

Theorising visual management

Abstract

Visual management is much used in practice, particularly in association with process improvement initiatives in diverse areas such as production and healthcare. The practitioner literature abounds with suggested best practice. However, there is little attempt to theorise about why the design and use of visual devices for such process improvement works in practice. Within this paper we describe a design theory which unpacks the role that material and visual artefacts proposed by visual management practitioners play within particular ways of organising work. We explore how first and second order affordances, situated around the visual artefact, connect three domains of action, which we refer to as articulation, communication and coordination. Two cases of such ways of organising are used to help ground both the theorisation and visualisation discussed.

Keywords: Visual management; visual workplace; visual devices; ways of organising; affordance; operations management; healthcare management

Word count: 7,422

Track: Open track (although the authors would like the paper brought to the attention of both the organizational studies and operations, logistics and supply chain management track as the theorisation proposed in this paper crosses these domains)

Theorising visual management

‘Everything that one can see in an organization sends a message, even a blank wall’ (Liff and Posey, 2004).

Introduction

This paper makes the following contributions. First, we describe key themes evident in a developed and thriving practitioner literature but which appears little discussed in the academic literature associated with the management of operations. This is the area of visual management. Second, we highlight the lack of theorisation underlying this highly successful stream of contemporary management practice. Third, we provide an initial theorisation of visual management in terms of the notion of affordances provided by informative artefacts within particular ways of organising work. Fourth, we describe how this theorisation provides elements of a design theory for visual management, which we aim to test in further work.

The phrase ‘visual management’ is used in some disciplines to refer very broadly to the application of a visual frame of reference (sometimes referred to as the visual turn), as well as associated visually-based research methodologies, to issues of management and organisation (Puyou, Quattrone, McClean et al., 2012; Bell, Warren and Schroeder, 2014). Within this paper we focus upon the narrower, pragmatic sense of the term adopted within the management of operations, as applied within diverse settings such as manufacturing and healthcare (Galsworth, 2005). We particularly wish to unpack the visual turn as framed within this particular area of managerial practice.

The success of visual management is usually linked to process improvement philosophies and particularly the philosophy associated with lean operations (Holweg, 2007). Besides a few notable exceptions, there is a surprising lack of coverage of visual management in the academic literature, both within production management (Parry and Turner, 2006; Bateman and Lethbridge, 2014) and within the management of healthcare operations (O’Neill and Jones, 2011; O’Brien, Bassham and Lewis, 2014). We speculate that this may be due to two things. First, the body of knowledge which constitutes visual management has arisen amongst communities of ‘lean’ practice over two decades. Publications which promulgate visual management are also heavily associated with management consultancy as applied to particular areas of industry and the public sector, which orient their key value-proposition in terms of these ideas. Second, we speculate that this lack of coverage may be down to the basis of visual management in what might be referred to as ‘folk theory’. In other words, the principles established for visual management by the practitioner community tend to be substantiated in terms of anecdotal cases of apparent good practice, rather than in terms of some foundations established in academic theorising, which open up avenues of empirical investigation.

The current paper attempts to theorise about the efficacy of a number of visual management principles. We base our theorisation around the positioning of visual devices placed at the heart of visual management. We particularly consider the notion of affordance (Gibson, 1977) in relation to such artefacts, but argue that this notion in its original form cannot account effectively for the place of visual devices within the accomplishment of organising. This leads us to argue that we need the idea of three domains of action and two levels of affordance to properly theorise about the part such artefacts play within ways of accomplishing situated choice within work.

To help ground our theorisation we utilise a simple case of routine action undertaken in a clothing repair shop. We explain how the visual and material devices employed within this setting are critical

to organising the work of multiple actors. In applying such theorisation to the case in question we establish some features of a design theory for visual management.

The visual workplace

There is evident linkage between at least four strands of work related to the notion of visual management. Visual management is particularly associated with the concept of lean production (Holweg, 2007), but has more recently been utilised within ideas of lean services (Radnor, 2010). Lean production is an approach to production management that focuses on cutting waste, whilst ensuring quality. Visual management can also be seen to have its' genesis within the five key principles (sometimes referred to as pillars) of Shingo. These pillars are frequently referred to as the 5Ss after the Japanese words seiri (sorting), seiton (arranging or setting in order), seiso (sweeping or cleaning), seiketsu (standardising or integrating the first three principles into work) and shitsuke (sustaining discipline). (Hirano, 1995). Visual management is also particularly implemented in terms of ideas of the visual workplace (Grief, 1991) and particularly through systems of visual devices.

