IIID Vision Plus 2015

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IIID Vision Plus 2015

information + design = performance

Symposium Papers Abstracts & Speaker Biographies

Hosted by Birmingham City University, Parkside Building, City Centre Campus, Birmingham, BD4 7BD, UK. 3th – 4th September 2015

SYMPOSIUM PARTNERS

+ Birmingham City University (BCU)
+ International Institute for Information Design (IIID)
+ Information Design Association (IDA)

About the Symposium

On 3 September 2015, the International Institute of Information Design (IIID) partnered with Birmingham City University and the Information Design Association to organize the 16th international interdisciplinary symposium at the universities new Parkside Building in Birmingham UK.

The Symposium explored a wide variety of relevant and topical issues ranging from information at the beginning of the digital age, healthcare, inclusion, big data visualization, wayfinding and many other fascinating ideas relating to information, design and performance.

The event was a great success, with speakers and delegates from around the world sharing ideas across two days at the City Centre Campus, Birmingham City University. See the Programme (page 4) for the diversity of topics from international speakers.

For more information about the event, contact *colette.jeffrey@bcu.ac.uk* or visit iiid.net

About this document

The Symposium speakers were all selected through a peer-review process and those people invited to speak were also invited to submit a biography, abstract and a paper to be published in this document. The papers themselves have been formatted to a consistent layout, but they have not been peer-reviewed, edited or amended in any other way. All opinions are those of the authors, not the Symposium Partners.

Not all speakers submitted a paper, but most supplied a biography and abstract which have been included here. One paper, which was accepted but not presented at the event, is also included.

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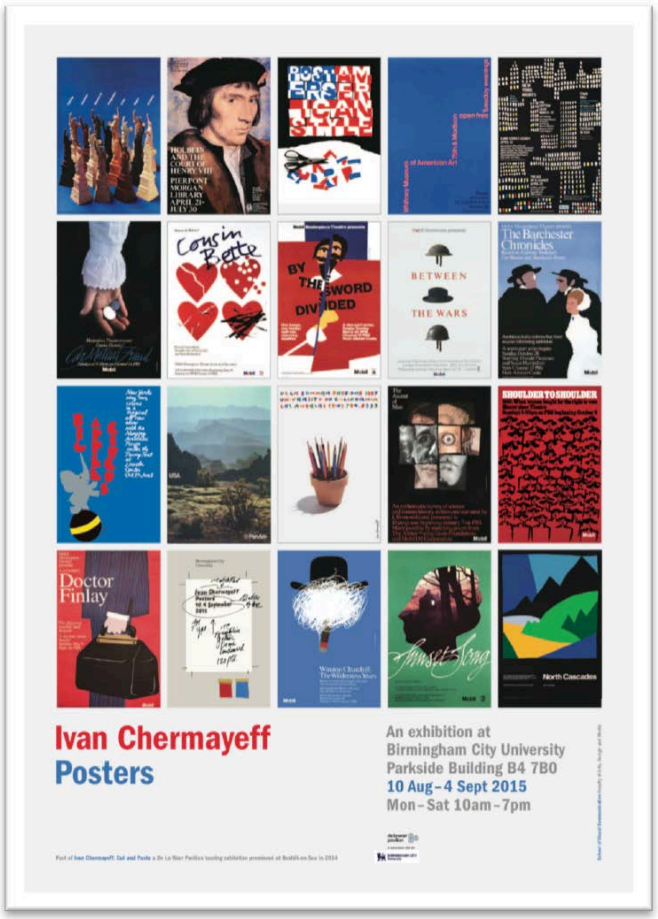
Ivan Chermayeff Posters exhibition

IIID Vision Plus 2015 coincided with an inspiring exhibition of graphic posters by Ivan Chermayeff displayed in Parkside Gallery. An introduction from Clive Richards was followed by a talk on Chermayeff's work by Alan Powers



Symposium Programme

THURSDAY 3 SEPTEMBER 2015

08:30–09:00	**REGISTRATION**
09:00–09:30	**WELCOME: CLIFF ALLAN	CHAIR: NATHAN TROMANS** *Vice-chancellor, Birmingham City University*
09:30–10:00	**GUEST SPEAKER MAT HUNTER	CHAIR: CLIVE RICHARDS** *Chief Design Officer at the Design Council gives the Vision Plus 2015 keynote*
GROUP A	**WAYFINDING	CHAIR: ROB WALLER**
10:00–10:20	Tim Fendley, *The future of city wayfinding*
10:20–10:40	Sue Manley + Guy Warren, *Dementia friendly wayfinding information design*
10:40–11:00	Andrew Haig, *Small screen wayfinding: an alternative to existing mobile maps*
11:00–11:10	Colette Jeffrey, *Are you lost? The interplay of information, people and environment whilst wayfinding:* LIGHTNING TALK
11:10–11:25	Q + A PANEL SESSION
GROUP B	**IMPROVING PERFORMANCE	CHAIR: ANDREW BOAG**
11:55–12:15	Jennie Schaeffer + Rikard Lindell, *Design to engage: embodied information in control rooms*
12:15–12:25	Helena Nagel, *Business benefits from information design:* LIGHTNING TALK
12:25–12:45	Sukanya Baksar + Rupesh Vyas, *Improving public service forms in India*
12:45–12:55	Geraldine Marshall, *Above all else show the data:* LIGHTNING TALK
12:55–13:10	Q + A PANEL SESSION
GROUP C	**HISTORICAL INFORMATION	CHAIR: CAROLINE ARCHER**
14:10–14:30	Martin Killeen, *Treasures of the Cadbury Research Library*
14:30–14:50	Elaine Mitchell, *Acquiring the names and knowledge of plants: the nursery catalogue in the Enlightenment*
14:50–15:10	David Osbaldestin, *Sanserif: face of information, instruction and industry in the nineteenth century*
15:10–15:25	Q + A PANEL SESSION
GROUP D	**PERFORMING ARTS	CHAIR: VERONIKA EGGER**
15:55–16:05	Steve Chamberlain, *Hard facts, soft fictions, silent discourse:* LIGHTNING TALK
16:05–16:40	Mary Collins, *Historical dance notation*
16:40–17:00	Pablo Munzo, *Dance notation systems viewed as a problem of information design*
17:00–17:15	Q + A PANEL SESSION
17:30–18:15	**IIIDAWARD FIZZ FOR TWO	CHAIR: MARTIN FOESSLEITNER** A get-to-know each other session, over cocktails in the Atrium
18:15–19:30	**RECEPTION	CHAIR: CLIVE RICHARDS** To include opening of the Chermayeff exhibition by Alan Powers

FRIDAY 4 SEPTEMBER 2015

08:30–09:00 **REGISTRATION**

09:00–10:00 **LAUREATE AWARD | CHAIR: CLIVE RICHARDS**

GROUP E **INFORMATION FOR WELLBEING | CHAIR: KAREL VAN DER WAARDE**

10:00–10:20 Adrian Sutherland, *Zoomable information presentation for managing patient care*

10:20–10:40 Robert Sharl, *Storytelling for the quantified self: designing information for personal health management*

10:40–11:00 Stephen Boyle, *Medication alert fatigue*

11:00–11:15 Q + A PANEL SESSION

GROUP F **PERFORMANCE ENHANCING | CHAIR: VERONIKA EGGER**

11:45–12:05 Karel van der Warde, *Influence of visual information on the effects of medicine*

12:05–12:25 Koteshwar Chirumalla, Per Erik Eriksson, Yvonne Eriksson, *Designing instructional videos using principles of multimedia learning*

12:25–12:45 Rupresh Vyas, Sejal Tiwari, *Improving digital literacy through information design*

12:45–12:55 Oliver Tomlinson: LIGHTNING TALK: *Talking diagrams: how information design thinking can help win business*

12:55–13:10 Q + A PANEL SESSION

GROUP G **SYMBOLS AND STANDARDS | CHAIR: PETER SIMLINGER**

14:10–14:30 Geoffrey Peckham, *ISO symbols: the key to global safety communication*

14:30–14:50 Rodrigo Ramirez, *RutaCL: development and testing of a typeface standard for highways in Chile*

14:50–15:10 Keiichi Koyama, Hitomi Horiguchi, *Communication support board: standardization through application design*

15:10–15:25 Q + A PANEL SESSION

GROUP H **PERFORMANCE: 'THE COMPLETION OF SOMETHING DESIGNED' | CHAIR: OLE LUND**

15:55–16:15 Susan Verba, Sarah Perrault, *Design for understanding: creating open-world, open-ended design experiences for undergraduates*

16:15–16:35 Sheila Pontis, Michael Babwahsingh, *Start with the basics: understanding before doing*

A.-L. Carlsson and N. Svensson Harari, *The Designers and the Users of Manual Assembly Instructions* (accepted but not presented at the conference).

16:35–16:50 Q + A PANEL SESSION

16:50–17:00 **REFLECTION SESSION | CHAIR: CLIVE RICHARDS**

SECTION 1: WAYFINDING

The papers presented in the Wayfinding session were:

1/ The future of city wayfinding – Tim Fendley
2/ Dementia friendly wayfinding information design – Sue Manley + Guy Warren
3/ Small screen wayfinding: an alternative to existing mobile maps – Andrew Haig
4/ Lost or Wayfinding? The interplay of information and people in buildings whilst navigating – Colette Jeffrey

The future of city wayfinding

Tim Fendley

Keywords: Wayfinding, Urban design, Information design, Smart cities, Legible cities, Urban planning, Signage, Mapping

Abstract

A decade ago a team of information designers sat down to think about an open wayfinding brief. What came from it was a concept for Legible Cities. The idea was to activate and pedestrianise the centre of cities, to give the urban realm back to walkers, thus creating healthier cities and reaching goals involving both health and sustainability. The system has gone through the most rigorous testing and at every turn its impact and benefit to the city has been proven, not only in terms of sustainable travel and increased footfall to boost the economy, but in its citizens' health as well. Bristol was the first Legible City, the first to have the system in place, and followed by Legible London, this was the first wave of Legible Cities.

Since the concept's inception, similar systems have been implemented and the concern is that many of these imitations are simply that, and the global standard is limited to look and feel. How can we continue to ensure the system stays relevant, fit for purpose, and ultimately able to support urban goals pertaining to a healthy population? The field will mature over the next ten years and it will do so in six ways; the distinctiveness of places will have more importance, considered thinking and planning knowledge will be integral to the process, the physical world will connect to the digital world to communicate in a common tongue, the function of the Legible Cities system not be second to its design, wayfinding will grow to be represented on an official level, and will be part of government budgets from the onset.

Introduction

For a city, a decade is but a moment. But in design a lot can, and does, happen in 10 years. A decade ago, a team of information designers sat down to think about an open wayfinding brief from an organization representing the centre of a world city. This followed a report by Jan Gehl Architects, for the same organization, focused on the need

to activate and pedestrianise the centre of cities, to give the city back to walkers making a more pleasant city. Many of the Gehl recommendations were implemented: city squares given a new lease of life; pavements widened; al fresco dining; and street activity encouraged. Many might be unaware of the catalyst, but most have felt its impacts. The brief identified the confusing and general lack of guidance for pedestrian information. It requested a set of "guidelines." The organization was the Central London Partnership, led by Pat Brown. The information designers were Applied and we called our response Legible London. I think by now you can guess the city.

Legible London launched in 2007 and is now used more than one billion times a year. Our response was not a set of guidelines. No matter how well designed and written, guidelines would have minimal impact. The response was guided by three core observations. First, cities have complex management systems: central government; mayor(s), boroughs; representative organisations (BIDs, BIAs); and more. Second, information for pedestrians was delivered by all of the above and there was little or no coordination among them. We found 36 wayfinding systems in the central area alone. And third, people, the users of the information, want to learn one system and one system only.

