in order to help improve their current business process. They were:

(1) window display; and

(2) newspaper advertising.

As these were early studies to test the proof of concept and efficacy of the use of Tales of Things within the estate agent sector, putting QR codes on signs outside houses was

not considered appropriate at this point. It is however something that may be investigated in the future. In both of these case studies, when a user scanned a QR code, the requested information includes additional photographs and complete details of a specific property, held on the estate agent's web site. This process was designed to work both during and outside normal working hours and work in any location that had internet coverage for mobile phones.

Within the estate agent market sector, three groups of users were identified:

(1) estate agents;

(2) property vendors; and

(3) property buyers.

For the estate agent, the process of object hyperlinking property listings must be a relatively simple process that will not impact in a negative way on their current business operations, be easy to maintain, replicable at low cost for multiple property listings and work outside normal working hours (Quigley and Burke, 2013). The branch manager for the estate agent who participated in this study cited that the reason he had chosen to take part:

> [...] is that there have been a great number of developments with technologies related to Estate Agents in recent years, such as Google Maps and iPhone apps. Any technology that can give an edge over the competitor is extremely important.

Such a comment illustrates the shift in the real estate sector to mobile-based interaction with products and services, yet there needs to be a balance between the time investment in terms of technological literacy required to interact with the system in relation to the benefits that it provides. The Tales of Things system assists by providing a complete solution which gives several immediate advantages to the business. These include automatic generation of QR codes (thus ensuring good clean compact version 3 QR codes); the provision of write back capability; the ability to link video to the property; the fact that the entry can easily be edited and finally the advantage that QR codes can be read by generic readers. The requirements of this user group are; the ease with which they can input data into the web-based system on tales of things.com; the ability to easily match QR codes to each property for marketing material; and the ease of using the mobile apps to show their clients how the scanning technology works. Showing clients how the technology works is important for two reasons; firstly as a means of showcasing their services to potential property vendors, and secondly as a means of showing potential property buyers what properties they already have for sale. Both the web-based client and the app are of key importance to this user group.

Although the second group of users, property vendors, are not required to interact directly with the Tales of Things platform, however, if they choose to use a particular estate agent because of the "value added" services they provide, they will want to be aware of the extra benefits. In this respect this user group, needs to be able to quickly see the display of information available to their potential vendors and how the system will enhance the selling process. The process needs to be straightforward and easily implemented. The property vendors user group will not be required to enter data and there will be little requirement for them to access the web site. The most important component is that of the app and usage on mobile phones.

The third group of users, and perhaps the most important was that of the property buyers. For them the system needed to be easy to use and be impressive enough that the information portrayed would encourage them to follow up on any properties that they explored through scanning the QR codes.

5. Data collection methods

Two estate agents were chosen for this study during a four-week period. In both of these case studies, when a user scanned a QR code, the requested information includes additional photographs and complete details of a specific property, held on the estate agent's web site. The first agent coded the properties displayed in the window and the second agent the properties advertised in a free newspaper. The estate agents were keen to use the technology and were able to derive "real business value from the study". In both cases the agents intended to continue with a form of the codes as they "improved the customer experience" and "gained a form of competitive edge over their rivals".

5.1 Case study 1: window displays

A regional estate agent with a large window display was chosen for the first case study. The traditional window display contained a number of properties on individual A4 sheets, which contained the property address, a short description on the condition and location of the property, a number of bullet points relating to the statistics of the property (e.g. number of bedrooms) and a few small photographs. For more information people browsing the display would typically have to request further information in the office. When the office is closed, customers search for the property on the estate agent's web site. In order to achieve this, customers are required to remember certain information about the property, i.e. location and price, before looking through all the possible results to find the correct property. This is a relatively lengthy process for the customer.