The visual workplace employs the idea of using visual devices situated within work settings to communicate with 'doers' – the actual people performing work within these settings (Grief, 1991; Hirano, 1995; Liff and Posey, 2004). Galsworth (Galsworth, 1997) defines the visual workplace in terms of the principles of Shingo – a set of principles first established in the work of the industrial engineer Shigeo Shingo (Hirano, 1995). She refers to the visual workplace as '*a work environment that is self-explaining, self-ordering, self-regulating, and self-improving – where what is supposed to happen does happen, on time, every time, day or night*' (Galsworth, 2005). Visual workplaces are seen to be instantiated through visual systems, which Galsworth (Galsworth, 1997) defines as '*a group of visual devices that are intentionally designed to share information at a glance, without having to say a word*'. A visual device is further defined by Galsworth (Galsworth, 1997) as '*a mechanism that is intentionally designed to share information vital to the task at hand at a glance – so that what is supposed to happen does happen*'. She then confusingly goes on to define visual information as '*messages communicated through any of the senses: taste, touch, smell, and hearing as well as sight*'.

The visual management literature argues that there are four main types of visual device, defined in terms of whether '*the message it sends is likely to be obeyed*' and '*the potential risk or loss if we decide to ignore it*' (Galsworth, 1997). This distinguishes visual devices in terms of a 'ladder of control' ranging from visual indicators and signals on the one hand to visual controls and guarantees on the other. Visual indicators and visual signals merely suggest certain behaviours to actors but adherence to the messages on the part of such actors conveyed by these devices is optional. In contrast, visual controls and visual guarantees attempt to ensure that adherence to the message is automatically undertaken through the structure of the device itself.

A visual indicator is seen to provide or share messages with receiving actors, but it is passive. In other words, whether the receiver of the message complies with the message is optional. Hence, a visual sign placed alongside a particular road and indicating a direction to some designated place necessarily serves to inform a driver of a possible outcome, but the driver does not need to turn his automobile in that direction if his intentions are otherwise.

A visual signal also provides a certain message to a receiving actor, but in this case there is an expectation that the receiver takes attention and reacts to the message. The classic example of a visual signal is the traffic light. A red light on this device will indicate to the driver that she should stop. If she fails to stop she is likely to suffer from sanction (such as a police fine) or other deleterious

outcomes (such as crashing into crossing traffic). To reinforce the message visual signals tend to be no longer passive but active – their properties change to reinforce the message. Hence, the traffic light changes colour to reinforce the changing nature of hazard in the road situation.

Visual controls attempt to impact upon the behaviour of the receiver directly by building the message into the physical environment itself – *‘the physical structure of the device sends the message’* (Galsworth, 1997). The response taken by the receiver of the message is hence no longer limited solely by the message itself. Use of the device constrains potential future action. Hence, speed bumps signal a message to drivers to slow down. However, if a receiver of this particular message does not slow down he is likely to damage his automobile’s suspension. Equally, lines within a car park indicate to users of the car park the proper positioning of parked cars. If such users do not park within a designated parking bay they are likely to be fined by the parking authority.

Visual guarantees are also known as mistake-proof, fail-safe, or Poka-Yoke devices. *‘A visual guarantee is designed to make sure that only the right thing can happen. It prevents us from doing the wrong thing’* (Galsworth, 1997). Visual guarantees are normally devices designed explicitly to determine certain behaviours unequivocally. For instance, a simple defect-shute of a defined size and down which the machinist must pass every product he produces, ensures that each product is checked in terms of a defined tolerance of width. Another example is the moulding of a tool-holder such that it becomes impossible to position a particular tool in the wrong place and in the wrong orientation for easy access by workers.

Within more recent literature Galsworth (Galsworth, 2005) has modified her taxonomy of visual devices by changing some of the terminology and locating ‘ownership’ of such devices with particular roles in the workplace. Visual standards define what is supposed to happen in the work setting and are the responsibility of engineers and supervisors. Visual displays indicate the answers to the core questions of where, what, when, who, how many and how - they are the responsibility of supervisors, managers and schedulers. Visual metrics provide feedback on performance and are the responsibility of supervisors, managers and executives. Visual controls and visual guarantees still appear in her taxonomy in much their original guise.

Visual devices as described are particularly associated with the attempt to translate organisational expectations into directly observable, concrete practices. Such expectations may be formulated by management. However, within production management philosophies such as Shingo, these devices are frequently designed or co-created by work-groups with the express purpose of continuously improving production processes. Such organisational expectations are frequently framed within the visual management literature as ‘discipline’ – influencing, directing, limiting or guaranteeing people’s behaviours through visual devices (Galsworth, 1997). Visual devices such as performance boards or check-lists therefore are an attempt to convey expectations of valued behaviour while also implying that such behaviour is monitored to ensure adherence.

Visual devices are also used to tackle what Galsworth (Galsworth, 1997) refers to as information deficits. An information deficit occurs when information does not get shared rapidly, accurately and completely amongst the workforce as soon as it becomes available. Galsworth (Galsworth, 1997) believes that such deficits come in two forms: location deficits and specification deficits. Location deficits result from not knowing where things are. Specification deficits result from workers not knowing what is required, when it is required, how to do something and how much or how many of something is required.

Visual management has continued to influence the practice of operations and production management (Liff and Posey, 2004; Galsworth, 2005; Parry and Turner, 2006), particularly as it concerns lean operations (Bateman and Lethbridge, 2014). There is a recent trend to adapt many of the principles of visual management to service as well as manufacturing settings. For instance, manual whiteboards as visual devices for enabling coordinated work have been used within healthcare, within higher education and within legal settings.