We found 4% of people using the 36 systems and 44% using the London Underground map for walking. Almost everyone buys into the tube map, even for something it is plainly unsuited for. We proposed the city needed a system, not guidelines—a system that would present a single way of doing things for its users, the people walking around London. In the process, we would design the best way to impart complex information by using human geographic cognition, we would develop a legible language, and we would set up methods to allow all the city's organizations to play their part.

Ten years later and the response we made that day has, like Gehl's ideas, largely come to fruition. Legible London has provided coordinated walking information across the capital, offering benefits for our transport system, the economy, tourism and the environment. There are more than 1,200 miniliths, midiliths, and monoliths on London's streets, located at key junctions, outside tube stations and on main routes. Legible London appears on bus shelters, on 600 cycle hire stations, on billboards, and in print. It was the system for the 2012 Olympics and has been adopted and is run by London's transport organization. It is official.

The system has gone through the most rigorous testing and at every turn its impact and benefit to the city has been proven. It is used more than one billion times a year. Its return on investment is around the heady ratio of 5:1. For a transport system, 2:1 is powerful.

It has gone beyond London's boundaries. In pursuit of improving transport systems, the health of citizens and tourism industries, Legible London-inspired solutions have popped up in Sweden, China, Australia, the U.S., Canada, and Russia, as well as across the UK. They all have similar beacon-style units featuring to-scale maps and heads-up orientation (of course), with integrated directional information. It has become a global standard. A great British export.

But here's the rub. Aspects of the architecture of the system are fundamental, and some need adjusting to suit the environment. Considered thinking, planning knowledge, and expertise are required. My concern is that many of these imitations are simply that, and the global standard is limited to look and feel. I see this as the first wave of Legible Cities, and the field will mature.

In a decade, Legible London has gone from a glint of an idea to a global standard (of sorts). I think six things will impact its influence over the next 10 years.
Where have you landed? In Europe or the U.S.? In an age of global sameness, differentiation and local flavour will be increasingly important in cities.

1. Local character, global standards

We have all benefited from global tools: Twitter, Facebook, Google Maps, and many others. They share a knack. They are the same wherever you go. One of the real differences we encounter every day is our environment, the places we live and work and travel to and through, and even here global brands such as GAP, McDonald's, and Starbucks are creating replica High Streets.

I believe the differentiation and distinctiveness peculiar to places will have more, not less, importance in the digital age. Events, unique gatherings and face-to-face meetings will become more powerful. And local flavour, accent, and attitude will be ever more sought after. The response will be to represent this difference at the city level. Its character will come out through language, local knowledge, and place names. Cities have city-wide transport systems for good reason. They will have wayfinding systems to match.

The fundamental methods created with Legible London will be used wisely and interpreted in each city. This means local character and identity will come through but using a method that we all learn to understand.

2. Planning as important as design

In 1961 the designer Herbert Spencer walked a route from Central London to London Airport (now Heathrow), documenting road signs, and highlighting in Typographica 4 magazine the confusions and sometimes dangers of unregulated and "non-designed" roadside messages.

Two years later the issues he raised led two designers, Jock Kinnear and Margaret Calvert, to create an information system for UK roads. It standardised the appearance of all signs throughout the country and still lives today. It has informed many other countries. Consistent look, purpose-designed typefaces, and defined sizes (relating to road speed) were indeed advances.

The more significant innovation, however, was that the system established a national use of progressive disclosure. It demanded a reduction in visual noise by limiting use of agreed symbols and names, and it defined rules for where and how signs are placed. These innovations are harder to spot for the non-information planners among us, but they are crucial and they work.

Forward to today and Richard Simón, my colleague at Applied, walked the same route as Herbert Spencer to see how 50 years have treated the system. The visual guidelines and the layout remain. The typeface is timeless. However, the system has been infected with interference: a proliferation of new signs. All were designed within the guidelines (which is good), but the principle of simplicity is being lost. Safety demands a minimal amount of information. We now face an essay at almost every junction.

Such planning rules are not as visible and therefore it is harder to know if you have got them right. Over the next 10 years their importance will become more understood and better debated. Their terminology will be defined and it will demand that cities have more expertise to manage them.

3. Technology at the heart of Smart Cities

The idea of a seamless journey is central to Legible City thinking. Delivering it with hundreds of touch points is a different matter. Thankfully, the last few years have seen a dramatic opening of data for public use. There are rivers of event, activity, and transport data linked to locations, and this flow will strengthen in the era of Big Data. Add in that soon we won't have to worry about getting an Internet connection, or paying for it. All Wi-Fi will be free, roaming charges long gone. The future is one of connecting people to places to data, and at the same time delivering a common picture of a city. We envisage intelligent systems to connect the physical world with the digital: one system to allow the city's organizations and businesses to communicate in a common tongue, via whatever medium is requested. With this approach we can ensure that quality is high, cost is low, and data is live. In a word, smart.

4. Function will match form

There is currently an over-fixation with aesthetics, most notably with the form of objects within wayfinding projects. Signs are just one aspect, and their design should be matched if not surpassed by the function of the system. As Steve Jobs said: "Design is not just what it looks like and feels like. Design is how it works."

Looking good is not the same as being good. Legible London's functional architecture has been copied many times. It is pretty robust and will deliver in most cases. But I wonder how many times the architecture has been understood, and delivered to suit unique places. The future will see more respect, time, and effort to craft and manage the background data and system architecture. This will take expertise and organizational responsibility. More time will need to be spent evolving the system to adapt to inevitable changes in the city, not just leaving the system to fend for itself. We will have central control systems and people in roles to manage these.

5. Organization will be official

In the UK during the early 1990s, the field of "urban design" gained traction after a slow burn from its modern emergence in the 1960s. There was a continuous need to explain to clients, mostly city governments, what urban design was and why it was important. It was rare that a city had an urban design officer; now every local authority has. The field

has matured, with representative organizations and its own language—defining it as a profession.

Wayfinding will also grow as a profession. We will grow our language, develop accepted models, find our own organs of communication (of which the Society for Experiential Graphic Design [SEGD] is the founder), and we will establish the domain, located between urban and information design. City wayfinding systems will be run by wayfinding officers and there will be management teams, and roles and structures, not just consultants.

6. Budgets will not be borrowed

Wayfinding hasn't had a home. It can belong to the marketing department, the visitor information team; is it a part of the streetscape manual? Projects are sometimes initiated by the heritage team, by local business organizations, or by developers. Should it be run by the transport authority or the city planners? The result is that budget is the driver, and budget can come from any, and sometimes a collection of, these departments, organizations, and sources.

I worked on a number of first-wave web projects from 1995 onwards and it has been fascinating to see how businesses and the web have evolved, sometimes kicking and screaming through different phases, from a lack of a budget line and arguments over control to the centre of a company's operations. In the same way, Legible Cities will move away from begged and borrowed budgets with, invariably, a focus on capital expenditure, the initial build and launch event. They will move to economic case-driven, multiple agency-funded schemes that are wide reaching and revenue funded from the heart of local government. Over time, the failures of the "look good but can't afford to manage it" solutions will give way to clients and cities that demand longevity, flexibility, evolution, and control.

Legible Cities will become an essential part of the transport and visitor information systems of the city, funded by pooled resources from all interested and dependent parties. Legible London has made real the concept of a Legible City and has set a global standard. This is currently focused on the interface. The next iteration will see the architecture of the idea being used to its potential. I think there will be a renaissance of city coordination. Wayfinding standards will rise and more people will find cities easier places to wander and walk.

Our vision for Legible London was to enable people to explore, to have the confidence to get lost and enjoy the city more. Creating an identity that would encourage people to walk. Although Legible London has achieved a great deal, the industry still has a long way to go, and much to deliver to realise a more significant change in people's attitudes.

References

+ *Legible London: A Wayfinding Study* (Applied, Central London Partnership), 2006

+ *Legible London: Yellow Book* (Applied, Mayor of London, Transport for London), 2007

+ I Walk New York: A Plan for Pedestrian Wayfinding in New York City, (Applied, New York City Department of Transportation), January 2011

Biography

Tim Fendley is an information designer, speaker, writer and founder of Applied, the wayfinding consultancy. He is also the founder of Living Map, a start-up devoted to publishing beautiful maps. He was the founder of Union Design with Robin Richmond in 1991 where he designed Graphics International and Circular magazines and created the first digital products for Gilbert & George. He formed MetaDesign in London in 1995 with Erik Spiekermann, joining offices in Berlin and San Francisco. At MetaDesign he ran design programmes for Orange, The Economist, Lexus and Glasgow. He was the lead designer of the ground-breaking Bristol Legible City Initiative, and has a passion for city design. Bristol Legible City was the first scheme of its kind to focus on making the city 'legible' and at the same time creating a strong identity. Tim formed Applied in 2003 to further his interest in the application of information design. He has created new approaches to understanding and explaining places. Tim led a multi-faceted design team to create Legible London. He was instrumental in instigating and naming the project and lobbying for its funding, he was closely involved in all aspects of the creation of the system. The scheme has won numerous international awards and has set a global standard for urban wayfinding. He's designed the multi-modal transport systems for Vancouver, North America's Greenest City; legible scheme's for Cleveland, Ohio, Glasgow, Leeds, Milton Keynes, and Brighton, legacy wayfinding for Queen Elizabeth Olympic Park in London, and an all encompassing strategy for New York City. He also designed the first digital pedestrian maps for mobile devices as well as the most comprehensive Airport mapping system in the world for Heathrow. He is currently working on sorting-out Toronto's transport system, a wayfinding master-plan for a new gulf city district and a legible city scheme for the Rio Olympics. Tim is on the advisory board of the Helen Hamlyn Centre at the Royal College of Art – a department focused on inclusive design, and is a tireless speaker and campaigner for the development of accessible wayfinding systems for public places. A trained orienteer and lover of maps, he established Living Map to realise his vision for truly legible maps of our cities.

Dementia friendly wayfinding information design

Sue Manley & Guy Warren

Keywords: City Wayfinding, Dementia, Information Design,

Abstract

Dementia is becoming a very topical issue for many towns, cities and institutions, and is considered a disability under the Equalities Act of 2010, so the need to provide dementia friendly information design for people is becoming a key factor in developing wayfinding solutions. This paper will consider: What is the impact of dementia in the public realm? What does 'dementia friendly' mean for information design? How does dementia friendly design impact other users? Does it create conflicts? Is dementia experienced differently for different people? York City council have an aspiration to be a dementia friendly city, and this permeates all aspects of public realm design, particularly wayfinding and information design.

By using the York wayfinding project currently being developed by Placemarque as a case study, we will outline key factors that are informing the design process such as working with the Joseph Rowntree Foundation, consultation and testing ideas with user groups, and how we have had to adapt our design process and solutions to meet these needs. Have these solutions then resulted in better information design for all users.

Key issues being considered are: Use of colour; Use of icons; Using landmarks; Typefaces; Mapping styling; Contrast of both sign to back ground and information on the signs; Sign placement; Levels of detail; Information structure and nomenclature; Additional audible and text based support information via digital downloads. *"What is good for people with dementia is good for everybody" York Dementia Without Walls Project*

Biography

Sue Manley is a founding director of Placemarque Ltd. She started her professional career as an architect with wide-ranging experience in major practices and Local Authorities in London and the South East, and now is based in Manchester. Sue's particular expertise lies in formulating development strategies, visitor orientation techniques, wayfinding and information management, brief formulation, project and design management. Sue carries out award winning bespoke wayfinding projects across the country for towns, cities, universities and shopping centres.

