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AFFORDANCES OF INTERORGANISATIONAL INFORMATION SYSTEMS (IOIS) – A PHARMACIST'S PERSPECTIVE

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Abstract

The IS research community is still struggling with a proper theorisation of the IT-artefact. The debate manifests in questions regarding the effect of IT (Markus and Silver 2008), the identity of systems (Reimers et al. 2009), or more generally the appropriate theoretical tools for studying these systems. Part of the quest for theorising the IT-artefact is whether technology possesses inherent properties affecting human behaviour or if technology is a product of a social construction? The notion of 'affordance' seeks to overcome this dualism by positioning itself as a relational concept. An 'affordance' is mutually constituted by subject and object. This paper uses the notion of 'affordance' to analyse an electronic ordering system between pharmacies and wholesalers. The paper aims to scrutinise different means of ordering from a pharmacist's perspective. In doing so, benefits as well as challenges of using 'affordances' to study the IT-artefact are exemplified. The paper demonstrates that 'affordance' as an analytical tool offers a much richer analysis of empirical data than a mere description of functional properties would allow. Despite its merits, the paper finds that the notion of 'affordance' requires theoretical extensions in order to render it more suitable for the study of interorganisational information systems.

Keywords: IT-artefact, affordances, interorganisational information system, ecological psychology.

1   INTRODUCTION

The question what the IT-artefact actually is and how to grasp it theoretically, resurfaces continuously in different pieces of research. In a literature review on inter-organisational information systems (IOIS) Robey et al. (2008) bemoan the missing 'fit' of theoretical tools and the materiality of the technological artefact under scrutiny. The authors urge researchers to engage with the IOS-artefact on theoretical grounds. Reimers et al. (2009) seek to explain and understand the evolution of an information system. One aspect of their research question that also motivates this paper concerns the difficulty to establish the identity of an artefact throughout time. Given all the changes over the years, in which way does it make sense to speak of the selfsame artefact? Does such identity rest on some essential properties of the artefact and what would these be? The (causal) relationship between technological artefact and social elements is controversially discussed too (Markus and Silver 2008; Markus and Robey 1988). Even in the group of intermediate approaches between technological and social determinism the conceptualisation of the technological artefact is subject to a debate (Grint and Woolgar 1997; Hutchby 2001, 2003; Rappert 2003; Pinch and Bijker 1987). Hutchby (2001) criticises the constructivist metaphor of technologies-as-texts (Grint and Woolgar 1997) on the grounds that it attempts "to purge all rogue references to the 'inherent properties of technologies" (Hutchby 2003, p. 582). His third way between constructivists and realists rests on the notion of 'affordance'.

The ecological psychologist James J. Gibson (1979) coined the term 'affordance' to refer to the multiple uses for which artefacts may be employed. He stresses that we do not perceive the qualities of objects but their affordances. An affordance always points into two ways simultaneously. It exists only in relation to an individual and an object. Thus, this concept offers the potential to simultaneously incorporate human agency as well as the constraining and enabling character of technological materiality. While the concept originated in Ecological Psychology, it has subsequently been employed in sociological studies of technology (Hutchby 2001; Rappert 2003) and recently in the IS literature as well (Markus and Silver 2008; Grange and Benbasat 2010; Leonardi 2011).

This paper seeks to examine the value of 'affordances' for the study of IT-artefacts by employing it in a case study on an electronic ordering system. Studies in information systems research (ISR) generally target a higher level of generalisation by focusing on user groups rather than individuals. In line with the theoretical background of the concept this paper takes the perception of individuals as a starting point. The paper delineates similarities between individual accounts. It shows that affordances can be used to derive generalisations for user groups. The system under scrutiny allows the transfer of orders between pharmacies and wholesalers in Australia. While representatives of both groups would qualify for an affordance-based analysis, this paper concentrates on the pharmacist's point of view. The analysis will demonstrate the usefulness of affordances for ISR. An affordance view characterises the IT-artefact in much more detail than is possible by simply resorting to the description of features. It acknowledges the constraining and enabling materiality of technological artefacts as well as the social processes of interpretation and appropriation. In this view the IT-artefact reveals itself as being flexible in its affordances to people. At the same time it avoids misinterpreting flexibility in terms of arbitrariness. By depicting the affordances of different means for ordering, they become present as an ensemble of complementary affordances at the disposal of pharmacies. This allows conclusions to the constraints under which they operate. By taking the dimension of time into account the analysis shows that an answer to whether or not the identity of a system changes is more likely to be found in the affordances than the properties of the artefact.