The affordance of material and visual artefacts

It is tempting to adopt an idea much-used in many aspects of literature to explain the link between the articulation of an artefact such as a visual device and the actions taken in some domain of coordinated work such as the movement of a production stillage. This is the notion of *affordance*. The concept of affordance appears first in the work of Gibson (Gibson, 1977; Gibson, 1979) who defines it as ‘*what the environment provides or furnishes*’. The idea is that actors directly perceive the opportunity for action within the structure of the environment. Hence, a horizontal surface of sufficient size in relation to some actor affords support – it is stand-on-able. Or alternatively a surface at more or less knee height in relation to the actor affords sitting on – as an affordance it is sit-able. This idea is related to Gibson’s view that meaning is not a cognitive act. Meaning is already present and available to actors in the environment. In directly perceiving aspects of this environment actors inherently pick up cues to action.

However, for certain structures within the physical environment to afford action the actor must have certain capabilities or effectivities for performing action. Effectivities are ‘*properties of animals that allow them to make use of affordances*’ (Shaw and Turvey, 1982). In this view, affordances require the actor to have particular abilities which allow her to make use of a particular structure in the environment to effect action. As such, effectivities clearly relate to the embodied apparatus of a particular actor – on the one hand, to an organism’s sensory apparatus and on the other to an organism’s effector apparatus. The sensory apparatus consists of all the sense organs making up the organism while the effector apparatus consists of all the organs through which the organism can transform aspects of the environment. Hence, for instance, a rock of a particular size and shape is only sit-able because we as humans have stereo vision allowing us to sense physical objects as three-dimensional. But we are also bi-pedal organisms and as such can effect the act of sitting.

Therefore, the original theory of affordances relies on a number of key presuppositions:

- That the physical environment is structured – that the properties of structures are non-arbitrary, meaning that such properties are invariant across situations and hence are observer-independent.
- Physical structures within the environment are perceived directly by actors without any intermediate, conscious, cognitive processing.
- Physical structures constrain or enable actors through the opportunities they provide for action.
- Whether a physical structure affords action by a particular actor depends upon the effectivities of the actor – its’ sensory and effector apparatus.

To summarise, an affordance is an opportunity for action made possible both by the effectivities of the actor and by structures in the environment.

The concept of affordance has been much applied in thinking through notions of appropriate design in relation to artefacts such as computer interfaces (Norman, 1999). However, the concept itself seems

particularly well-suited to helping explain actions in relation to physical or material artefacts used for informative purposes, such as those proposed within the literature of visual management. Examples include manual whiteboards, magnetic tokens, post-it notes and Kanban cards.

The very physicality or materiality of such artefacts has led us in previous work to propose their particular suitability for domains of organisation that we refer to as situated choice support systems (Author, 2013a). One of our published studies involved an investigation of the practices surrounding a manual whiteboard used for the allocation of beds within the Intensive Care Unit (ICU) of an Australian General hospital. The physical state of the whiteboard as well as cues provided by the actual state of the hospital ward constrained action choice for medical practitioners. Such situated choice is seen as critical to facilitating organisational routines (Becker, 2004) performed by multiple actors within this setting.

An illustration of the whiteboard in use within this case is provided in figure 1. The observed state of this whiteboard as well as the observed state of the ICU itself, were used by nursing staff to make situated choices about bed allocation. For instance, the nurse manager always made a call at 9 am each morning to operating theatres to determine likely demand for ICU beds. This call was always taken in front of the whiteboard and from where all the beds on the ward could be observed.