Guy Warren is a graphic designer with over 20 years experience of information design. Based in Sussex, he has been a director at Placemarque since 2004 where he is responsible for information design and brand development on all Placemarque wayfinding and environmental graphic projects. His particular interest lies in typography and identity and its place in the built environment, combining the principles of urban design, information design and branding to develop wayfinding solutions that are rooted in the place. Guy leads the Placemarque design team implementing a range of major wayfinding projects throughout the UK and the Middle East.

Small screen wayfinding: An alternative to existing mobile maps: Actively acquiring spatial knowledge

Andrew Haig

Keywords: GPS-enabled mobile maps. Small screen wayfinding

Abstract

GPS-enabled mobile maps appear to make wayfinding for pedestrians easy. Route directions with an accompanying map are generated providing instructions of how to get from here to there. However, research indicates that the use of mobile maps impedes the acquisition of spatial knowledge. Should battery failure or poor GPS reception occur, users who have been over-relying on their device may find they have little idea where they are.

There is room for improvement in how spatial information is delivered to mobile phone users. Currently, smartphones have simply inherited mapping systems devised for larger screens.

After an overview of research being conducted into the design of a smartphone wayfinding application, this paper proposes ADW: Active Device Wayfinding where users follow route instructions by visually matching spatial information on screen to their surroundings. This information, which focuses on landmarks, not maps, is the central concept behind the improved presentation of on-screen spatial information for pedestrians. Landmarks are key environmental elements utilised when wayfinding that are currently not used to their full potential in smartphone-based wayfinding.

Also discussed are the problems associated with using mobile maps along with a description of how landmarks can aid pedestrian smartphone wayfinding. The complexities of adding landmarks to navigation systems are explained and a review of alternative ways of describing spatial information on a smartphone is provided.

The problem with mobile maps

Spatial knowledge acquisition is impeded in two key ways with mobile maps. Automated route instructions are passively followed with the surrounding environment not focussed upon (Parush, Ahuvia & Erev 2007), and users need to interact with maps displayed in a small device interface. Using a small (and only partly visible) map and interacting with it is cognitively demanding, so time is spent focussed on manipulating the map rather than observing 'the lay of the land' (Willis, Hölscher, Wilbertz & Li 2009).

Automation and passive route following

Using an automated navigational system means that the user has less situational awareness, and exhibits poorer skills at the task they are performing (Parush et al. 2007). If an automated system fails and a user has to switch from the passive monitoring of it to active participation with the system, poor performance ensues (Johansson,

Cavalini & Pettersson 1996). Environmental clues experienced when wayfinding on 'auto-pilot' have probably been ignored – becoming lost is now a likely result.

The mobile map interface

Another issue confronting mobile map users is the *keyhole problem*. First outlined by Meyers (2005) where cropped image areas and text entry fields in web browsers made web site usage difficult – the keyhole problem relates even more to interaction with mobile maps. With a mobile map the user is required to interact with a large topographical map of a region and manipulate it through a small window interface. As a result, only a smaller portion of the larger view is visible – a limited 'keyhole view'. Wayfinding decisions then need to be made with the aid of this restricted map. A cropped map leads to spatial knowledge that is fragmented and disjointed as the spatial relations between landmarks and the broader context of the environment are not fully understood (Dillemuth 2009; Willis et al. 2009).

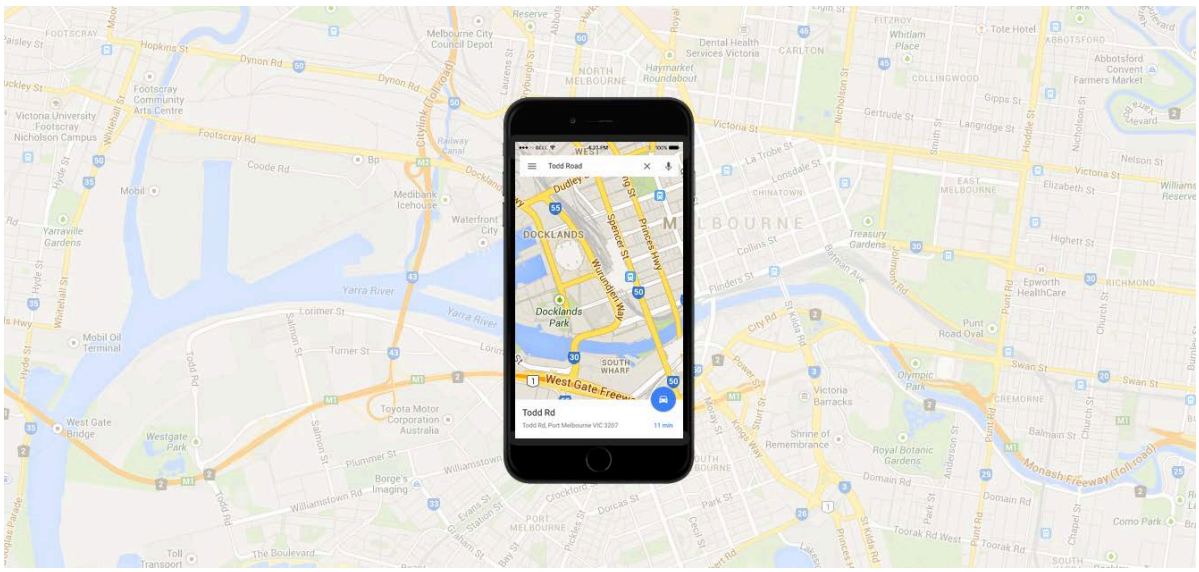


Fig. 1. The keyhole problem: large map, small screen.

Coupled to the keyhole problem is the amount of interaction necessary for using and understanding the dynamic format of a mobile map. Time is spent dragging, swiping and zooming the mobile map (Willis et al. 2009). This means that a user is principally head-down in their device, often whilst mobile, and less head-up in the environment. This isn't active device wayfinding. With mobile maps, users focus on attempting to understand the continuously updating GPS-based map trying to match it to local, immediate surroundings to make sense of their location. Less attention is paid to global spatial information (Ishikawa, Fujiwara, Imai & Okabe 2008; Willis et al. 2009).

The rationale behind ADW is to be found in examining how paper maps are used. Two studies compared wayfinding performance using mobile and paper maps. Both studies found that users with paper maps consistently outperformed users with mobile maps across a variety of conditions. Mobile map users made more stops and walked longer distances than paper map users. They made more directional errors and drew poorer

topological sketch maps of routes (Ishikawa et al. 2008). Mobile map users also demonstrated weaker skills estimating distances and displayed poorer knowledge of the spatial configuration of different types of environments (Willis et al. 2009).

One possible explanation for these results could be the amount, and type, of cognitive load being placed upon the user. When using a paper map, the representation of spatial information must be aligned with the real world surrounding the user. The simple mental effort invested in that process means the environment is incidentally learned and partly memorised – the terrain is *actively encoded* (Münzer, Zimmer, Schwalm, Baus & Aslan 2006). Rotating a map either physically or mentally to match the surrounding area is an example of this behaviour. Here, cognition is focused on completing a wayfinding task by attempting to understand the surrounding environment – this is 'head-up', active behaviour. In this case a modest cognitive load focussed on the real world has a positive effect on the users' ability to perform their task.

Activating the user: connecting with the surrounding environment

The hypothesis here is that ADW, Active Device Wayfinding will perform more successfully than a mobile map in aiding the acquisition of spatial knowledge. The ADW interface must easily connect information depicted on-screen to the observable surroundings and should enable wayfinding to occur immediately with minimal interface interaction. The intent here is to reduce time using the device and increase connectivity to the surroundings. The key element of this application will be something that everyone intrinsically uses when wayfinding – landmarks.

Landmarks

Lynch (1960) described landmarks as being key environmental elements that assist people when wayfinding as they are easily identifiable points of reference. Landmarks are also the most commonly recalled components of an environment (Michon & Denis 2001). For pedestrians, landmarks perform well. Pedestrians can easily pause, gather their thoughts and process spatial information before continuing their journey.

Landmarks can be classified into two distinct types: global and local landmarks. Both types of landmarks work as reference points in an environment. Global landmarks are highly visible reference points and may be located on- or off-route and provide universal orientation clues. Local landmarks can fill in the gaps between global landmarks and work in conjunction with them. Local landmarks may be visible solely within a particular region and may be noticeable only from a small range. An individual uses local landmarks for navigation very much at decision points, or as intermediate goals that exist along a route (Raubal & Winter 2002; Steck & Mallot 2000).

Landmarks are a significant area of enquiry in wayfinding research. In the digital context, a large body of recent research examines them from a computational systems perspective where a key issue is about obtaining landmark data and integrating them into a navigational system. Other research considers the visualisations of landmarks. If landmarks are to work as a digital wayfinding aid, some questions emerge: how can a 3D landmark that exists in the physical world be described and acquired by a computer system? How can these data be used to create a digital landmark system? How should

landmarks be visualised for on-screen use? Numerous attempts have been made to resolve these questions. The following section discusses some of this work in brief.

Acquiring landmarks for use in a computing system

Before a computing system can acquire a landmark, it must be able to identify landmarks. Algorithms form the basis of this work. Using GIS (Geographical Information System) data various landmark-identifying algorithms have been able to identify landmarks (Elias 2003; Nothegger, Winter & Raubal 2004; Raubal & Winter 2002; Winter, Raubal & Nothegger 2005).

Nothegger et al. (2004) is the most fully-realised study here. This work compared landmark selection made by people and a computational model where the 'conspicuity' algorithm developed by Raubal and Winter (2002) was used. This algorithm uses visual, cognitive, and structural attributes described in data to determine how conspicuous a landmark may be. A *visual landmark* has strong visual characteristics and can be seen from many directions. A *cognitive landmark* may be culturally or historically important – its distinctive meaning may make it stand out. A *structural landmark* has a key role in structuring space and will occupy a prominent location. Tiananmen Square in Beijing is an example.

Of the nine intersections used by Nothegger et al., seven façades were selected by both the human participants and the algorithm – indicating the potential for automatic landmark detection.

Integrating landmarks into a digital system

Once landmarks have been identified, these data need to be included in existing navigation systems alongside related route data to enable route directions to be provided (i.e. "turn left at the old church in 200 metres"). The system also needs to know which landmark, once present in the system, is the relevant one to call up to work with the route instructions. An individual can be spatially related to a landmark in a few possible ways: the landmark may be in the distance and either off-route, or on-route or, close by and either off-route or on-route. The landmark can be at decision points (route nodes) or in-between decision points.

Two computational models using extracted landmark data have been devised by Klippel and Winter (2005), and Richter (Richter 2007; Richter & Klippel 2007). Both models focus on route intersections and are indicative of work completed on integrating acquired landmarks into a computer system. Klippel and Winter's model uses landmarks based upon their relevancy. The landmarks computed to be the most suitable in aiding turn directions are the most relevant ones to include in route directions. Richter relied on familiar human route descriptions where the words 'before' and 'after' are often used as descriptors. Eligible landmarks to be used in this system would be located either before or after any key decision points along a route. Instructions such as "turn left at the intersection *before* you come to Landmark A" or "turn right *after* Landmark B" would be employed.