The properties displayed in the window have an individual webpage on the estate agents web site that contains a complete description of the property details, additional pictures, floor plans and energy reports. A QR code was created for each property in the estate agent's window display. This QR code directed users to the property's webpage. Customers browsing the window display were not advised, encouraged or prompted to scan the QR codes, though a sentence was provided to explain that the QR codes could be scanned using the free Tales of Things app available from the related web site. The respondents were the general public who on walking by the shop were interested in the display and scanned a property. A limitation of the study was that we were not able to collect information about the demographics and profile of the users. We did find however that most of the scanned properties were what the estate agent termed "first time buyer" properties. Throughout the studies the number of scans were counted, documenting the date and time for each scan. The primary objective of collecting this data was to record whether there is sufficient demand for this form of technology on estate agent listings and to analyse the property type(s) that were receiving the highest proportion of scans. By recording the date and time, it was possible to correlate the number of scans with the opening hours of the estate agents. Based on this information, the estate agent can make appropriate decisions regarding, for example, the timing of opening hours and any required alterations to fit with peak

demand for property information requests. The display was updated each week, for four-weeks, creating new QR codes for any newly displayed properties.

QR codes were only placed on the "for sale" properties as the rental market was identified as highly variable, with short periods between when properties were listed and when they were taken off the market. The "sales" market typically has a longer gestation period for properties.

5.1.1 Results and insights. In total there were 39 properties displaying QR codes with an average price of £296,490.

Scans are only counted if they were deemed to be unique, i.e. not from the same IP address. In total there were 46 scans, across the 39 properties displayed, for this case study. The majority of the scans were for properties typically bought by first-time buyers or landlords, i.e. those properties in the lower price range. The properties with a higher-price did not receive the same high frequency of scans as those in the lower-price range. Figures 1 and 2 show the kinds of properties we coded and the resulting number of scans.

Scans were more likely to take place on a Saturday afternoon or early evening, when footfall is high. Estate agents could potentially look at this data to ascertain the impact on the business of (for example), a change in opening hours.

The experience of creating the QR codes was described as positive by the estate agent staff with words such as "relatively simple, quick and intuitive". The integrity of the window display was not compromised by the inclusion of the QR
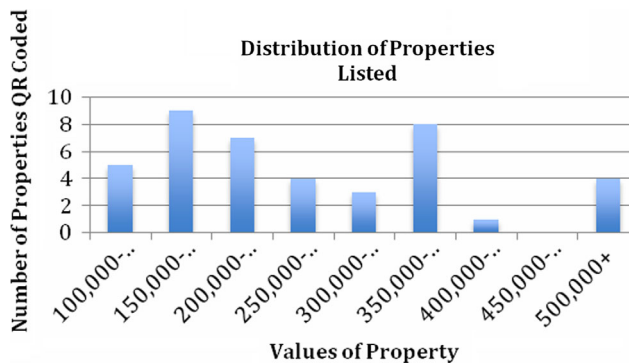
Figure 1.
Distribution of properties
with QR codes by value
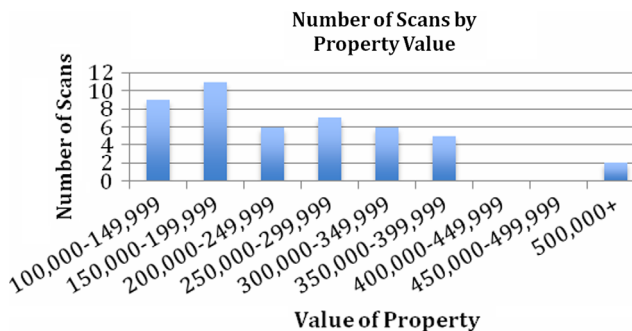
Figure 2.
Distribution of scans
by property value

codes, though the estate agents considered that a permanent adoption would require the window display to be redesigned, in order to place more properties at a comfortable scanning height.

5.2 Case study 2: newspaper advertising

Building on the findings of the first case study, this stage of the research examined whether the technology could be used in other traditionally offline advertisements. A local estate agent, who advertises the properties they have for sale in the local newspaper, was chosen as the partner in this case study. The advertisement displays a small picture of each property with a few short bullet-points to highlight key details, e.g. price, number of bedrooms, heating and so on. To access complete property details, customers need to search for the property on the estate agent's web site, using the details to help define the search.