The next section provides an introduction to the concept of affordances. Subsequently, the unit and level of analysis will be presented. The fourth section describes the case material. A functional description is followed by two accounts of individual pharmacists, which form the empirical basis of the analysis. Section five aims at generalising these accounts to the level of community pharmacies. Next, the benefits as well as the shortcomings of the concept of affordances are discussed. The paper proposes several extensions to the concept in order to render it more suitable to the study of IOIS.

2 THE CONCEPT OF AFFORDANCE

Several accounts can be cited to illustrate the continuing struggle of scholars to clarify the nature of technological artefacts like information systems (e.g. Grint and Woolgar 1997; Pinch and Bijker 1987). In line with Hutchby (2001) this paper argues that affordances represent a third way that avoids either of the extreme poles. What technology is and what it does, is neither solely determined by its materiality nor its interpretation. The following sketches the argumentation by Grint and Woolgar (1997) as well as Hutchby (2001). It serves as a motivating background before engaging with the concept itself.

Grint and Woolgar (1997) review theories of or perspectives on technology. Starting with the perspective of technological determinism, they quickly come to the conclusion that such deterministic accounts in their pure form are scarce. It is, in their view, primarily used as a straw man for many constructivist accounts. Their analysis leads them to the observation that constructivist accounts renouncing any form of technical determinism still associate social change with technical properties. Grint and Woolgar stress the importance that such constructions do not result from some imagined intrinsic properties of technology. They critically review the positions of several renown scholars (Pinch and Bijker 1987; Orlikowski 1992). Their criticism bases on the observation that these accounts allow for constructivist argumentation only to a certain extent. The concept of 'interpretative closure' or 'stabilisation' is inconsistent with the constructivist scepticism towards technical capacity. Grint and Woolgar advocate for an anti-essentialist stance by proposing to treat technologies as text.

Hutchby (2001) is critical about this approach. In his view it leads to a conception of technologies as tabulae rasae. In a response to a critical assessment of his approach by Rappert (2003), Hutchby (2003) underlines that Grint and Woolgar explicitly contend "we do not mean to suggest that any reading [of technology] is possible, although in principle this is the case." (1997, pp. 72-73). That is, technologies are open to any possible interpretation. However, this is counterintuitive. At some level Hutchby argues, the capacity of an aeroplane and a bridge differs. Both do not lend themselves to the same interpretation. He proposes to talk about affordances instead of seeing technologies either in their interpretative textual properties or their essential technical properties. In that way, "[…] we need to pay more attention to the material substratum which underpins the very possibility of different courses of action to an artefact […]" (Hutchby 2001, p. 450).

The ecological psychologist James J. Gibson (1979) coined the term 'affordance' to refer to the multiple uses for which artefacts may be employed. He argues that while classical attempts suggest measuring object-inherent properties, we actually do not perceive the qualities of objects but their affordances. Gibson proposes an ecological approach to visual perception. Although most of his book focuses on visual perception the developed concept of 'affordance' is not limited to it. He starts out with the premise that the *environment* refers to the surroundings of animals. Animals in his sense are organisms that perceive and behave. The surroundings of an animal include other animals. He sees animal and its environment as an inseparable pair. The central concept of affordance implies this complementarity of the animal and the environment.

In Gibson's terms "The *affordances* of the environment are what it *offers* the animal, what it *provides* or *furnishes*, either for good or for ill." (italics in original, 1979, p. 127). An affordance is not a physical property of an object but exists relative to a subject. Affordances are only specifiable in relation to an individual and thereby exist only when two entities (subject and object) are considered simultaneously (Heft 1989, p. 4). "Although the material properties of a technology are common to each person who encounters them, the affordances of that artifact are not. Affordances are unique to the particular ways in which an actor perceives materiality." (Leonardi 2011, p. 13).

An object called 'seat' may not afford 'sitting-on' for a child. The child has a different body-scaling (leg-length, body weight) than an adult. The affordance of an object that characterises it as a seat in the linguistic domain is therefore only specifiable if the engaging subject is simultaneously taken into account. Heft (1989) argues, "affordances are the environmental counterparts to the animal's

behavioral potentialities" (p. 6). The perceptual and behavioural capabilities of an individual co-implicate (1) what is perceivable and hence describable of the environment, and (2) what is significant of the environment in relation to an animal's actions.