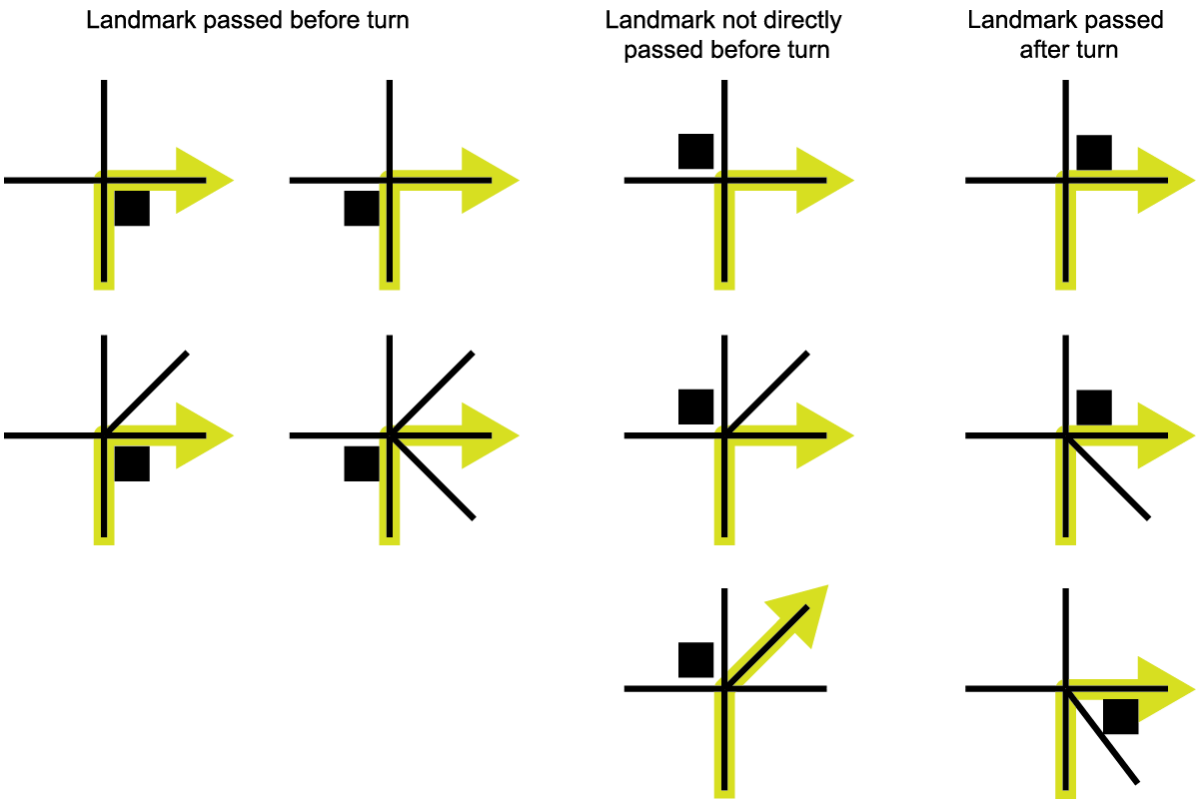


Fig. 2. Possible landmark locations at turns. (After Klippel & Winter 2005).

The problem with digital landmarks (has a solution)

No commercial navigation system uses landmarks. Difficulty exists in both collecting reliable landmark data and embedding landmarks into existing geodata systems. These activities are time intensive, and therefore expensive. Richter and Winter (2014) describe how obtaining crowd-sourced landmark data may be the most cost-effective way to proceed here. Understanding the role of landmarks in wayfinding is very much an intuitive human skill so using the expert local knowledge of people to compile reliable landmark data seems a logical step. Richter and Winter explored how landmark data could be incorporated into OpenStreetMap, a crowd-sourced topographical map system. Google Maps also uses crowd-sourced map data supplied by locals – known as the Map Maker initiative – to supplement other sources of map data. As of March 2014, cities in the Phillippines, Poland, Romania, Serbia, Pakistan and India, amongst others, have had their Google Maps created by volunteer members of the Map Maker program (GoogleMapMaker 2009). Landmark data could be collected in a similar crowd-sourced fashion.

Alternative spatial visualisation systems

Research has been conducted exploring other modes of spatial visualisation. Some of these visualisation techniques have utilised landmarks and display qualities desirable in an ADW smartphone application. A brief description of work completed in this area follows.

Sketch maps and strip maps

Agrawala and Stolte (2001) devised *LineDrive*, an automatically generated destination map system for motorists that reduces a standard computer-based map to a generalised sketch map – a type of map familiar to wayfinders. Such a schematicised approach could work on a smartphone. Extraneous map information is removed and elements on the map are not scaled uniformly to ensure that important roads, turns and landmarks are communicated clearly. Test results revealed that the system was popular amongst motorists, but they found that if lost, finding their way back to the correct route was difficult as non-route roads were missing from the map. This was later rectified by presenting a standard digital map alongside the *LineDrive* map.

Route Aware Maps (RAMs) (Schmid, Richter & Peters 2010) uses a schematised strip map and places the route in context by depicting the network of roads and landmarks in the immediate vicinity. Should wayfinders deviate from the route this support network of off-route roads can be utilised to help them find their way back on course. Also suggested in this work is a GPS-enabled version of RAMs that have the capacity to compute the support routes described above. The above two studies don't truly satisfy the 'active' element being investigated yet they could work at smartphone scale for pedestrians. Schmid et al. (2010) was not subject to empirical testing.

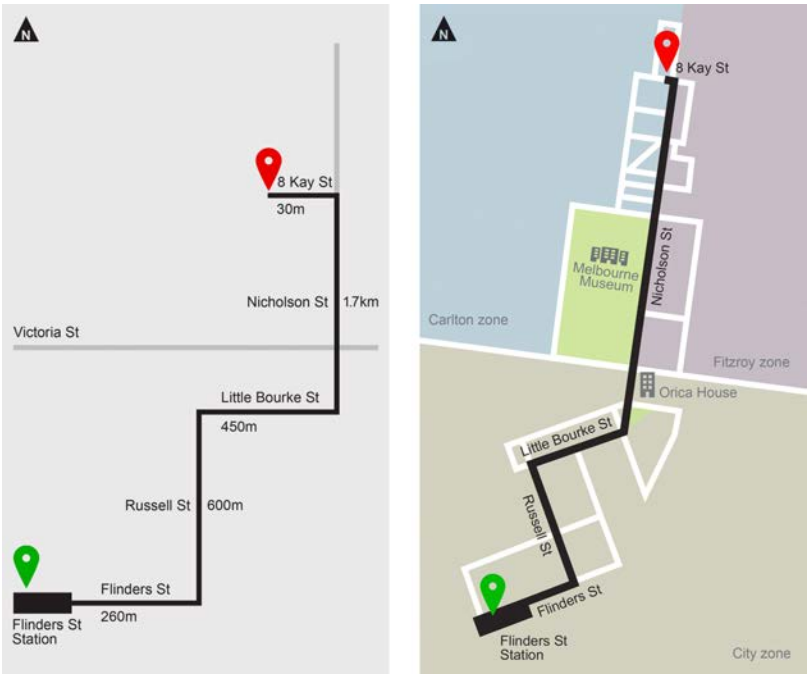


Fig.3. Left: Generalised 'sketch' map. (After Agrawala & Stolte 2001).
Right: Route Aware Map. (After Schmid, Richter & Peters 2010).

Compass

Crowsflight is an iOS (Apple) app that combines a compass view with a mobile map. The compass orientates the user towards the destination, and a map can be swiped to, on another screen to provide context. The intent here is to make wayfinding more exploratory and until the destination nears, the app does not require frequent checking.

This app has not been the subject of empirical research – and doesn't use landmarks – but is an interesting concept. An amount of ADW likely occurs as the user needs to understand the compass interface and relate the directions through the surrounding region to the destination. However as a standard mobile map is used in part, this app suffers the usual keyhole problems.

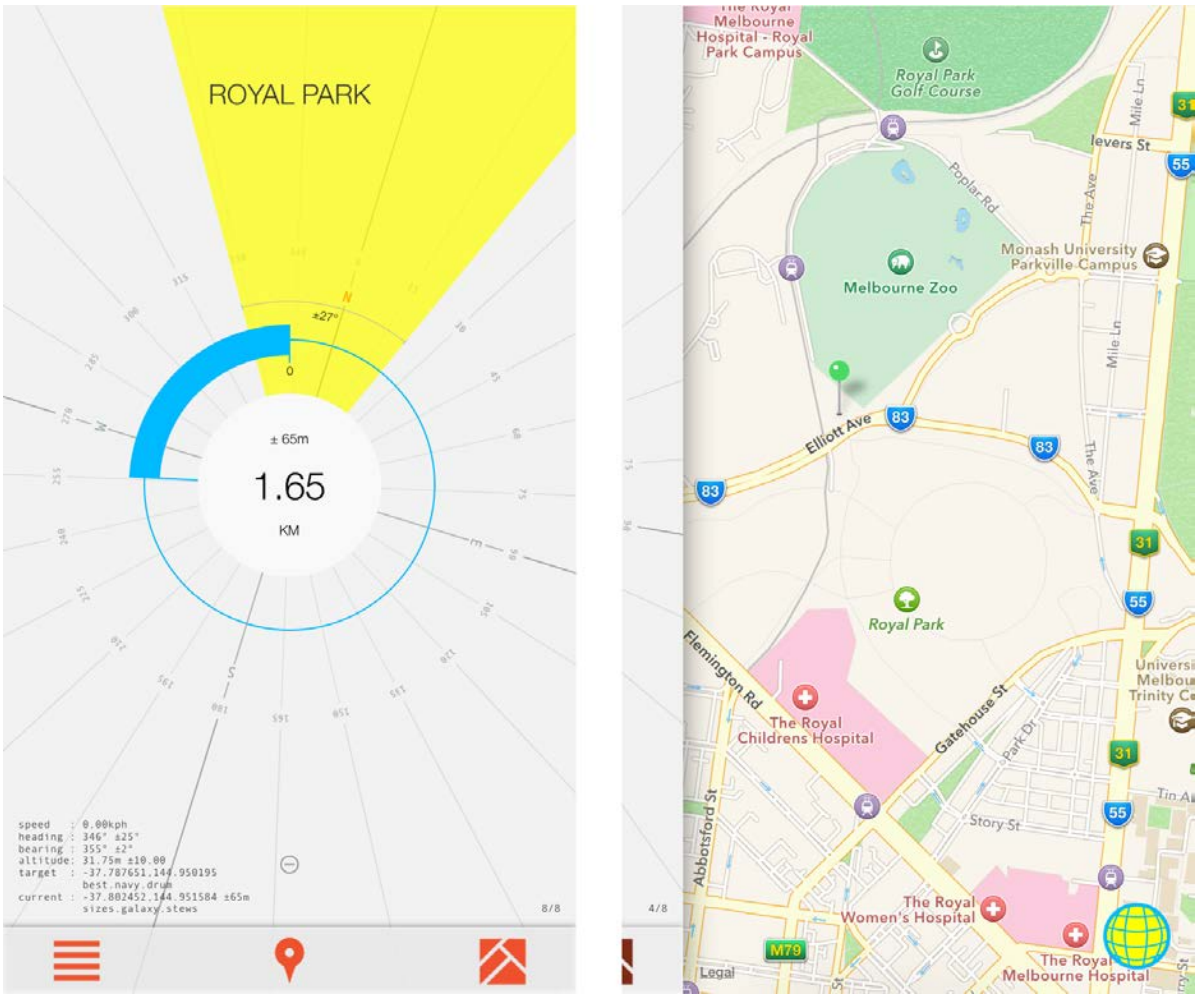


Fig. 4. Crowsflight iOS app © CW&T 2013

Landmark visualisations

Here photographs of landmarks have been used to supplement wayfinding directions in hierarchical overview+detail interfaces (Hile, Vedantham, Cuellar, Liu, Gelfand, Grzeszczuk & Borriello 2008; Hirtle & Sorrows 1998; Lee, Kwong, Pun & Mack 2001). However, photographs are literal depictions of the real world and time of day and seasonal variance may mean that a landmark can look quite different to its photograph. ADW will occur here as users have to match photographic wayfinding instructions to their corresponding real building landmarks.