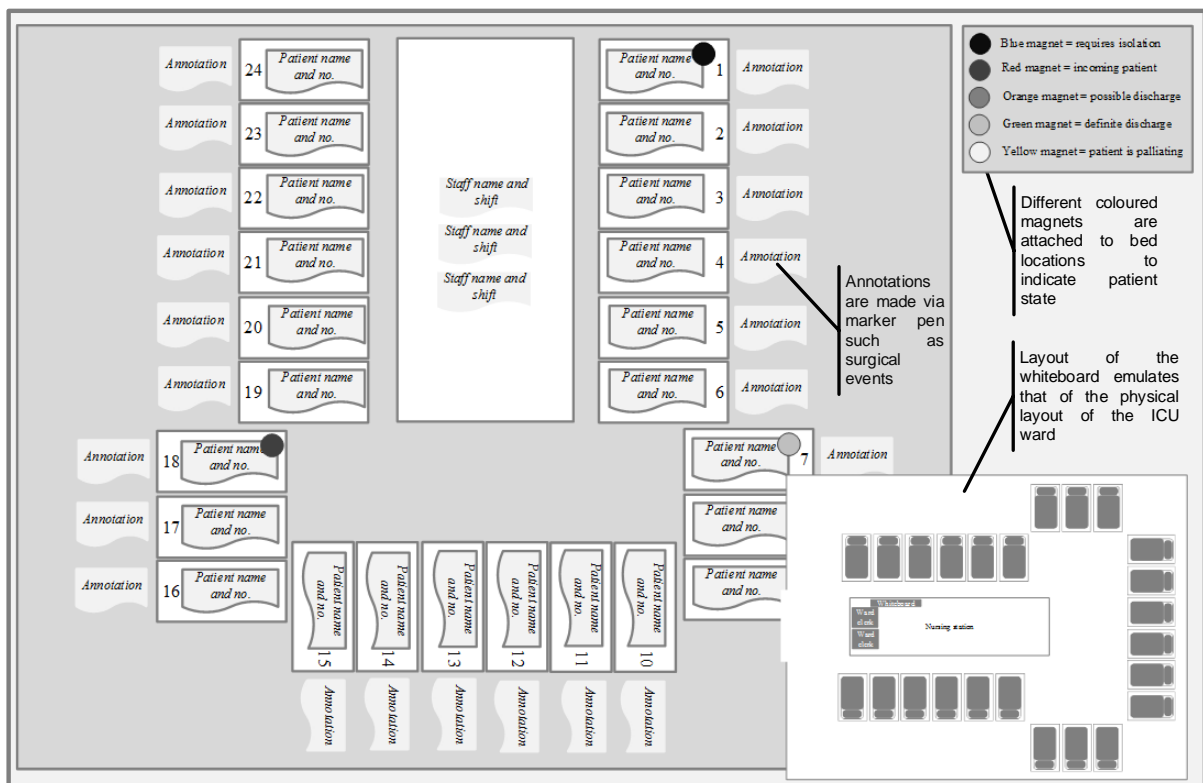


Figure 1. A manual whiteboards used in intensive care

The visual management literature would analyse this case as follows: The whiteboard itself acts as a visual device which controls and directs what activities can be performed on the ward. Visual signals such as a magnet placed on a picture of a bed cubicle tell the admitting nurse that no new patient can be placed in this bed. Visual controls, such as the colour associated with particular magnetic tokens, tell nurses to act (or not to act). For example, a yellow magnet indicates a patient is palliating so certain actions are not required. Visual guarantees are enforced by the physical workplace itself.

Hence, only one patient can be put in a particular bed on the ward and particular bed locations are associated with particular types of patient.

The visual management of the ward promotes the carrying out of activity in a routine manner where actors can directly perceive the visual device in the environment, such as the hospital ward, and act routinely with little deliberation based on visual cues for action. In previous work (Author, 2013a) we referred these systems of routine action which utilise artefacts such as kanban cards, flight progress strips and manual whiteboards as effective manual systems (EMS). We theorised that such systems have a number of features in common. Such systems typically involve routine and repetitive action on the part of participating actors. These systems tend to deliberately eschew the use of digital computing and communications technology. Instead, they involve the manipulation of physical artefacts. Actors utilise tacit knowledge of the use of such artefacts as well as the way in which the work environment is structured as cues to appropriate and immediate action.

Such artefacts are seen to be particularly suited for supporting what we refer to as situated choice. Within organisational routines in situations such as healthcare, choices of appropriate action are built using a *logic of appropriateness* rather than a *logic of consequences*. A logic of consequences underlies conventional models of decision-making and digital computing systems built for decision support. In contrast, a logic of appropriateness means that responses to situations are accomplished using direct appreciation of patterns in the working environment together with tacit knowledge of appropriate response. Hence, within the ICU the nurse can make immediate, situated choices about bed allocation.

Ways of organising

Within the current paper we focus upon another example of an effective manual system – that of a small clothing repair shop. The shop performs repairs to clothing as well as engaging in a limited amount of new clothing production. Three actors within this setting undertake a number of routine tasks on a daily basis including taking jobs from customers, selecting jobs to work upon, completing jobs and matching customers to completed jobs. This particular case is useful for our purposes in explaining difficulties with the concept of affordances because it is far simpler in nature than the ICU case referred to in the previous section.

The routine work here takes place within a long rectangular space within a shop positioned on a busy high street. At the front of the shop are two machine areas with sewing machines. Positioned further into the shop area along the right wall is a reception desk. Alongside this desk is placed a card-holder which hangs on the wall and is used for the scheduling of work. Behind this are two changing cubicles. On the left hand side of the room hang racks of clothing. This rack extends to the back of the shop. There is also clothing on hangers placed upon on a hook outside one of the changing rooms. These hangers are for jobs that are to be completed the same day they are brought in.

The main artefact used within this effective manual system is the card-holder (see figure 2). This consists of four rows of horizontal clamps fixed to the wall and into which are placed job cards. A particular job card consists of a rectangular piece of cardboard on which are recorded data about the client such as name, address and telephone number. All job cards also have a coloured sticker placed in the corner indicating the month the order was taken. The first three rows of the card holder hold cards assigned to the six days of the working week. The last row holds cards relating to jobs that have been completed and are waiting for collection.