He provides one example that points to the existence of affordances in a social context. The postbox, he argues, affords letter-mailing to a letter-writing human in a community with a postal system (ibid, p. 139). The physical appearance of a postbox does not specify this affordance. In the US a postbox looks differently than in Great Britain or elsewhere. The ability to perceive a postbox is thus an acquired knowledge in a socio-cultural context. The notion of context is difficult to grasp and the literature on affordances provides little guidance. There is a wider context in the sense that an individual is living in a society with a postal system. But there are affordances in relation to the postbox that reveal themselves only in other contexts. For instance, a postbox accepts mail 24/7. Thus, the postbox affords letter-mailing outside of normal business hours. An affordance that is particularly present to individuals in time-sensitive situations. As stated before, the environment in Gibson's sense includes other animals as well. In fact he claims the "richest and most elaborate affordances of the environment are provided by other animals […]" (Gibson 1979, p. 135). The resulting interactions are characterised by reciprocal or mutual affordances. "[…] what the seller affords to the buyer cannot be separated from what the buyer affords to the seller […]." (ibid, p. 135). Gibson ends with his discussion of these social interactions by merely stating that the perception of these mutual affordances is enormously complex but nonetheless lawful. The case study in this paper elaborates on affordances that form around a context of interaction with another actor.

The concept of 'affordances' is not undisputed, even in its originating discipline. The rather fundamental discussion on how to define an affordance is the topic of a special issue of *Ecological Psychology* (2003). A closer examination is however out of the scope of this paper.

Hutchby (2001) emphasises four aspects of affordances that are relevant for the following analysis. First, the concept of affordances is not limited to a specific type. For instance, there are affordances of the natural environment, other artefacts and other actors. Second, affordances describe a functional and relational aspect of an object's materiality. An object may enable and constrain an activity (functional), but this is dependent on the actor (relational). Third, in a human world objects and affordances are tied in a complex web of rules and values governing action. These rules are subject to learning. Fourth, the affordances of artefacts as manufactured objects are not necessarily solely dependent on their natural features (i.e. material they are made of) but can be designed into them. This last point became prominent in the field of Human-Computer Interface design and relates to the work of Norman (1990). His view however is not wholly consistent with Gibson's original conception of affordances (McGrenere and Ho 2000; Leonardi 2011).

Markus and Silver (2008) propose the notion of affordance to overcome deficiencies of the concepts 'spirit' and 'structural features' by DeSanctis and Poole (1994). Especially, the latter is subject to a concern that is also relevant here. Markus and Silver (2008) argue that the original conception of 'structural features' regards them as properties of an artefact. This raises the problem of decomposition. In short it addresses the question what to consider as a (relevant) feature. How far must an analysis advance to produce meaningful results? Affordances seem to overcome this deficiency. They are not inherent to the artefact but exist in relation to a specific 'user group' (ibid). The specification of such a user group is methodologically challenging and seems prone to a similar decomposition problem. The theoretical background of affordances argues from the perception of an individual. Thus, this paper holds the position that the direction of theorisation is to move from individual accounts to groups of users. It avoids the a priori assumption that affordances exist for a pre-defined user group. Technological properties resurface in affordances by presenting themselves differently to different individuals or to the same individuals in different contexts.

The discussion of the literature shows that the examples provided by scholars to illustrate the concept of affordances are rather simple. This paper transfers the concept to a more complex setting. It may thus serve as a test environment for the theoretical concept.

3 UNIT AND LEVEL OF ANALYSIS

The case study on which this paper bases covers a period of 25 years. The empirical data collection was carried out as part of a larger research project over the last 4 years (Klein et al. 2008). The research project was positioned in the area of IOIS. It focused on the development of electronic ordering systems between pharmaceutical wholesalers and community pharmacies in Australia. The research project employed a case study design (Yin 1994). Consequently, semi-structured interviews were carried out with representatives of wholesalers, software vendors, associations and pharmacies. The analysis of affordances in this paper features two individual accounts of pharmacists. In total nine interviews with pharmacists lasting one hour on average constitute the empirical footing on which the analysis of this paper rests. Despite one interview, all interviews were tape-recorded and transcribed. Albeit interesting from a research perspective, a wider analysis of affordances relating to other user groups needs to be postponed to another paper due to space restrictions.

The market for pharmaceuticals in Australia is tightly regulated. Today, three full-line wholesalers operate nationwide. They are providing the full range of products sold in Australian pharmacies to roughly 5.000 pharmacies. Legislation prohibits the formation of pharmacy chains. Depending on the state the ownership of pharmacies is restricted to 4-5 outlets. A lot of pharmacies are organised in so-called banner-groups which are largely owned by the three wholesalers. Basically, members of these groups pay a subscription fee to get support for joint marketing activities. Moreover, the owning wholesaler provides discounts to the constituents of a banner group. However, there is no contractual obligation to order exclusively from this wholesaler. A large number of small software vendors are competing. The installed base of the 4-5 largest vendors accounts for 80-90% of the market.

4 MEANS OF ORDERING

The practice of ordering pharmaceuticals and receiving the delivery of the ordered items forms the core of the case description in this section. A basic functional description of the order-delivery cycle and the different means of ordering precedes two individual affordance-based accounts of pharmacists. This constitutes the basis for the later analysis of affordances in the next section.