The process of disseminating the complete property details to the customer was streamlined by creating individual QR codes for properties, displayed alongside the property picture. The QR codes can be scanned using an application-enabled smartphone to direct the user to the correct URL. The use of QR codes reduced the total number of properties that could be displayed in total, which meant only 20 percent of the properties in the advertisement had QR codes created for them, which represented a stratified sample of the property portfolio for the company.

QR codes were created for the properties over a four-week period, with the time-stamp recorded. As the free newspaper was delivered to 120,000 homes across the targeted area, the respondents were the recipients and readers of that estate agents newspaper section.

Alongside the advertisement, instructions were included regarding how to download and use QR code scanning applications.

5.2.1 Results and insights. This case study displayed 58 QR codes over the four-week period. The first week the QR codes were displayed, they were run alongside an editorial explaining the aim of the research. The total number of scans throughout the period was 165 (Figure 3) with the number of scans performed each week increasing for the first three-weeks and almost constant in week 4. The first week may have had a number of users "testing" the codes, rather than people interested in the properties.

The sharp rise in the number of scans from week 2 to week 3 was potentially due to a change in the sizing of the QR codes, which made the codes easier to scan. The anecdotal feedback from vendors has been that the use of QR codes has made this estate agent a more attractive proposal when seeking a business to help sell their property as the level of advertisements or innovation in the estate agent influenced vendor's choice of agent.
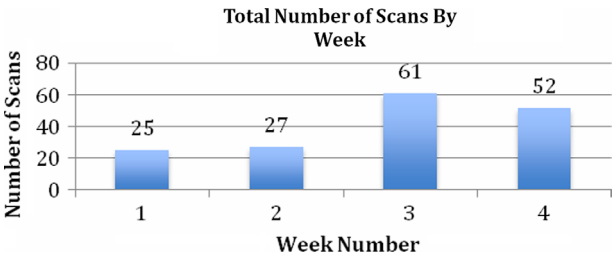

Figure 3.
Number of newspaper scans per week

The estate agents were able to learn these new skills quickly and suggested implementing "real-time" QR codes, i.e. QR codes that directed the user to web pages displaying offers such as the "latest price reductions", but it was considered that changing the technology in the middle of the study might have impacted on the results. However, the advantage of the Tales of Things site was that the system could easily facilitate any changes and amendments quickly and at low cost. Throughout this research, the estate agent chose to place a QR code in their company banner, at the top of the newspaper advertisement page. This QR code directs users to the main web site. The newspaper banner QR code (i.e. the QR code embedded with information about the estate agents) had 28 scans during the research period and has become a permanent feature on the company advertisements. The estate agent is now looking to fully utilize QR codes in their advertisements, window displays and property brochures.

During both these cases we had informal anecdotal observation with the estate agents and the staff with positive and enthusiastic responses.

6. Discussion
We approached this work within three theoretical contexts, the business context, the technological context and the social context. Having completed the work, we now need to consider the theoretical issues that the research has highlighted and the implications for managers and practice in general.

Within the business context, we can identify a range of issues, such as a new marketing avenue; the competitive advantage gained by the use of QR codes; and an improved cost effective consumer experience. In particular, as virtual reality advances and markets such as "wearable tech" develops, the potential future of estate agents may not involve "shops", thus saving on overheads, salaries and running costs. Such technology would impact on the industry in terms of competition by lowering the barriers to entry; by giving increased power to the buyers and as the technology is low cost, increasing the potential commission to the estate agents, thus classically replicating Porter's (1980) positive elements of "determinants of competition". Within the technological context, which we identified as the internet of things, the study aimed to remove barriers between physical and virtual spaces and to "disrupt" the usual customer/manager experiences to a level where the process of buying a property became a new and very different experience. In particular, the power balance changed as the potential buyer was suddenly able to have access to increased information at the touch of a screen, a facility previously only available to webmasters. The idea that the use of personal media matched an individual's bespoke information needs proved effective and radically shifts the notion of power and politics in an organistion to a Mintzbergerian (1991) notion of "expertise games". In this world everyone can become an expert within the organisation via the use of personal media. In addition this new world then begins to change the answer to the question "for whom does the organisation exist" as the traditional organisation moves, via use of social media links to a virtual, global, interlinked 24/7 environment. This will be the true result of a full scale internet of things "connected" internal and external environment. This leads us naturally into a discussion of the third and final context, the social context. We outlined Turkle's (2011) ideas of "multitasking to multilifing" where as all things are connected we can then augment out lives with virtual reality. Developments such as Google glasses and apps such as Blippar (which allows users to bring together information,

entertainment and three-dimensional experiences) will change the way in which we react with products. Whilst the use of our action research methodology is sometimes controversial (especially in positivist fields) this new tech has the potential to change our very social systems as the socio-technical aspects of our lives become predominant.