The key presuppositions of Gibson's original notion of an affordance make it difficult to apply this idea to the use of artefacts such as the card-holder and its associated job cards. This is because Gibson's notion of an affordance relies upon direct perception of cues provided by physical structures, which stimulates action in relation to such physical structures. Hence, in the case of the ICU, a magnetic, coloured token affords one type of action. Namely, it can be placed in a particular position on some metal surface. In contrast, in the case of the clothing repair shop, a job card affords two types of action. As a physical structure it is not only write-able or draw-able it is also position-able.

But in such cases familiar within the context of EMS there is a paradox surrounding the affordances of such artefacts. Clearly a physical artefact such as job card affords actors certain actions. However, the affordances of such artefacts are typically used as cues or triggers to further action in another context or domain – the domain of work. For instance, in the case of the clothing shop, selecting a job card from the card holder triggers work on a defined garment. This linkage is difficult to account for within the classic notion of an affordance which suggests that actors directly perceive the action afforded by that artefact and perform an action that involves that artefact. In the cases we have studied actors perceive a possibility for action by looking at a whiteboard or scheduling tool and then they act somewhere else- in a separate work domain..

Schmidt and Simone (Schmidt and Simone, 1996) propose the idea of a second-order affordance to overcome the conceptual limitations of affordances in situations such as those described above. The idea relies upon the notion of two linked domains or physical environments. One domain, termed the articulation domain, is the domain in which artefacts such as job cards are manipulated. A related domain, termed the work domain, is the domain in which work is performed. Hence, arranging magnetic tokens on a hospital whiteboard is undertaken within the articulation domain and constitutes articulation work. Such manipulation acts in the capacity of coordination mechanisms in the field of work. The movement of magnetic tokens, for instance, serves to coordinate the arrangement of patients on the hospital ward.

Therefore, the idea of second-order affordances is proposed to try to accommodate the situation where manipulation of a structure S1 in domain A affords manipulation of a structure S2 in domain B. Domain A is the *articulation domain* and domain B is the *work or coordination domain*. Hence, the manipulation of a magnetic token on a whiteboard is a first-order affordance in the articulation domain. This action triggers a second-order affordance in the related work domain, such as moving a patient to a particular bed on the ward. As such, the manipulation of a structure in the articulation domain acts as a coordination mechanism which serves to control the flow of work in the coordination domain.

But for this theorisation to have any efficacy we must explain how the relationship between a first-order and a second-order affordance actually works. As we understand it this relationship relies on the notion of convention. Actors within the setting learn and utilise rules about the relationships between actions associated with the manipulation of structures in the articulation domain and structures of action in the coordination domain. This must involve proposing a third domain of action which couples or connects the articulation domain with the work domain. First and second-order affordances we believe are coupled through communicative conventions established by multiple actors within situations of routine work. Hence, the articulation domain within which first-order affordances operate is connected to the coordination domain in which second-order affordances operate through an intervening communication domain.

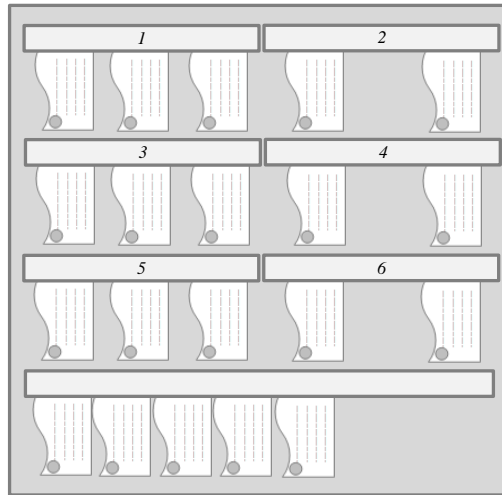


Figure 2. The card holder

In terms of our case in question, within the articulation domain workers are manipulating artefacts such as job cards and the card-holder. The articulation domain is therefore best expressed as that domain in which actors manipulate data structures. For instance, in the case of the clothing shop, a worker presumably inspects the card holder a number of times throughout the working day. They can be observed to continuously pick job cards from the card-holder and return job cards back to the holder.

The coordination domain involves the performance of actors in instrumental, coordinated work. Within this domain workers within the clothing shop are continually collecting garments from the hanger, making alterations to garments and returning garments to the appropriate hanger.

To properly explain the effective coordination of action amongst multiple actors in cases such as the clothing shop we must theorise an intervening layer of action which involves the communication of intentions between multiple actors. In previous work (Author, 2013b) we have found it useful to regard manipulation of data structures in the articulation domain as serving as various forms of ‘speech act’ (Searle, 1970) in the communication domain. In other words, each manipulation of a data structure is likely to trigger one or more informative actions, which fundamentally involve communicative conventions relating manipulations in the articulation domain with manipulations in the work domain.

This means that we propose that it is useful to think about situations such as the ICU and the clothing shop as a *way of organising* – a way of accomplishing mutual action between multiple actors. Such ways of organising may be usefully unpacked in terms of three domains of action: an articulation domain and a coordination domain coupled together through a domain of communication.