4.1 Functional description

Australian pharmacists primarily sell pre-packaged products to their customers. The pharmacist does not manufacture most of the products. Instead, he relies on a second party to deliver the goods, a role which the pharmaceutical wholesalers assume. Both business models (wholesaler and pharmacy) are based on an order-delivery concept. This basically means that the pharmacist issues an order (list of items) to the wholesalers. While pharmacies are free in regard to which wholesaler they send their order to, they generally have a primary wholesaler where the bulk of their orders go. The wholesaler processes the order, commissions the items and subsequently dispatches a delivery to the pharmacy.

From the late 1980s to the mid 1990s software vendors started to promote dedicated software to pharmacies. Electronic ordering is part of this software. Table 1 provides short characterisations of the different means of ordering. The order list is automatically populated with items that have been sold/dispensed during the day. This list can be turned into an order list. However, this order list can be manually edited before sending it off. After the order is sent off, the pharmacist can dial into the wholesaler's system in order to download the invoice including information of out-of-stock items. There is a commitment that orders reaching the wholesalers' system until a specific 'cut-off time' (e.g. 11 am) will be dispatched with the next delivery. Until recently all wholesalers supported up to two deliveries per day. This has been cut down to one delivery per day. Because each pharmacy is on a specific position in the run of the delivery vans, the pharmacist knows when to expect the van. The delivery is at the same time used to collect empty boxes (from previous deliveries) as well as any return items. Despite using electronic means, pharmacists can call the wholesalers. Each of them

operates dedicated call centres in each state. The sales staff is able to look-up the stock levels and can alter other orders (e.g. electronic orders) for the pharmacy that is calling.

Means of Ordering	General description
Phone	Used to be main way of ordering in the 80s. The introduced electronic ordering gradually replaced ordering by phone as the major way of ordering.
PDE	A small handheld device that is able to scan barcodes and transmit an order over a modem connection to a specific wholesaler. It cannot transmit orders to multiple wholesalers. The PDE was introduced in the early 1980s by the wholesalers.
Software (modem)	Software was introduced to pharmacies first as a dispensing system and subsequently as a point-of-sale system. The diffusion took place from the late 1980s until the mid 1990s. Over 90% of all orders reaching the wholesalers are electronic today. The software relies on a modem connection and implements proprietary product codes and communication protocols for each wholesaler.
Software (internet)	In 2006 a software was rolled out that relies on a different architecture than previous versions. A server encapsulates the proprietary protocols of the wholesalers as a central gateway. The pharmacy software would interact with this gateway rather than directly with the wholesaler systems. The system supports a broadband connection. Wholesalers pay a subscription fee to the gateway but pass it on to their customers.

Table 1.   Means of ordering

4.2   Case Vignette I: Peter Miller (pharmacist)

Peter Miller (fictional name) is in the pharmacy business for almost 30 years. A few years ago he resigned as a pharmacy owner but continued working as a pharmacist. The pharmacy he is currently working in is located in close vicinity to a doctor's clinic in the Melbourne area. Peter has the impression that pharmacy margins are nowadays eroded by external pressure of the government and by internal competition in the industry due to supermarkets and price-aggressive pharmacies. He favours the pharmacy's policy to put more emphasis on personalised care than on retailing. This is reflected in the turnover ratio (70% prescriptions, 30% shop). A lot of the business is repeat business meaning that people come back regularly. Instead of going to the doctor, a lot of people go to the pharmacy first, at least for minor ailments, because consultation is provided free of charge.

When dispensing a product, Peter scans its barcode to make sure it is the correct product. Furthermore, he records and checks the patients' details in his software and makes sure that there are no critical interactions. "Cause if something goes wrong, we're liable. And even if the doctor writes the wrong thing we dispense it, but we're liable…we're supposed…we are the filters." For that purpose a patient's medication history is needed. This is part of the software.

By scanning the product and thereby dispensing it, the product is added to a stock usage list that forms the basis of a later order list. According to Peter, theoretically, the order list should be correct but never is. Peter reasons that for instance seasonal products should not be reordered on the basis of actual usage. Moreover, some drugs may be needed only occasionally but cost a lot of money: "cause you know, we have dispensed something that's a 1.000 [Australian] Dollars we don't want."

The shelves are labelled with barcodes which were used for ordering with a PDE-device. This is not done anymore. Today, a clerk would go around the shop to check whether something needs to be reordered. Furthermore, the barcodes are used to indicate the correct place for storing delivered items.