The implications for managers and practice in general are three-fold. First, there has to be a point at which the managers are aware of new technology that is available as this will be critical to survival in the current economic situation. This can be done via employees, networking, links with local universities and so on. Second, once there is awareness there needs to be a willingness to try something new. In both our cases our estate agents were keen to trial the product. We also found that the sellers were eager to sell the property and were agreeable to the trial as they would gain advantage for themselves. Third, the studies demonstrated that the new form of marketing was successful both in engaging customer interest; in attracting the attention of other estate agents and acted as a catalyst for continuing interest regarding ways in which digital technologies can be applied in the marketplace.

QR codes have been used by the advertising industry for a number of years, though the use of this type of technology is relatively new for estate agents. QR codes were appearing in property listings for the first time for many people and there was a learning curve for both the users and suppliers of the codes. The technology was adopted quickly by the estate agents, showing that there is relatively little training required to produce and use QR codes.

Newspaper editors were pleased to use QR codes in their publication, producing editorials on the innovation in the housing market, which has encouraged other estate agents to enquire about using the technology.

Burke and Speed (2013) considered the relevance of tagging to information accuracy and trust. They commented "whilst tagging technologies probably at the moment cannot solve relational uncertainties, tagging can certainly be employed in order to assist with informational uncertainties". In these studies we issued the user groups with additional information that reduced uncertainty. Although the scan rate was low initially, this increased in both case studies as they progressed.

This research indicates that the business process of property listings can be improved through the use of new digital technologies and specifically through the use of object hyperlinks, such as QR codes. People are using their mobile phones for an ever-increasing number of uses and businesses should be looking to capitalise on this trend. The benefits of this type of information system are that it is accessed via a user's own mobile phone, which as an affective technology is one already integrated into their personal information space and daily life.

Figure 4 encapsulates our main findings.

As the environment becomes more technologically driven, the estate agent's awareness of new products and willingness to risk going to market is likely to increase. The agent gains competitive advantage at low cost and thus adopts the new technology into the marketing strategy. The seller considers the advantages of QR codes in improving access and the potential market for "views" and agrees to have the property advertising coded. The vendor (buyer) has an enhanced positive experience of using the tech to view the property and as the connectivity of the real internet of things comes to fruition, there will be increased demand and a better product that the estate
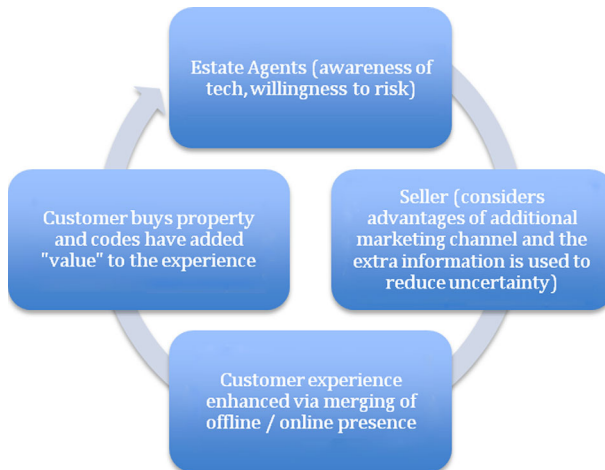
agent can then utilise to restart the cycle. This model acts as an initial conceptual model and may be useful as a starting point for other researchers.