Fig. 5. Time of day can make recognising photographs of landmarks difficult.

Testing

The next steps with this research are to design a prototype application using landmarks from a particular region and to test the prototype in the field alongside standard commercial mobile maps. Key tests undertaken will compare the speed of travel and the accuracy of acquired spatial knowledge.

Conclusion

Currently, smartphones are the preeminent device used for pedestrian wayfinding. As technology evolves, screens will emerge in many formats, most likely in smaller rather than larger sizes, and into wearable configurations. Should the hypothesis of this research be supported through testing, the core principles of Active Device Wayfinding may help inform how pedestrians find their way with smartphones and the next generation of devices. Employing the principles of ADW, namely: minimal device interaction; robust connectivity between screen, landmarks and environment; and minimal use of maps (given the keyhole problem) means that users will be able to actively find their way aided by a device rather than being passively led by their device.

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Reference notes

Figure 2 modified from: Klippel, A & Winter, S 2005, Structural salience of landmarks for route directions, *Spatial Information Theory*, vol. 3693, p. 352. © Springer-Verlag Berlin Heidelberg 2005. With permission of Springer Science+Business Media. doi: 10.1007/11556114_22

Figure 3 (on left) adapted from: Agrawala, M & Stolte, C 2001, 'Rendering effective route maps: improving usability through generalization', *Proceedings of the SIGGRAPH '01 28th Annual Conference on Computer Graphics and Interactive Techniques,* ACM, New York, p. 241. © 2001 Association for Computing Machinery, Inc. Reprinted by permission. http://doi.acm.org/10.1145/10.1145/383259.383286

Figure 3 (on right) adapted from: Schmid, F, Richter, KF & Peters, D 2010, Route aware maps: multigranular wayfinding assistance, *Spatial Cognition & Computation,* vol. 10, no. 2-3, pp. 184-206. © Taylor & Francis Ltd. Reprinted by permission of the publisher (Taylor & Francis Ltd, http://www.tandfonline.com). doi: 10.1080/13875861003592748

Biography

Andrew Haig is a communication designer from Melbourne Australia with 30 years of professional design experience encompassing both industry and academia. He has worked for leading Australian design companies, been a partner in a multidisciplinary design consultancy and has significant teaching experience. Information design, identity design, typography and user experience design are his specialist fields. Major exhibition design projects for Museums Victoria are his most notable recent professional design projects. He holds a BA in Graphic Design and a Masters Degree in Design by Research in web design and aesthetics. Currently Andrew is a PhD candidate at Swinburne University of Technology where he is researching wayshowing/wayfinding by personal portable device.

Are you lost or wayfinding? The interplay of information and people in buildings whilst navigating

Colette Jeffrey

Keywords: wayfinding, human behavior, disorientation, orientation, navigation inside buildings, information design, sketch map generation

Abstract

Finding the way to a destination can be easy when there is a clearly defined pathway, no alternative routes and someone who knows the way that can be followed. A wayfinding task becomes much more difficult inside a building with identical corridors and multiple entrances, levels and routes. Studies have found a person's ability to navigate is influenced by information factors, people factors and the environmental factors, but much less is known about what people actually do when they get lost inside buildings and whether there is interplay between these factors, with equal influence, or if one factor dominates. This paper describes three tasks aimed at gaining further understanding of how information, people and the environment influence orientation and disorientation inside buildings. The first task asked participants to sketch a map explaining a complex route that someone could follow, from an external start point through two buildings. The second task asked people involved in creating wayfinding systems to predict what people who are lost inside a building were most likely to do to re-orientate themselves, and the third task asked participants to recall a time they got lost and write down what they did to find their way. The initial findings identified common approaches to sketch map generation and frequently used wayfinding strategies, but there were differences in what people recalled doing when they got lost and what people creating wayfinding systems predicted people would be most likely to do. The sketch maps were interesting in terms of information design, route selection, map orientation and landmark inclusion. The written responses were interesting in terms of actual and expected wayfinding behaviour and also emotional responses to feeling lost. This is an on-going study of human disorientation inside buildings and further insight will be gained in the next research stages that are outlined in the conclusion.

Biography

Colette Jeffrey is senior lecturer in Graphic Communication and a PhD candidate at Birmingham City University. She is Director at Copper Jetty Ltd, a design consultancy solving wayfinding, information design and brand design problems. Before joining BCU in 2009, she worked as a wayfinding consultant, inclusive design director and information designer. She researched and co-wrote the NHS official guidance on wayfinding in hospitals, published in 1999 and has published numerous research papers and articles on wayfinding in complex environments. As project director and inclusive design director at Applied, a specialist wayfinding and information design consultancy based in London, she helped develop map and sign solutions for legible city projects in Brighton and Leeds. At Brand Union and Information Design Unit she solved wayfinding problems at sites including 30 NHS hospitals, the Natural History Museum London, Tower Bridge, Heathrow Airport, a shopping centre in Dubai and Wembley Arena.

Section 2: Improving Performance

The papers presented in the Improving Performance session were:
1/ Design to engage: embodied information in control rooms – Jennie Schaeffer + Rikard Lindell,
2/ Business benefits from information design – Helena Nagel
3/ Improving public service forms in India – Sukanya Baksar + Rupesh Vyas
4/ Above all else show the data – Geraldine Marshall

Design to engage? Embodied information in control rooms

Jennie Schaeffer & Rikard Lindell

Keywords: control room; design; tangible interaction; ambient interaction; emotion

Abstract

Information and the design of information effect the situation in control rooms for automated industrial processes. The design conveys to the operators the state and changes of state of the process. According to the common view among control room equipment developers, issues for design in highly automated control rooms, include the operators likely ignoring information, being bored and are not noticing variations until the variation triggers an alarm. Such problems can have economic and environmental consequences. In the highly automated control rooms of the future, these risks of can be dealt with from various point of view. The current thinking behind human-computer interaction **(**HCI) design is engineering the 'human factor' instead of understanding the human situation. Visionary areas in computing might convert HCI product development processes to design-driven processes that focus on user experience. The TAIPA research project presented in this paper focuses on the user experience in two control rooms. Based on the results and previous research, we examine how the information might be given a tangible and ambient design to engage operators. This paper presents illustrations of aspects of future design for the control room.

1. Introduction

Research financiers, policymakers, and industry managements consider further automation in the manufacturing and process industries to be a matter of survival for the European industry. The Swedish Digitalisation Commission speaks of a digitalization tsunami that will change the foundation of the Swedish labor market (Digitaliseringskommissonen 2015). Technology for process automation is expected to enter a new phase, which will further increase automation (Nandorf 2015). Visionaries in areas such as ubiquitous computing have presented various technologies for the

future of user interfaces (Hornecker 2014). Simultaneously, embedded systems are increasingly being developed by in the industrial engineering field producing sophisticated technology. The Internet-of-Things connects all systems and big data aggregates information (Chen et al. 2015). One matter for research is to understand how to use the knowledge available from ubiquitous computing to the improve operator interface for the process industry.

A problem with today's user interfaces for process automation is that their design is in accordance with the cognitive psychological-based HCI (i.e., one human interacting with one computer through a screen, keyboard, and mouse). This design approach, which considers the user's mental model and the system's state, can be described as a technology-driven design process (Krippendorf 2006; Buxton 2009). In it operators are described as components. "A human operator can become just as important a component in a regulatory or control system as the electronic or mechanical components" (Ivergard and Hunt 2008). This quotation illustrates how the rational approach tries to *engineer* so-called *human factors.* As a consequence the design loses context and important, but immeasurable, experiential qualities that go beyond usability. In order to incorporate these experiential qualities in design, it is important to learn more about the overall situation and microelements of experiences based in real life situations.

In a broad overview of control rooms, Ericson et al. (2008) say that the design of control rooms does not sufficiently consider the organization and the people who work in it. Ericsson et al. (2008) also note that there is a strong link between users, the organization, and the technical conditions. Thus, the design of the operator interface should be seen as an integral part of a greater whole. McCullog (2005) questions the one-sided focus on the utilitarian perspective and argues that interaction design needs to take account of cultural values and that digital technology does not eliminate the human need for place. Farrington et al. (2009) show that the design of the physical space must be taken into account with regard to social interaction.

Interaction design has focused on embodied interaction and tangible user interfaces (TUIs) over the last two decades (Hornecker 2014). Ishii and Ullmer (1997) presented their vision for HCI as follows: Tangible Bits to link users' perception and understanding of digital artifacts by digitizing everyday physical objects and architectural surfaces.

Ambient interaction is interested in how the environment can be part of the interface, so changes in processes can be sensed instead of having to be consciously perceived. This can be achieved through the presentation of information using artistic techniques (Beale 2007). At first, ambient interaction can create obscurity, while exposure to it over time gives the viewer an understanding of the underlying process. In discussing the relationship between Tangible Bits and ambient interaction, Ishii and Ullmer (1997) argued that these areas are closely related because ambient feedback helps users understand the system.

In 2001 the information design community made an early attempt to bring in user experience and a design-driven approach. It embraced how principles from computer games (a game called StarCraft™) could contribute to interesting solutions for displaying complex information in power distribution control rooms (Weisscher, 2001).

One problem in design is that industry associations, system designers, and design agencies seem to mainly base design and development of interfaces for operators on a view that operators in highly automated process industry are bored, emotionally uninvolved in their work, and have mental distance from the process. Cummings (2013) supports the view that operators can become bored because of the high degree of automation; this is based on a study that investigated boredom in unmanned vehicle simulation environment. Cummings's (2013) findings point to the future control rooms having to support the operator to efficient attention switching if these automated control rooms have long, bleak stretches of doing nothing punctuated by brief events.

However, the research in the fields of TUIs, information design, and interaction design have not been reflected in the design process among control systems development companies, judging by the systems produced. One could ask whether highly automated control rooms could be rethought from the perspective of combining user experience, context, TUIs, and ambient interaction--and then redesigned accordingly. Instead of testing people in a simulated environment, as Cummings (2013) did, we turned to real life settings to find out whether the emotions reported by the operators in their interaction with the control room could provide a user-experience perspective on the design of the future control room. Our assumption was that the results would provide interesting input to the research question: Could and how might the information be provided in a tangible and ambient design to engage operators?

2. Method

The support for design of TUIs and ambient interaction requires data that focuses on the user experience. In line with previous ethnological studies in control rooms and focusing on communication (Heath & Luff 1992), cognitive load and user interface inefficiencies (Bias et al., 2014), social interactions (Farrington-Darby & Wilson 2009), and collaborative production of computer commands (Heath & Luff 2000), we used methods from ethnography to include users and real world environments in our study. But in contrast to previous studies in control room (Bias et al. 2014; Farrington-Darby and Wilson 2009, Heath and Luff 1992; Luff and Heath, 2000; Petterson, Randall, Helgesson 2004), our study focused on emotions and artifacts from an operator's point of view. We choose two power plants to study: plant A and plant B. Plant A had teams working in the control room and plant B had a single operator per shift. We spent 36 hours at the plants observing and interviewing. The interview method was based on photos in combination with observations and field notes. Photo-based interviews are used in design research and ethnographic studies to facilitate communication around beliefs, feelings and assumptions among individuals in different groups (Ball and Smith 1992; Collier 2001; Epstein et al. 2006; Harper 2002; Göthlund and Lind 2010; Salvador, Bell and Anderson 1999; Schaeffer 2014; Scherer Cohan 1992).