The computer automatically generates an order list but according to Peter it is important to manually review that list for several reasons. First, "we have better prices from different wholesalers, certain drugs have better prices from different wholesalers." Secondly, efficient stock keeping requires minimising the amount of dollars on the shelf. "[…] everything that is on the shelf is costing its money. […] you need to maximise turnover." Because the reimbursement is fixed for most products "it is imperative that we buy for the correct prices."

Stock-outs are not a frequently encountered problem and most people would be fine with coming back the other day. However, Peter admits "it's more than annoying to say 'yeah ok, well come back in a couple of days'". In these cases he calls the wholesalers by phone to make sure that the wholesaler has the item on stock so that "[…] we can say to them [the patients] 'yes, it will be there tomorrow at two o'clock'[…]." When ordering electronically the pharmacy receives a list back (invoice). The list indicates the items that will be delivered as well as those that are out of stock (no invoice number). This however takes some time.

The pharmacy contracts two wholesalers and gets one delivery per day by each. Orders coming in until 11 am (the other 7 pm) arrive the same day at 2 pm (the other in the morning of the other day). Peter is quite content having a cut-off time at 11 am because "[…] everybody wants to be delivered at the same time."

Peter is sceptical concerning a change of software. According to him, "if you got a better deal, then it might be short-sightedness to change, 'cause then it'll take us month to get used to it."

4.3   Case Vignette II: John Myers (pharmacist, owner)

The pharmacy of John Myers (fictional name) is located on a high street with no other pharmacy in the nearby vicinity. John has 20 years of experience as a pharmacist. The last 15 years he acted as a proprietor of the pharmacy. While 20 years ago the retailing side of the business was more important he considers the healthcare side as that what differentiates a pharmacy from anything else. The front-of-shop (retailing) contributes to 30% of turnover and the dispensary amounts to 70%. This ratio used to be 50-50 in the past. Compared to branded or price-driven pharmacies he considers the personal health-related advice more important: "you are not just selling a product, you know, it's health care."

When dispensing John would record the patients details in the computer (personal data, insurance data, etc.). However, he would not record all drugs in a patient medication history because this is not legally necessary for every product sold in a pharmacy and as he is present most of the time, he would know the history of the patient coming to him.

Johns reckons that he would have about 99% of everything he dispenses on stock. In case of a stock-out, most people would come back the next day. "Good business practice means that you can have everything when you need to for everybody. […] it's a balancing act between holdings and money to pay for things, it costs you money to hold all that stock. […] So the whole point is to keep enough, always keep one more than the one I need." John admits that he hates people having to come back. In these cases he prefers to make sure that the needed item will be delivered in time. "[…] so if I'm promising something to somebody or they need it, I prefer to make sure, that it's there […] and it gets done that way." Additionally, he tries to minimise stock-outs by using a secondary wholesaler. Still, most orders would go to his primary wholesaler in order to get the best prices.

In addition to ordering, John sees the phone call as a monitoring device for his relationship with the wholesaler. "And also I can get on the phone and see, if you know, not know somebody personally, but have an efficient, have somebody at another end of the line, who actually will take a phone call and act on what you asked of them, rather than to ignore you or forget […]".

The major part of orders is done electronically. The system produces an order list depending on the sales of the day. However, "I don't like to do that, I prefer to print out, what I have used and manually go through it […]. It makes me check what I am doing. […] it's a better control on your stock levels that way." John's cut-off time for the primary wholesaler is 11 am and he gets the delivery 2.30 pm the same day. He places his main order at 9 pm at the end of the day. The bulk of ordering is done at the start of the month in order to maximise the time for payment. Due to a recent cut-back to one delivery a day John needs to order more carefully to avoid stock-outs. About an hour after placing the electronic order, John can download an invoice from the wholesaler that indicates any stock-outs.

When John started, most orders were placed over the phone and PDE-devices for electronic ordering only gradually diffused. Today, he relies on computers for running the pharmacy. "[…] it's like being a delivery driver: if your truck is not working, you can't work." This is especially critical regarding the recording of people's information and information that needs to be handed out to patients. The access to information and the need to pass information to the customer has a much greater role today than it used to. "[…] by now we need to have that on our computers and we need to be able to produce it and print it and replicate it, so we can pass it on to our customers." Due to the difficulties in getting used to a new software, John would be hesitant switching to another system.

5   ANALYSIS

In this section the findings are generalised in a three-staged process. The next subsection generalises the individual accounts to affordances relevant for a group of users. Subsequently, these abstractions are categorised and set into relation with pharmacists' strategic considerations. Next, two major changes in the historical perspective are used to contrast the functional and affordance based view.