Three Domains of Action

Within the articulation domain, actors act upon artefacts such as the job card and the card holder. The coordination domain corresponds to the domain in which work is performed such as picking garments, repairing garments and returning completed garments to hangers. Interposing between these two domains lies the informative or communication domain where the manipulation of a particular artefact such as a job card signals intention from one actor to another. The communication domain expresses the intention associated with particular articulations of the visual device. It is not the device itself (which provides the first order affordances) but rather the expression of concrete practices

implied by the device and part of the discipline or expectations (Galsworth, 1997) enacted through the device. Thus we can combine features of both areas of theory to explain the interconnection of these three domains of action.

Hence, the positioning of job cards in the card holder *asserts* to particular actors the likely completion dates of jobs. This serves to help workers decide on the scheduling of their own work. The act of picking a job card from the card holder by a particular actor is likely to serve as a *commitment*; signalling to other workers that this worker intends to complete the job by the completion date. Returning a job card to the card holder by an actor will presumably *declare* a job as completed.

We take it as a general principle that these three layers of action can be analysed separately but in practice are coupled. The idea of coupling is taken from the work of Dourish (Dourish, 2004), where he defines it as '*the degree of coordination of two elements, and how that coordination is maintained*'. We further propose that this idea of coupling, at least as it applies to effective manual systems, appears to relate to the idea of first and second-order affordances, as we have described them. The coupling between the articulation and communication domains we think must refer to the traditional notion of first-order affordances. Actors use the manipulation of data structures within the articulation domain with the intention of affording communication between themselves and others. The state of the articulation domain at any one time may serve to communicate collective intentions, which, in turn, affords the coordination of work within the coordination domain. This is the idea of a second-order affordance.

To take just one example to stress the relationship between coupling and affordances and the visual management of the system: a production worker selects an item of work by picking a job card from the card holder. The job card itself asserts to this production worker the garment to be selected and the type of work to be conducted upon it. But the removal of this job card also signals a commitment by this worker to other workers in the production shop that she will complete the job in the time required. This act of selecting a job card therefore not only affords the action of doing the correct work on the appropriate garment it also affords the coordination of work amongst the multiple workers of the clothing shop.

A design theory for visual management

We propose that the theorisation of ways of organising discussed in previous sections provides certain features important to a design theory for visual management. Such theorisation is important for explaining not only how these systems work but why they are effective in particular situations of work. A well-formed design theory of this nature should also suggest ways in which visual management can be better undertaken in practice.

We believe that a large number of the examples cited in the practitioner literature on visual management, particularly as they pertain to the use of visual devices within wider visual systems, can be explained as ways of organising effective manual systems. Our previous work suggests that such systems have four features in common. These features relate the effectivities (sensory and effector capacities) of actors with structures in the physical environment of the work situation.

The first feature is that these systems involve use of material and typically highly visual artefacts for informative purposes. The second feature is that the physical manipulation of such artefacts in relation to each other is important to informing actors within group work. The third feature is that the overall state of the physical environment in which such manipulation takes place is also important to

informing actors. The fourth feature is that the manipulation of physical and visual artefacts is important to supporting situated choice.

Feature 1: the materiality of artefacts

There is sufficient evidence within the cases discussed to show that the very physicality of the artefacts we have discussed is particularly important to the informative potential of these ways of organising. Hence, in terms of effectivities, it is critical that such artefacts are easily sensed by the sensory apparatus of particular actors and easily manipulated by the effector apparatus of particular actors. For instance, in terms of an artefact such as a job card it is not only important that this artefact affords actors the potential to write upon it, it is also important that it affords positionability. A job card can clearly be positioned, usually in relation to other such artefacts upon the card-holder. This means that the physical arrangement of artefacts in space as well as the movement of artefacts through space is important to their informing capacity (Zuboff, 1985). Informing is a concept coined by Zuboff to refer to the way in which the manipulation of artefacts ‘...*produces a voice that symbolically renders events, objects and processes so that they become visible, shareable and knowable...*’. Moving a magnetic disc on an ICU whiteboard is a significant and informing act as is the positioning of a job card upon the card-holder.

We feel it is incorrect to refer to the key artefacts proposed within the tradition of visual management purely as visual devices because the message conveyed by such devices is frequently sent over other sensory channels besides vision. This is acknowledged in the typically very general definition used within the literature for ‘visual management’ provided in the first section of the paper. For example, a speed bump may be seen but is also experienced as a kinaesthetic sensation. A magnetic token is seen but its position-ability relies upon manipulation through haptic sensation. Hence, as a vocabulary, it is also somewhat cumbersome to refer to the visual workplace or visual management. A more appropriate idea would perhaps be managing the semiotics of the workplace.