A longer study would be required to forecast the expected use of QR codes in the long-term, particularly in terms of the three user groups outlined. The barriers to entry for user groups such as estate agents are extremely low with minimal costs and training required. These same low costs with use of an affective technology also reduce the barriers for the property buyer and vendor user groups. Therefore, it is envisaged that an increasing number of estate agents will adopt this technology, leading to further innovations in use, e.g. as a portal to request viewings, mobile optimised web sites or as a means for customers to ask property specific questions.

7. Conclusion
Inevitably in a study such as this there are limitations. We found that reducing the size of a standard QR code so that we were able to place them on a newspaper advert without obscuring the photograph of the property was a technical problem because as the size reduces so does the ability to scan. Whilst we did manage this successfully, this is a factor that would need further consideration in future studies.

The three research questions that the research aimed to fulfil were *RQ1-RQ3*.

The key terms of *RQ1* concern both "ease of use" and "all parts of a community". Did the QR codes provide an easy and accessible way for all parts of society to use this particular form of digital media? The answer lies in usage – were the codes used? Yes. Was this a real increase in terms of the overall customer numbers? Yes – but difficult to prove without some form of control group. However, the overall impression from the staff who worked in the agent 1 (window displays) was that there was certainly a marked interest in properties, but in what is termed "first time buyer" type of properties. Was the technology used by "all parts of the community?" Difficult to identify – it was certainly made available to all parts of the community and we endeavoured to make sure that both the case studies were free to the public (public high street window and free newspaper). *RQ2* asks about "impact on an SME". Did the

work impact on the company? Yes, there was increase in interest, internally within both studies the research was carefully observed and there was certainly interest from other estate agents in the area who also wanted to use the technology. Did profits increase? Although we did not have access to sales figures for the first study, from the 39 properties that were allocated codes, the average price range was £296,490. These were scanned 46 times over the four-week period, but no actual sales went through to completion during those weeks. So, there was impact, but in a small, concentrated period of time. Further studies need to be undertaken in order to collect larger sets of data.

RQ3 asks about improvement to the customer experience and differentiation of the business. Although we did not undertake formal interviews, from the conversations we had with the front line staff, the customer response was overwhelmingly positive and in favour of new technology adoption. In terms of differentiation of the business, our estate agents were "early adopters" and the experience did differentiate them for a time. However, since the time of the trial many estate agents have taken on board the idea of QR codes and several major agents use them as standard on "for sale" signs as well as in window displays. New technologies such as "touchcode" where an invisible electronic code (produced using invisible ink), when "touched" by a smartphone, produces, a series related sounds and pictures, may also be deployed in similar ways in the future.

The context of the internet of things that formed the backdrop to this study, allows any object to connect to the internet through the use of hard links. The growth and propagation of smartphone technology has led to a number of competing hard link technologies, available at low-cost, together with a steady stream of newly available smartphone apps. QR codes themselves are also gaining large market shares in advertising; in 2012 the use of QR codes increased from 66 to 80 percent across US magazines (Matus *et al.*, 2012).

An increasing number of users are choosing to engage in multi-lifing experiences, by scanning QR codes, allowing them to interact, digitally, with an augmented reality. Organisations who have realised this trend have adopted new business processes that allow them to disseminate information effectively at relatively low-costs. The low-costs and high-impact of this technology make the barriers for entry low and ideal for small businesses. The technology also allows the opportunity to collect useful market research on customer behaviour, which enables organisations to more effectively market their products and manage their business.

Despite the new nature of this technology, the results confirmed that people are willing to embrace this use of mobile technology and adapt to new business processes. One reason for this could be that when contextualised within the fields of presence and affective technologies, employing narrative systems, such as storytelling, people are more likely to actually enjoy an information system. The holistic approach of information space theory allows for expansion of each user's activities where the tedium of searching for something becomes a playful interaction and where one has the potential to adopt Floridi (2005) notion of forward presence and imagine themselves in the spaces advertised by the real estate agents.

The aim of this paper was to present case study findings that explore the implementation and use of a low-cost digital technology platform to collect, process and disseminate information in business-to-consumer practices. Whilst this has been

achieved with this research, we are aware that the "Business of Digital Storytelling" has far reaching applications, results and impact with customers, retailers and systems managers, all of whom are indeed connected by the ubiquitous, ever growing "internet of things".

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