5.1   Affordances of the "community-pharmacy" user group

The vignettes suggest that electronic ordering and ordering by phone are two means generally distinguished by pharmacists. The following depicts both the affordances of electronic ordering and ordering by phone. By using the software, the electronic orders can be sent without any time constraints. Being an asynchronous medium it affords the pharmacist to place orders in the after-hours. Although the software is able to automatically generate an order list, it still allows employees to review and edit the order. This affords employees to manually go around the shelves and check the stock. Additionally, it affords altering the list due to seasonal and special needs. These affordances can be categorised to "optimisation of stock-levels". The functionality of sending orders to all wholesalers affords the pharmacist a freedom-of-choice. There are several implications that this freedom affords: First, it allows the pharmacist to exploit price differences between wholesalers. Second, the pharmacist is not locked-in to a specific wholesaler. His freedom-of-choice directly translates into potential bargaining power vis-à-vis the wholesalers. This power is 'potential' as most pharmacists prefer not to change their primary wholesaler often. Third, in case of stock-outs another wholesaler can be almost seamlessly contacted as a fall-back solution. The first two implications can be subsumed under the category 'price sensitive ordering'. The latter implication is strongly connected with another affordance. The 'invoice' does not only serve the function of a bill but specifies out-of-stock items as well. This feedback allows the pharmacist to quickly turn the (failed) order to another wholesaler. Thereby, it ensures a quick delivery constituting the category 'no-prolonged stock-out'. In conjunction with the delivery practices and cut-off times the system allows the pharmacist some predictability concerning the estimated delivery time. This can subsequently be turned into a pick-up time for a customer. These are subsumed under the category 'predictability of delivery'. Figure 1 illustrates the relation between technical features, groups of affordances and instances of affordances.

While the cut-off time for orders reaching the wholesalers is fixed due to technical reasons pharmacists can still phone the wholesalers for urgent orders. The sales staff is able to edit orders beyond the cut-off time, provided the commissioning has not yet started. Sometimes pharmacists prefer to call the wholesaler right away to reassure themselves and their customer that the requested item is on stock and will be delivered up to a certain time. The phone call signifies a commitment of the pharmacist to the customer. Apart from ordering, these phone calls are used to solve any problems that occur with the wholesaler. It affords a much richer conversation than is possible with electronic orders. Furthermore, the conversation and the subsequent actions by the wholesaler are expected to be an expression of a professional relationship. It affords the pharmacist to monitor this relationship. Although, the electronic ordering system is quite reliable phone ordering is considered as a fall-back channel if the electronic system is down for any reason. In contrast to the electronic system, the phone

call supports return transactions. These occur for instance if the delivery does not correspond the ordered items or if pharmacists realise that they have ordered too much of a specific product.
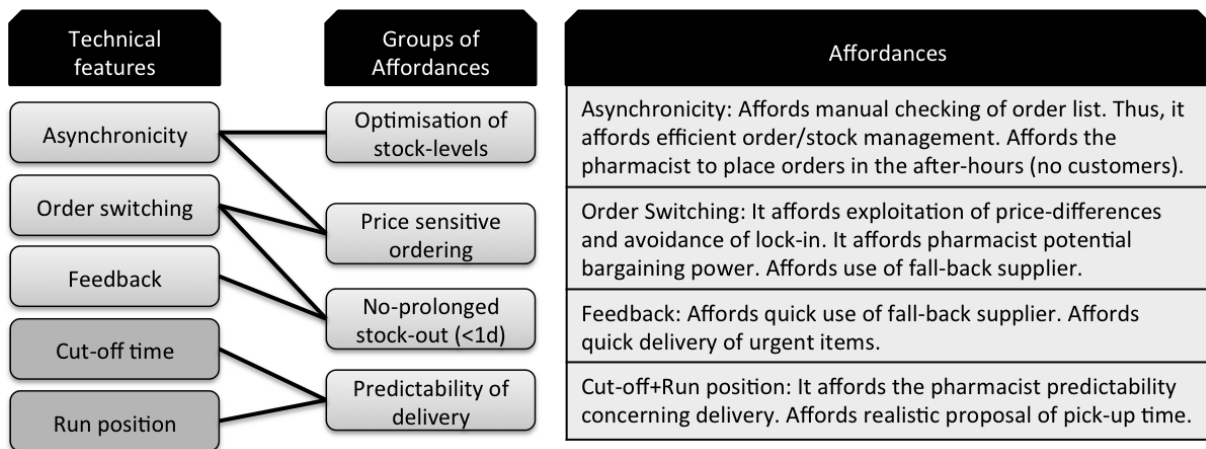

Figure 1.   Relational view on technical features, groups and instances of affordances

Due to the cut down to one delivery per day the position in a run has become a point of negotiation of the terms and conditions with the wholesalers. A fairly predictable delivery time affords the pharmacist to tell people when to come back. On the other hand, unstable delivery times are reasons for complaints. The position in a run signifies to a certain extent the importance of a pharmacy to a wholesaler. Moving the cut-off time and the delivery time would allow the pharmacy to adjust them to peak hours. Despite the cut down of the number of deliveries, the frequent deliveries still allow the pharmacies to optimise stock and shelf space as well as to reduce the risk of prolonged stock-out.