Feature 2: the temporality of artefacts

The second feature is that the physical manipulation of such artefacts in relation to each other is important to informing different actors across time. This means that it is important to separate out the act of articulating or form-ing the artefact from its use for doing something. Within the context of situations in which we are interested it is important to separate out (at least for the purposes of analysis) the act of placing a job card somewhere from the accomplishment of being informed by this action. There are two main reasons for this: the act of forming an artefact may be accomplished by a different actor from that being informed by the artefact; the association between the act of manipulating some artefact and the act of being informed by it is an arbitrary one. A certain artefact may hold significance for one actor but not for another. The same artefact may also inform two different actors differently. What turns the accomplishment of being informed into a non-arbitrary phenomenon for particular actors is the notion of a communicative convention. This seems to us to be at the heart of the enterprise of visual management.

It is perhaps no accident that most of the artefacts considered in this paper, and within the general literature of visual management, are designed to encourage and support group rather than individual work. Visible communication in support of coordinated activity appears to be particularly important to group routine work. In such circumstances it is not surprising to find the high visibility of such artefacts to multiple actors as critical to their effectiveness (Bateman and Lethbridge, 2014). The Kanban card (Hirano, 1995) is designed to be visible to all production workers to help coordinate the supply and use of materials. The manual whiteboard within healthcare settings (Author, 2011) is

deliberately placed to be visible to all nursing staff. Therefore, such artefacts seem especially good at helping to facilitate team work through the informing capacity of the visible artefact (Zuboff, 1985).

Feature 3: the place of artefacts within the wider physical environment

The third feature is that the structure of the physical environment in which such articulation takes place is also important to informing actors. The entire physical environment forms the 'gestalt' within which artefacts perform as active social entities (Preda, 1999). From the point of view of visual management, the card holder and the associated job cards within the clothing repair shop are visual devices. But such devices form part of a wider visual system, which is the entire physical environment within which and upon which actors perform work. In other words, the card holder is not the only visual device important to the coordination of work in this setting. As part of the wider visual system of the clothing repair shop, there is also clothing hung on hangers and placed on a hook outside one of the changing rooms. The very presence of clothes on these hangers signal to workers an intention – namely, it acts as a directive to complete these jobs in the same day they are brought in.

A key advantage of visual management as a philosophy is that it focuses on the physical environment within which actors act. It is also interesting that IT systems are actively discouraged in many aspects of this operational philosophy because such systems are seen to take information behaviour away from its point of use (Galsworth, 2005). The design principle of placing the visual device at point of use implies identifying the key user and the key use of such artefacts. This gels with the idea of unpacking the articulation of a particular device in terms of its communicative intentions, but also in terms of its action-outcomes.

Feature 4: affording situated choice

The fourth feature is that the manipulation of physical and visual artefacts is important to supporting situated choice. Within the ways of organising we have described, choices of appropriate action seem to be made using a logic of appropriateness. This means that responses to situations are accomplished using direct appreciation of patterns in the working environment together with tacit knowledge of appropriate response. Hence, within the ICU unit the nurse can make immediate, situated choices (Suchman, 1986) about bed allocation. Within the clothing repair shop actors can make instant choices about which garments to select next, as well as the type of work to be performed and by when. Thus, the structure of the physical environment as well as the structure of informative artefacts enables actors to reproduce the spatial and temporal order of clothing repair.

As mentioned in the first section, visual devices within the philosophy of visual management are particularly associated with the attempt to translate organisational expectations into directly observable, concrete practices. Visual devices are meant to enact 'discipline'. They are meant to influence, direct, limit or guarantee actor behaviour through visual devices (Galsworth, 1997). One way of theorising about this so-called 'ladder of control' is through the notion of situated choice. Situated choice is constrained choice. The very makeup of the physical environment, together with tacit knowledge held by actors linking structures to conventions of communication, limits action-possibilities for actors. The very effectiveness of the ways of organising work described in this paper, which seem to be representative of those proposed within the visual management literature, relies on the immediacy of action taken by actors. This serves to address issues such as the location and specification deficits discussed in the visual management literature.

However there are key difficulties with thinking through notions of control in relation to first and second-order affordances. The visual management literature appears to suggest that the level of control can be designed into and is associated purely with the artefact itself. But how does this help us

decide upon the appropriate way of typing the card-holder and job card as a visual device. For instance, in terms of the work of Galsworth (Galsworth, 1997), is it a visual indicator, signal, control or guarantee? It seems to us that the type you assign to a particular visual device depends upon the communicative conventions which serve to couple the particular act of articulation of the artefact with particular coordinated actions within work.

Hence, when the shop manager first fills out a job card and places it upon one of the racks on the card-holder, this artefact probably serves in the capacity of a visual indicator. It serves to *assert* that work needs to be performed upon a particular garment as well as the time by which such work needs to be completed. But it does not specify which actor should undertake this work and when. However, when some clothing worker takes a job card from the card holder and starts work on the garment, the very absence of the card on the card-holder serves as a visual guarantee. The particular garment worker *commits* to this work through such an act of articulation and no other worker is able to work on this garment until the card is returned to the card-holder.

Conclusion

It is interesting that the way of organising bed allocation and the way of organising clothing repair described in this paper were not designed by any management consultant and did not adopt any explicit principles of visual management. Instead, they were created by the participating actors themselves through a process of 'bricolage' (Ciborra, 2002). Nevertheless, through such involved design, many of the principles promoted by the communities of practice associated with visual management have emerged in the ways in which organising is accomplished and happens in such settings.