We introduced the interview by presenting the study as a design and research project on the control room of the future. We said that we were interested in every emotion, such as joy, amusement, irritation, and boredom that might come up during a shift. We were clear that there were no "bad" feeling; we were interested in all sorts of feelings. The operators were given digital cameras and asked to take a photo of an object related to a

feeling during the shift. The photographs could be either metaphorical or show an actual situation, place, or action. The participants noted on a form what was meaningful for them in the photograph and which feeling they wanted to describe and why. Since the participants were asked to take photos during their shifts and we discussed the photos whenever there was time during the shift; the actual interviews took between 2 hours and 8 hours. The interviews were recorded; the photographs were stored; and the personal notes on the photographs were transcribed into a document. The data was analyzed with a special attention to *which* feelings were described and how an artifact and situation related to the feeling.

3. Findings

Overall, our findings from the empirical study showed feelings of irritation, pride, calmness, insecurity, resignation, frustration, contentment, ambivalence, disturbance, worry, disgust, and anger related to interaction with different objects in the control room or the organizational context of the control room. No one reported a feeling of boredom. The reason could be that even though the two control rooms studied were automated, the operators had more action than downtime. Another reason could be that the participants did not feel it was acceptable to express a feeling of boredom. On the other hand, we did not register any hesitation among those interviewed about expressing other feelings, such as irritation, insecurity, and anger.

Another issue raised by one informant in plant B was what constituted an automated control room: "If you ask our CEO he will say, that our plant is 100% automated, but in reality there is no such thing since the reality is more complex than that."

When we observed 'downtime' in the control room, the feelings were not described as boredom but rather as pride and contentment. For example, one operator photographed one of those occasions, taking a photo of an interface and saying that when it is no problem in the system, there is a feeling of pride. He said: "I don't feel bored, I feel proud that I now deliver heat and water smoothly to the whole community." One consequence of the view of the operators as bored is that they are expected to take on other duties. An operator in plant B photographed a group of people to symbolize that in addition to handling the control of the processes the operators have to take care of guided tours. He said, apparently very stressed and aware of responsibility:

> People here think that we can do other duties, since they think we do nothing- we are just lazy and looking at a screen all the time. But I don't feel that at all, I have to be in an alert mode during my shift and we have a huge responsibility to deliver heat to the town.

Then he started to talk about how this responsibility affected his health.

In all the interviews, operators reported irritation in relation to artifacts and interfaces that could affect the stability and safety of the procedures. Irritation was, for example, reported in relation to the alarm list in plant B and in relation to the alarms in plant A. In plant B, the alarm list was an irritatant because it was regarded as being inconsistent with reality. The alarms looked the same and were presented without prioritization as to the seriousness of the situation. In plant A, the sound of the alarm and the visual

feedback were the same; a minor delay triggered the same sound and light as a serious incident. The experience of "superirritation" reported by a user in plant A was a mix between the actual irritation provoked by the lack of hierarchization of the information in the systems and the frustration to not be able to make genuine improvements in the systems themselves, to be taken seriously, and to have somewhere to turn to suggest changes.

The users overcome some of the most irritating features by creatively redesigning the system to the extent they could. One change, for example, was the installation of a short command so the sound of the alarm could be turned off without dealing with the actual alarm (that apparently created another source of instability for the process). It seems that with experience the operators no longer see the interface simply as a graphic representation of the system. For example, the operating manager in plant A, who has 19 years of experience in production and served 5 years, said, -With my experience you don't see the bars and squares. They disappear. When I see the screen I see the real production, the real doors and boilers.

The statement indicates the interface's materiality; the images become the plant. The clear perception of reality conveyed through the screen relates to an embodied learning as a result of the operators having moved physically through the power plant. Operators have developed their own overview curves and use live video streams from cameras of the process to support better decision making. The operator continued, "But we only got training in how we put things in the system, not in graphic design. It would be fun to invite a graphic designer to entirely redesign our graphical interface."

The computer hardware at the power plants we studies were general purpose PCs with cheap keyboard and mice. The humans actions have been safety regulated, whereas the hardware are not safety classified. On occasion in plant B, the screens went black and failures in the process that lead to frustration and powerlessness because the operators could not make repairs themselves.

Additionally, the irritation stimulated development of creative solutions for redesigning tangibles. For example, one operator pointed at one reason for irritation: three identical mice with one that had a knot on the cord. He asked, "In a moment when we have to make fast decisions, how could we judge which mouse that goes with which screen when everything looks the same?" The objects did not provide any visual or tangible cues. The operators' solution was to make a knot on the cord.

Some of these irritating problems were not possible to solve because of the lack of a supporting context in the company and then the operators' feelings of irritation changed to another reported feeling: *resignation* and even *disgust*. The operators gave an examples of problems they could not change. For example, their telephone systems did not have coverage in the plant premises, but the operators could not affect which telephones they would have in the future nor were small improvements supported, which made the operators feel resigned. The feeling of disgust was described as the "submarine feeling" when related to worn out, sweat-soaked chairs in the control room. Although heir chairs were used 24 h a day, every day of the week and they could not change chairs any more often than those in the municipal administration that were used a maximum 8h the day for 5 days a week. Using different examples the operators

described the complicated microrelations between power, objects, communication, their huge responsibility for an important process and having little influence over the context of the situation. That provoked a feeling of resignation.

4. Discussion and implications for design

Based on our study, the design of the future control room has to consider the microelements of experiences that can cause the feeling of pride, irritation, resignation, and even disgust with design. This perspective implies not ignoring the power relations in the plant and the perceived resistance in the organization to changing things like the telephone networks so they working, control systems so they are secure, and chairs so an operator does not have to sit in someone else's sweat and feels not "worth" a new chair. The design of the control system's user interface and its obvious lack of regard for users indicated that environmental factors had a low priority in both pant A and B. Another explanation for the bad user interfaces we saw in the study could be a lack of competence among the companies that develop the systems. Ericson et al. (2008) describes a strong connection between the users and organizational and technical conditions. Bergström et al. (2010) used TUI to explore and discuss the materiality of the computer. The epistemological link between our understanding of the control room context and embodiment indicates that TUIs and ambient interaction can improve operators' situation and the design of interface for process automation.

The operators in the control rooms we studied seemed to be very "tuned in" in their processes but irritated by hardware and software that worked against them. A design answer for the control room of the future that brings TUIs in to the design of controls is shown below (fig. 1).

Figure 1. A control room of the future. The ambient feedback is visualized both in the floor at the walls, the station for control incorporates TUIs, and the operator is respected for the fine tuned steering of the processes. The environment is the highly prioritized in the company. (Illustration Lasse Frank).

This design uses tangible and ambient feedback to control and follow up the processes. We suggest that a control system building on the real life experience, incuding design thinking in its process and supporting tangible and ambient interaction would make the processes smoother, and also make the role of the operator more like that of a DJ, an artist. What would happen with the organizational structure if the organization accept the operator as a star with demands? The TUI could bring an operator in to the flow and provide a design that takes into consideration the personal relations that the operators create with the artifacts. If design thinking is given more space than engineering and introduce a well-designed artifact, it might lead to change in the power structures of the organization. The ambient- and TUI-based control room of the future would also provide hierarchization of information feedback in both the sound and visuals (figures 2 and 3)

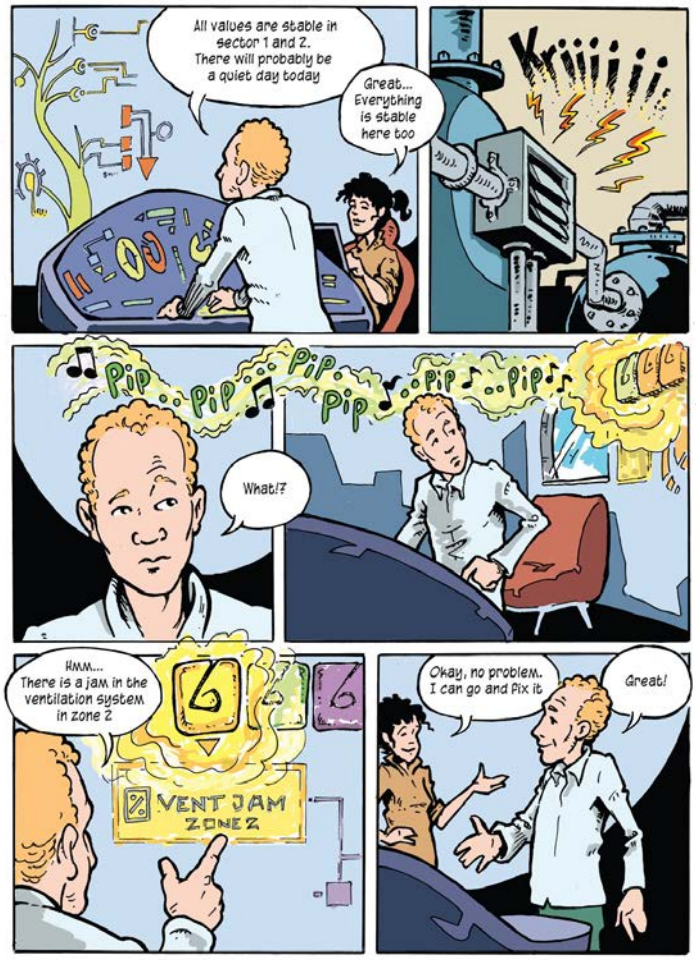

Figure 2. In the control room of the future, the alarm list is visible on the wall. An alarm for less important problem in the plant is an appropriate ambient sound of, for example, birds, and the visual feedback shows clearly where the problem is located. (Illustation Lasse Frank).