5.2   Strategic considerations

The aforementioned affordances can be translated into strategic considerations under which Australian pharmacies operate. Figure 2 illustrates the strategic considerations described above and sets them into relation with affordances.

Figure 2.   Affordances from a strategic view

The optimisation of stock-levels is crucial for the profitability of a pharmacy for several reasons. Pharmaceuticals have strict expiry dates. Stock is not only devalued when reaching the expiry date (even before the expiry date, pharmacists may not dispense it anymore) but needs to be properly disposed (involving additional costs). Some of these products are very expensive and would bind money if purchased in inappropriate quantities. Furthermore, some products are only requested by a small (up to a single) group of patients. The requests may come in regularly or only occasionally. This is especially true for seasonal products. As a result pharmacies seek to keep stock-levels as low as possible. Fully automated ordering would run counter this need. Therefore, a manual review of the order is necessary. However, pharmacists seek to achieve a high service level towards their customers in terms of delivery capacity. Here the general conviction evolved that one day delay in dispensing would be tolerable in most cases. Customers would be assured that they could pick up their product the next day. Most customers would comply and come back next day instead of trying out another pharmacy. Due to decreasing margins and fixed reimbursement schemes pharmacists seek to get

discounts from their wholesalers. Loyalty schemes and banner groups allow them to benefit from a highly complex discount structure. This is often the reason to order as much as possible from their primary wholesaler. The secondary wholesaler would be used for specialised medicines, promotions or if a stock-out is imminent and the primary wholesaler would not deliver in time.

5.3   Evolution of electronic ordering

Different means of ordering emerged over time. The empirical data allows tracing back this development. Two major points of change are core to the analysis because they denote the unique perspective affordances allow compared to a technicist point of view.

In the early 1980s ordering by phone was the most prominent way for placing orders. In the beginning of the 1980s the wholesalers began to introduce the PDE devices. While this already allowed electronic (asynchronous) ordering, it restricted the pharmacist in switching their suppliers. The PDE was a wholesaler specific device that implemented proprietary specifications (product code; communication protocol). From the late 1980s to the 1990s the software vendors started to roll out pharmacy software along with the functionality of electronic ordering. From a wholesaler's point of view, the technical change brought about by this software is rather small. Still, the software vendors had to implement the proprietary protocols as well as the wholesalers-specific product codes. At the same time it constituted a major change from a pharmacist point of view. In contrast to the PDE pharmacies were able to send orders to each of the wholesalers electronically. The major part of the affordances described above relies on the technical functionality to send orders to multiple suppliers. The technical change induced a change of pharmacy practices.

A few years ago a new means for electronic ordering emerged. It builds upon the increasing availability of broadband in Australian pharmacies. The software vendors sought to ease their burden to implement the proprietary protocols and product codes in their software. Instead of each of them implementing these for their own, they jointly developed a gateway. While it places the ordering software on an entirely new technical basis, there are few things that changed from a pharmacy's perspective. Instead of the old and cumbersome modem connection, it transmits orders via broadband. The feedback is now quicker and allows faster rerouting of orders. Pharmacies do not regard this change as significant. From their point of view the introduction of electronic claiming with the government is far more significant. In contrast, the software vendors consider it a huge breakthrough as it bases on a new technical base and given that already some initiatives with that aim failed.

6   DISCUSSION

This section will engage in a discussion of the benefits and shortcomings of the concept of affordance for ISR. It will do so by first pointing out the benefits of the previous analysis. Next, the challenges of adapting the concept to the study of IOIS will be presented.

The paper sets out to advance the concept of affordances by applying it to a rich case study. The literature on affordance provides no guidance as to which methodology is appropriate to do so. Markus and Silver (2008) criticise the concept of 'structural features' by DeSanctics and Poole (1994) as the proposed distinction of 'core' and 'optional' features as well as the methodological 'scaling' of features on possibly relevant dimensions does not help to answer what feature really matters. Affordances help to overcome this. In that vein this paper contrasted a basic functional description with affordances deduced from individual accounts. By setting the technical functionalities into relation with affordances a more detailed analysis of IT in pharmacies is possible. Two major points of interest came to the fore that illustrate the difference between a technical and affordance-based analysis. First, the change from PDE to software based ordering constituted little technical change for the wholesalers but presents itself as a major change for the affordances of pharmacies. Second, the change from modem-based to ordering over the internet entailed a significant technical change but was barely mentioned by pharmacists. That is, while the affordances did not change, the technical basis

was exchanged. The answer to the question whether or not the identity of a system changes is more to be found in the affordances than the properties of the artefact. A detailed analysis of the evolution of affordances over large timescales was not possible in this paper. Yet, the previous argumentation indicates that from an affordance-based view an IOIS may change at different pace and in different degrees depending on the perceiving individual.