So what does our theorisation offer as a design theory for visual management? In other words, how does it help us do something like the design of a 'visual workplace' in settings such as production or healthcare? What explicit prescriptions fall out of our theorisation in terms of how to develop and implement the visual devices proposed by visual management?

The first key prescription involves thinking about visual devices not as purely physical artefacts, but in terms of actors taking action. A way of organising as we have portrayed it is best seen as an ensemble of both humans and artefacts taking action. Hence, 'visual devices' such as manual whiteboards should be positioned in terms of not only which actors undertake what articulations with them (first-order affordances) but for what purpose (second-order affordances). In other words, we need to think of such devices not only as data structures but coupled to the notion of such artefacts as communicative actors. We also need to think about what communicative conventions should couple with what actions of coordinated work.

The second key prescription involves the usefulness of thinking through patterns of action either *as-is* or *as-if* or *to-be*. In other words, we need better ways of thinking through how articulation, communication and coordination occur in existing settings. We also need ways of thinking through what patterns of articulation, communication and coordination we might want to see happen within some work setting. Finally, we need better ways of helping to change ways of organising work using visual devices. In particular we need ways of communicating the patterns of action expected of particular participating actors in relation to such artefacts within some work setting.

References

- Author (2011). Reference removed.
- Author (2013a). Reference removed.

- Author (2013b). Reference removed.
- Bateman, N. and S. Lethbridge (2014). Managing operations and teams visually. The Routledge Companion to Visual Organization. E. Bell, S. Warren and J. E. Schroeder. Abingdon, Oxon, UK.
- Becker, M. C. (2004). Organizational routines: a review of the literature. *Industrial and corporate change* 13(4): 643-677
- Bell, E., S. Warren and J. E. Schroeder, Eds. (2014). The Routledge companion to visual organization. London, Routledge.
- Ciborra, C. (2002). *The Labyrinths of Information: challenging the wisdom of systems*. Oxford University Press, Oxford.
- Dourish, P. (2004). *Where the action is: the foundations of embodied interaction*. MIT Press, Cambridge, Mass.
- Galsworth, G. D. (1997). *Visual systems: harnessing the power of the visual workplace*. AMACOM, New York.
- Galsworth, G. D. (2005). *Visual workplace/visual thinking: creating enterprise excellence through the technologies of the visual workplace*. Quality methods international, Portland, Oregon, USA.
- Gibson, J. (1977). *The theory of affordances. Perceiving, Acting and Knowing*. Lawrence Erlbaum, Hillsdale, N.J.
- Gibson, J. J. (1979). *The Ecological Approach to Visual Perception*. Houghton Mifflin, Boston.
- Grief, M. (1991). *The visual factory: building participation through shared information*. Productivity Press, Portland, USA.
- Hirano, H. (1995). *5 Pillars of the Visual Workplace: The Sourcebook for 5S Implementation*. Productivity press, Portland, USA.
- Holweg, M. (2007). The genealogy of lean production. *Journal of operations management* 25(2): 420-437
- Liff, S. and P. A. Posey (2004). *Seeing is believing: how the new art of visual management can boost performance throughout your organization*. AMACOM, New York.
- Norman, D. A. (1999). Affordance, conventions and design. *Interactions* 6(3): 38-43
- O'Brien, L., J. Bassham and M. Lewis (2014). Whiteboards and discharge traffic lights: visual management in acute care. *Australian health review* Published online
- O'Neill, S. and T. Jones (2011). Nursing works: the application of lean thinking to nursing processes. *The journal of nursing administration* 41(12): 546-552
- Parry, G. C. and C. E. Turner (2006). Application of lean visual process management tools. *Production planning and control: the management of operations* 17(1): 77-86
- Preda, A. (1999). The turn to things: arguments for a sociology of things. *The sociological quarterly* 40(2): 347-366
- Puyou, F.-R., P. Quattrone, C. McClean and N. Thrift, Eds. (2012). Imagining organizations: performative imagery in business and beyond. Abingdon, Oxon, Routledge.
- Radnor, Z. (2010). Review of business process improvement methodologies in public services. London, Advanced institute of management research.
- Schmidt, K. and C. Simone (1996). Coordination Mechanisms: Towards a Conceptual Foundation of CSCW Systems Design. *The Journal of Collaborative Computing* 5(1): 155-200
- Searle, J. R. (1970). *Speech Acts: An Essay in the Philosophy of Language*. Cambridge University Press, Cambridge.
- Shaw, R. E. and M. T. Turvey (1982). Ecological Psychology: The Consequence of a Commitment to Realism. Cognition and the Symbolic Processes. W. Weimer and D. Palermo. Lawrence Erlbaum, Hillsdale, N.J.
- Suchman, L. (1986). *Plans and situated actions*. Cambridge University Press, New York.
- Zuboff, S. (1985). Automate/Informate: the two faces of intelligent technology. *Organizational Dynamics* 14(2): 5-18