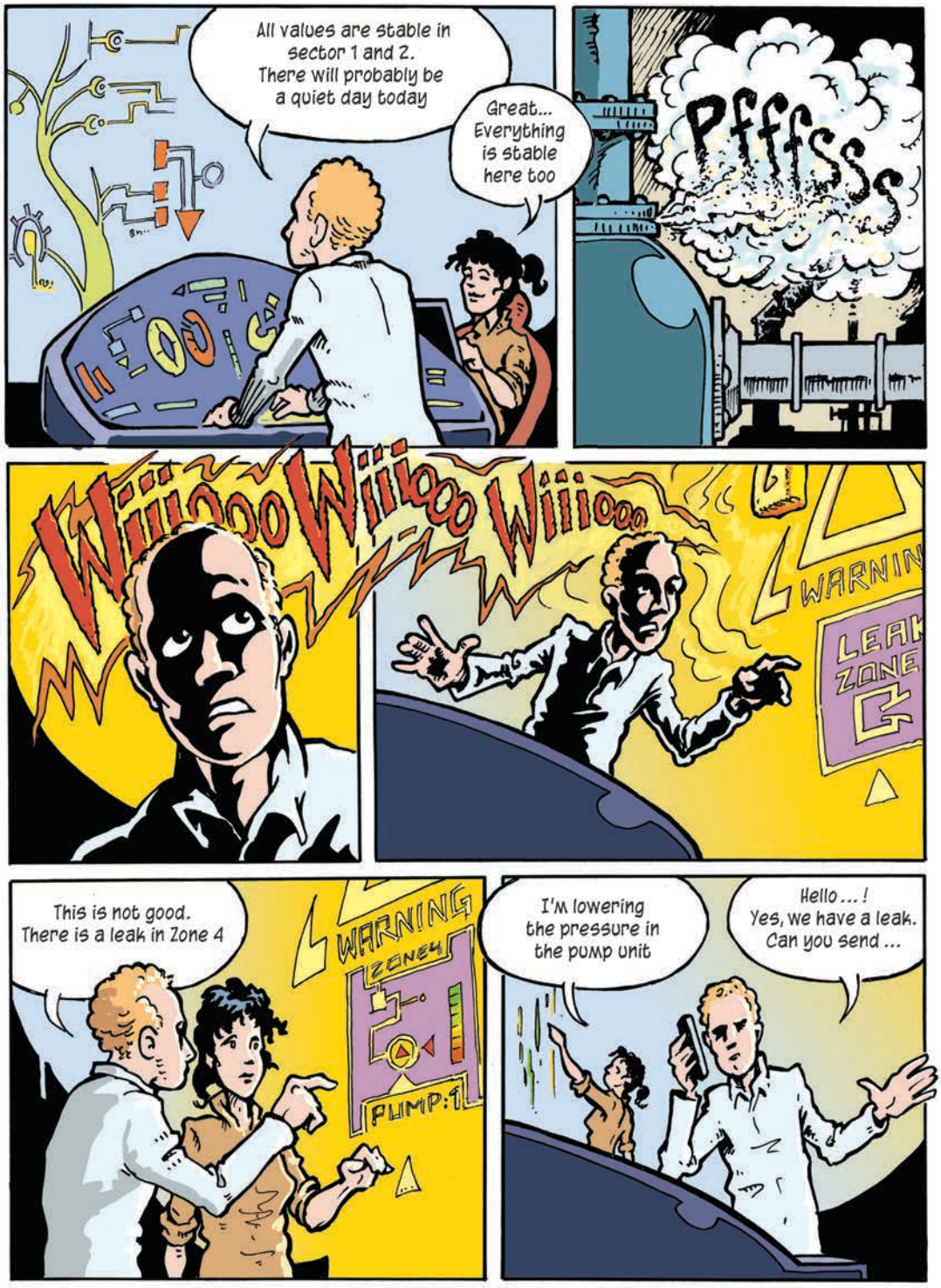

Figure 3. In the control room of the future, the feedback for an important issue causes a sound that catches more attention and lights up the whole wall to communicate the issue clearly and in detail.

Based on our observations and the irritation provoked by the struggles with interface design, we suggest that the control room of the future uses graphical designers as the operator and developer to develop for an interface design that preserves the underlying functionality but presents it more effectively on a graphical level (Figure 4).

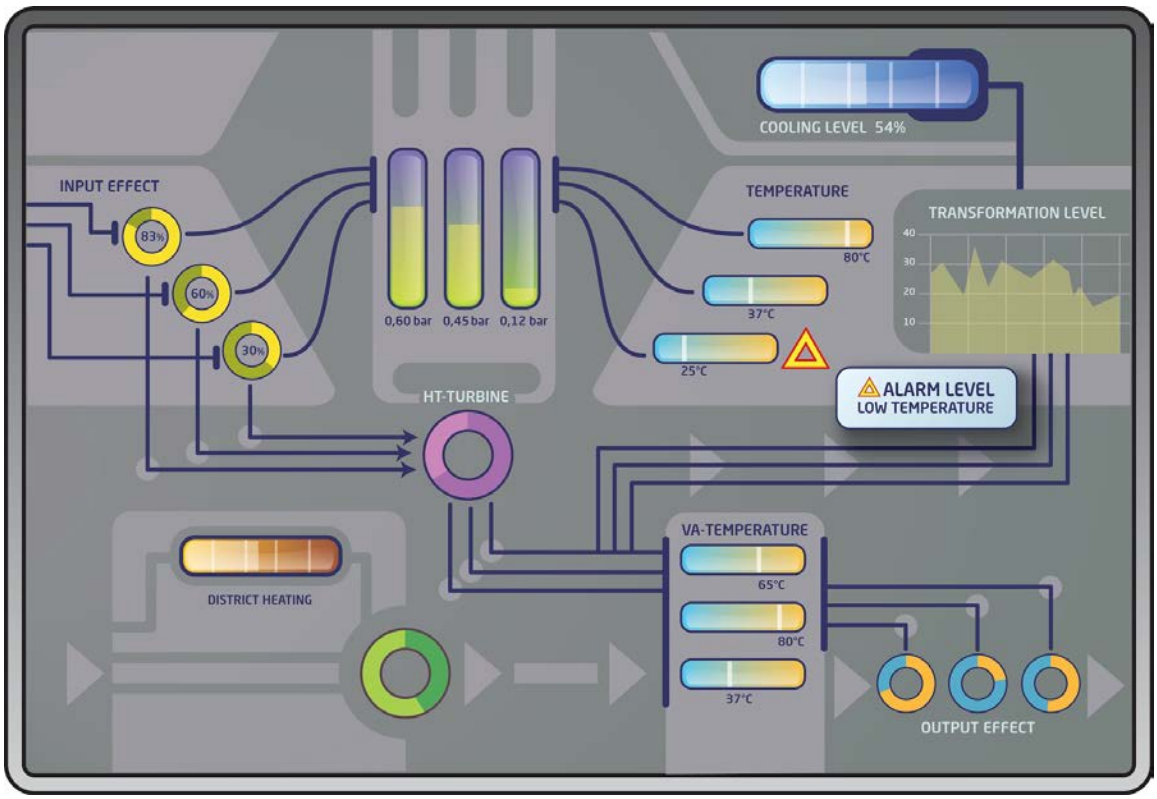

Figure 4. The control room of the future uses graphical designers to create the interface design in a user experience. It would preserve the underlying functionality but reconsider how information is presented on a graphical level.

Based on our study of the operators' emotions and lack of influence and power over the design, one interesting design issue is whether the responsibility for the systems design could be handled entirely by the operators. This is the case, for instance, with many electronic musicians and video artists who create their technology and interfaces. From a safety aspect, the systems that artists create to use on stage must be very stable because crashes and black screens are catastrophic. However, unlike the systems in the plant, these systems are not created according to safety standards. Giving operators this responsibility would address the issues reported in our study such as occurrences of hardware and software failures that lead the operators to feel irritation, powerlessness, and resignation because they could not do anything about them.

The control room of the future uses inspiration from music do-it-yourself (DIY) interfaces to put the operators in control, but at the same time stimulate engagement and reduce the risk of operators creating bad shortcuts to reduce the irritation in the workday (Figure 5).

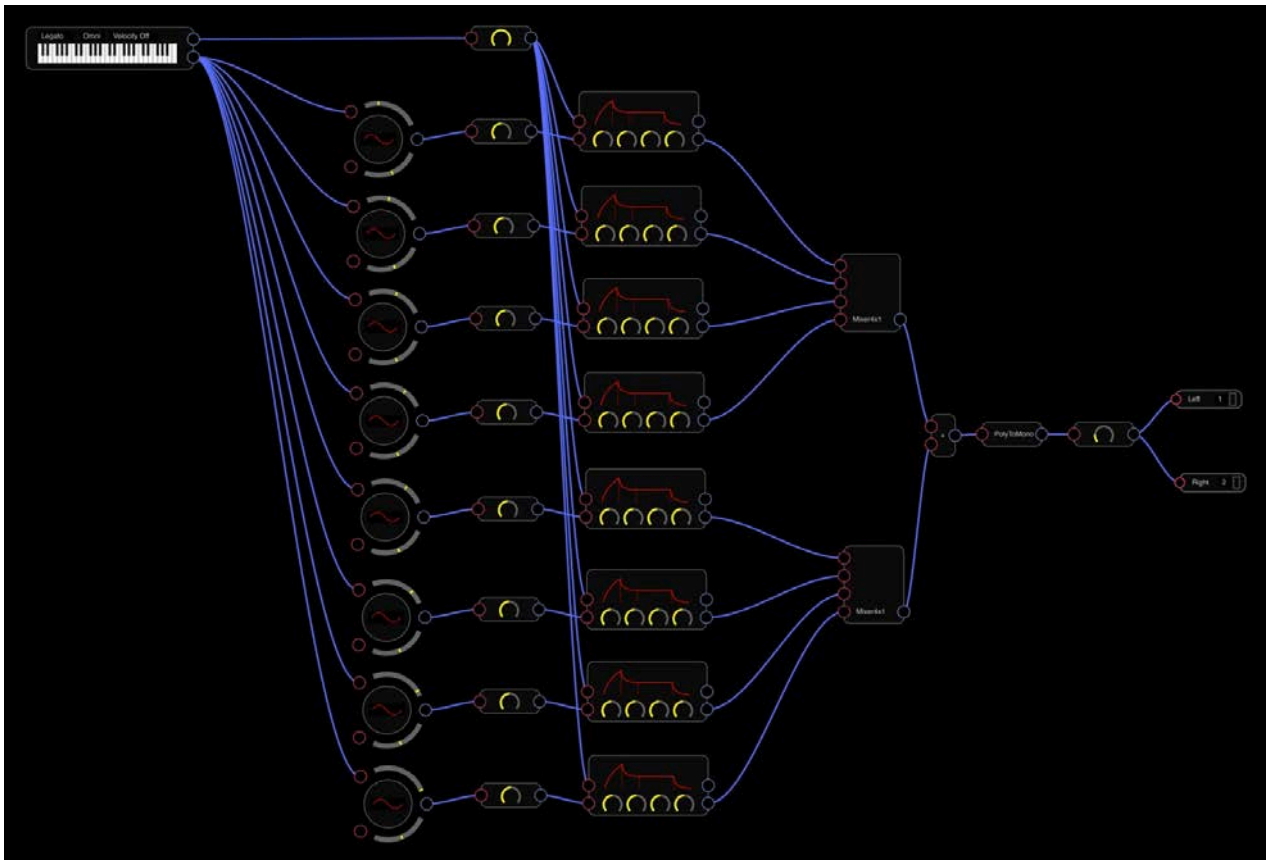

Figure 5. This interface redesign connects the system with the design but also adds new ways to interpret the functionality in the system behind the graphical level as shown in fig.4) This image displays a virtual modular synthesizer that runs on tablet devices. The user can make very complex patches and signal flows of virtual electronic circuitry. The virtual circuitry is a simulated model of the reality. The flow is animated and the user is aware of the system state. Furthermore this system, like most other music software systems, allows users to connect tangible controllers.

5. Conclusion

The operators in our study were engaged in the interaction with the system; they were not bored. The operators created relations to the tangibles in the control room context. However, our empirical findings showed that the emerging relations to the tangibles, alarms, and graphical interface evoked irritation and resignation. During downtime when everything ran smoothly our informants reported feelings of pride because of the meaningful purpose of the tasks.

The design of the future control room has to consider how to transform the feelings of frustration and anger in current tangibles into flow and engagement. We suggest that carefully designed tangibles that include ambient interaction would support this transition. Providing control of the design and creating playful relations with the interface of the system would enable the operators to have power over the system and the control room context.