The direction of theorising the IT-artefact is contrary to other attempts in the literature (e.g. Orlikowski 2000). Direct perception seems to be the counterpart to interpretive flexibility. It takes the level of the individual as the starting point. While the notion of "interpretive flexibility" already entails a social context, an affordance is investigating the individual perception. Hence, there is no conceptualisation of organisation. Furthermore, the specification of a 'user group' seems to be equally problematic as the problem of decomposition that Markus and Silver (2008) seek to overcome. The vignettes demonstrate that IT is embedded in a complex and highly contextualised web of routines. In different contexts (stock management, customer service, etc.) the IT-artefact becomes present in affording different things to the individual. The notion of affordance cautions against generalising too easily. At the same time, the analysis shows that individuals under similar circumstances exposed to similar contexts are likely to perceive similar affordances.

IOIS are primarily analysed on the organisational level (cf. Robey et al. 2008). The unit of analysis is often much wider to include potential factors impacting on IOIS. Reimers et al. (2004) distinguish four levels of analysis: Remote environment; industry segment value system; industry segment; firm. Each of these levels entails an array of potentially influencing factors. Reimers et al. (2009) incorporate these factors in the form of a structurational concept of action. Based on Giddens (1984) they argue that structure constrains and enables action while being itself reproduced through actions. By studying IOIS the researcher would thus deduce the underlying structure of the patterns of actions he observes. Thereby, the researcher infers a social structure that characterises the IOIS. An affordance arises out of the relation between a subject and an object. Instead of an individual actor, IOIS are situated on the level of social systems (e.g. organisation). It is thus a social system to which an artefact affords something. This leap in the level of analysis is not necessarily out of scope for the notion of 'affordance' as for instance the example of the mailbox shows. The notion of social structure is however not in the scope of Gibson's theory of perception. He is not particularly aiming at the explanation and description of social systems. It can be stated that the concept of 'affordance' is primarily addressing the micro-level while IOIS are mostly discussed on a meso- or macro-level.

The development and maintenance of IOIS represents investments of an organisation. An IOIS is not just in existence. It cannot be perceived as having an affordance of for instance 'ordering'. Instead, it requires an alignment of the participating social systems. Again, it might be too bold to state that the theory of affordances is incapable to deal with such phenomena. Still, Gibson designed the theory to better account for perception. Such phenomena would thus be covered by the notion of learning and maturation of individuals. But this does not entirely grasp the process of mutual alignment that organisations venture in an IOIS.

The concept of IOIS is a profoundly relational concept. Here 'relational' means a relation between two or more social systems. The process of ordering on the retailer's side makes only sense if there is a process of delivery on the wholesaler's side. Both processes receive meaning only in their recurring mutual constitution in interaction. One does not make sense without the other. In that regard an IOIS as such only affords 'electronic ordering' insofar as the act of 'delivery' exists as the interrelated counterpart of 'ordering'. Otherwise an electronic ordering system between wholesalers and retailers is inconceivable. Gibson simply states, "perceiving these mutual affordances is enormously complex, but […] nonetheless lawful […]" (1979, p. 135). As such the theory requires some extensions in order to provide further guidance or explanation on phenomena that are core to IOIS-research.

7   CONCLUSION

The paper set out to empirically test the Gibsonian concept of 'affordance'. After laying out the theoretical foundation of affordances the paper used two accounts of individuals as a starting point for the analysis. The study has several limitations. Due to space restrictions accounts of other user groups were omitted. Furthermore, a larger sample in regard to pharmacists may have revealed the need to introduce clusters inside the group of pharmacists. Both case vignettes demonstrated the different facets that a rather simple IT-artefact assumes in different contexts for an individual. The paper ventured to explore the intricate relationship between individual meaning and generalisability of findings. Although the discussion shows that further engagement with and advancement of the theory is needed, the findings suggest that 'affordances' are a promising tool to discover different intra- and inter-individual accounts of technology.

While the paper primarily aims for a theoretical contribution, the concept of affordance bears relevance to practitioners as well. It appreciates individual, potentially diverging perceptions of an artefact and its identity. For instance, Kanellis et al. (2000) propose to use the identity of a system and its loss in order to investigate the failure of systems.

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