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Biography

Jennie Schaeffer PhD has been a lecturer in Information design – Spatial design at the School of Innovation, Design and Engineering (IDT), Mälardalen University since 2006. She is a member of Information Design Research group. Jennie Schaeffer's research interest is in the field of spatial design and artifacts' relation to creative processes and communication. She is currently researching communication with users in museum settings by combining contemporary computer based techniques and sound in the projects Music in Motion and SONOTOPIA. In the TAIPA research project, her focus is on user experience of information and aretfacts in control rooms. Her licentiate thesis is called "Communication Space - Spatial Design in Manufacturing Industry" (2011). Her PhD thesis is called "Spaces for innovation" (2014) on the relation between physical space and innovation.

Rikard Lindell PhD is a senior lecturer in computer science with specialization in interaction design. He is interested in the new interface technologies for digital arts and multimedia content and creative work in cooperation. Rikard is also working on research commercialization with experience of the painful process of transforming an interactive research prototype to a reliable software with a sustained focus on the user experience. In this process, he has developed a material consciousness for code and an craftsmanship epistemology for programming grounded in practice, empirical data, and in crafts theory. Rikard is also a musician and release works via http://soundcloud.com/rikardlindell

Business benefits from information design

Helena Nagel

Abstract

Products and services provided by government departments, telcos, utilities, financial and insurance companies, get more and more complex all the time. Mobile phone, broadband, and energy customers have hundreds of tariffs to choose from. Public transport schedules and special deals can be difficult to grasp. People are often lost in shopping malls. How to make all this more transparent, better understandable to clients? This is a challenge I have been addressing in my work. This includes conceptual work for a ferry company as well as delivering products such as gift cards, to them, the objective always being how to make their offerings clearer and more attractive to clients. Or, redesigning information signs and stands for a major department store in Tallinn. Or, work on bills for a local utilities companies so that those bills would become a real communication channel between the client and a utilities company. Or, applying major conceptual changes in wine catalogues and shelf talkers to make it easier for local wine lovers to orient in modern world of wines. Such a work has not been easy, I have encountered several challenges. These vary from short-term cost increases to resistance to change from the side of management as they are not aware of what information design can really deliver. However, with long-run benefits on the table, the clients have become convinced and open to change. And, the changes have really worked. In my presentation I would address the complicated nature of the everyday activities, the "explosion of choice", while graphic design can really help making life simpler. I would discuss barriers I have encountered from the side of clients and how to overcome them. The presentation would be illustrated with real cases I have worked on.

Biography

Helena Nagel is an Estonian graphic designer. She holds BA and MA degrees in Graphic Design from the Estonian Academy of Arts; her MA Thesis was titled *Diagrams: Theoretical Framework and Application in Teaching History*. She is currently employed by the Estonian oldest advertising agency Age McCann, where she specialises in delivering information design solutions. She was previously employed by Vatson Wunderman (affiliated to Young&Rubicam), where she worked as art director for many international corporations as well as largest Estonian companies. Helena has been awarded several times by „Golden Egg", the premier event for Estonian ad agencies: In 2012 she received Bronze Egg in Design, in 2009 Silver Egg in Graphic Design, in 2009 Bronze Egg in Outdoor Category and was Winner in 2009 in "Quality paper", Corporate Design. Helena is also lecturing Information Design at the Design Institute of the Estonian Entrepreneurship University of Applied Sciences.

Improving public service forms in India

Sukanya Baksar & Rupesh Vyas

Abstract

In India, the government provides certain services to the citizen in its jurisdiction that they believe should be available to everyone irrespective of their economic backgrounds and these are known as Public Services. The channel through which a citizen may avail of these public services starts with the process of filling a public service form. The challenges of the public service forms range from the lack of structured information lacking the principles of typographic hierarchy and Gestalt to outdated information. This dissuades most people from availing these services due to the tedious, redundant and repetitive nature of these forms. Also since most forms exist in isolation to other public service forms that exist, a user has to provide the same information on numerous occasions leading to frustration on the part of the user, also resulting in a lot of repetition in the database.

This paper follows public forms in the Telecom sector and addresses the issues faced by the users, and eventually making the delivery of Public services to our citizens better by improving the user experience through these forms. Taking up a design process, this design intervention looks at understanding the context, the target users and system in which these forms work. Thus leading us to a sustainable design that enhances a user experience thus promoting more utilization of these public services. Also bearing in mind that our country is moving ahead with a massive thrust on an E-governance approach, this design intervention looks at the future of a citizen centric system of Public Service forms which promotes more use of public services by creating a seamless experience both at the end of the governing body as well as for the users.

Biography

Rupesh Vyas is a Senior Faculty in Communication Design, Activity Chairperson Online Programmes at NID. In recent past he has been Head of Information Technology and Coordinator of Graphic Design. He is taking lead role in developing Information and Interaction Design as emerging domain under Communication Design and IT Integrated Design Disciplines at NID. He is a Board Member of International Institute of Information Design (IIID) and recently been nominated as World Regional Representative for India. He has contributed significantly to some of the major consultancy project having National importance like Information Design for Census of India 2011 Data Collection and Digitization processes and Multipurpose National Identity Card for Citizens of India from Ministry of Home Affairs, Government of India, Smart Card based Indian Union Driver's License, Standardizing Visual Design for National level implementation, by Ministry of Road Transport and National Informatics Center, Government of India. He was key planner and Chair for "Vision Plus 2010" conference in India hosted at NID. "Vision Plus" invited national and international

Scholars and experts from 14 countries, covered a wide range of engaging issues in the domains of Communities, Healthcare, and Mobility.

Sukanya Baksar is a student of Graphic Design in her third year at the National Institute of Design, Ahmedabad. Within the field of Graphic Design her areas of interest are Typography, Print, Research and Storytelling. Previous projects that has have been involved in include— a teaching tool that helps visualize Hindustani Classical music for students, Branding collaterals for the International Open electives 2015, Design of a visual form to explain the design process in the Small scale industry sectors, etc. As a designer she believes in contributing with her skill sets in a collaborative and multidisciplinary milieu, which she believes is what leads to innovative design solutions. She looks forward to being a part of evolution of seeing Design move into fields that it is currently underutilized in and hopes to be able to contribute significantly to it. Not very outside of Graphic Design areas of her nterest include— Music, Biology and Philately.

Above all else show the data

Geraldine Marshall

Abstract

The world abounds with information constructed with symbols, codes and characters sets which proliferate both the physical and digital world and manifest themselves in print, on screen, and in the environment. It is easy to overlook their impact on our visual landscape and they can become an invisible, largely disregarded source of visual communication. Their presence and purpose is absorbed unconsciously and is processed by the viewer without deliberate analysis or interpretation of the message, instruction or command. But what if we are able to consider the nature of the information displayed based on aesthetic choices of lettering style, the process of application, or the historical trends through a systematic, quantitative data collection; with every aspect of the visual element of the information or message being assessed and recorded. What could the potential be? As part of my PhD research I have created a taxonomical database of environmental lettering to create statistical data that can be organised for analysis and elucidation to assist in the understanding a city's social, cultural, ethnic and historical visual identity and in doing so, map our visual *Graphic DNA*. The database is the most comprehensive detailed study of environmental lettering on public signage to date and it makes it possible to analyse the seemingly overwhelming profusion of information presented by lettering in the environment. The study has the potential to examine anything from the frequency of any number of lettering styles chosen in the communication process to the production methods and materials used for application. From the information collated it can also be used to observe historical and social changes within a community or city. As part of Vision Plus 2015 I would like to present the taxonomy database to date, and highlight the potential that such a study could contribute to the organisation and consideration of effective communication and information design and 'above all else show the data' (Tufte, E R, 1983).

Biography

Geraldine Marshall is a PhD candidate at Birmingham City University. *Graphic DNA* is the title of her PhD research, which aims to develop and implement a systematic taxonomy to record environmental lettering; the result of which will help understand a city's social, cultural, ethnic and historical visual identity. Based at Birmingham City University, this research stems from my undergraduate investigations into lettering in the urban environment, the visual effect on its surroundings and the thought process of its application – accidental or intentional. As well as creating an extensive photographic archive recording the ever-shifting lettering landscape of Birmingham, I also lead type tours of the urban environment for students and other enthusiasts.

Section 3: Historical Information

The papers presented in the Historical Information session were:

1/ Treasures of the Cadbury Research Library – Martin Killeen

2/ Acquiring the names and knowledge of plants: the nursery catalogue in the Enlightenment – Elaine Mitchell

3/ Sanserif: face of information, instruction and industry in the nineteenth century – David Osbaldestin

'Acquiring the names and knowledge of plants': the nursery catalogue in the age of enlightenment

Elaine Mitchell

Abstract

'On the whole, whatever Imperfections may be found to be attendant on the following Performance, the Goodness of the Intention must plead for Excuse, and procure to the Compiler the Countenance … of the more Enlightened.' Thus Birmingham nurseryman John Brunton closed the preface to his catalogue of plants 'botanically arranged according to the system of Linnaeus'. Published in 1777 the pocket-sized catalogue listed plant material that ranged from the tender to the hardy, representing 'the Growth of many Countries'. During the eighteenth century Britain experienced a flood of plant introductions from around the world, the result of exploration, colonisation and commercialisation. Whether grown for beauty or utility, a more extensive range of plants was a commodity in increasing supply. The nursery business expanded and through catalogues, trade cards, instructional manuals and books of botanical illustration, or *flora,* plants and print combined to satisfy a market for gardening knowledge and botanical curiosity. In contrast, though, to the potential beauty of its flowery contents, the eighteenth-century nursery catalogue gave an understated performance, being the modest wallflower to the showy blossom that was the *flora*. But the nursery catalogue with its columns of plants was more than a shopping list for the horticulturally acquisitive, more than a manifestation of global trade in a commercial world. These small publications were instructional tools, vehicles for new scholarly knowledge and agents for the demonstration of intellectual pursuits by nurserymen and thus for the negotiation of their social standing. The nursery catalogue is an ephemeral item and provincial survivals are rare, but John Brunton's list provides an effective demonstration of the ordering and classification of the natural world following the work of taxonomist, Carl Linnaeus. It demonstrates the application of new scientific knowledge to the provision of information in a commercial world, adopting ideas of improvement and enlightenment to communicate effectively.

Biography

Elaine Mitchell is a postgraduate research student at the University of Birmingham and a graduate of the MA in West Midlands History. Her research within the Centre for West Midlands History centres on urban gardens, gardening and horticulture in eighteenth-century Birmingham. Earlier work on Birmingham's Vauxhall Pleasure Gardens explored eighteenth-century public space in the manufacturing town, and the development of new technology in the early nineteenth century through an investigation of Jones & Clark, Hothouse Manufacturers. From 2012 to 2014 Elaine was Managing Editor of *History West Midlands* and is currently fulfilling the same role on *Fortunes of War*, a collection of essays marking the 200th anniversary of the Battle of Waterloo. She has recently been invited to join the Steering Group of the Centre for Printing History and Culture, a joint initiative between Birmingham City University and the University of Birmingham.

Section 4: Performing Arts

1/ Hard facts, soft fictions, silent discourse – Steve Chamberlain
2/ Historical dance notation – Mary Collins
3/ Dance notation systems viewed as a problem of information design – Pablo Munzo

Hard Facts, Soft Fictions, Silent Discourse

Steven Chamberlain

This is an attempt at 'Kino-Lightning-Talk' , a presentation of a film that will never be made. This paper is the second draft of an unmade film. Unmade like a bed, untidily arranged and unready. The essay, from the French, is a an attempt to make a film, an interrogation, not just of material facts, but reflexively, it interrogates the modes and medium of it's making. This attempt is an effort to see essay films through the prism of information design, to interrogate it refractively.

Essay films are hybrid documentary, experimental, avant-garde films, highly subjective, often politically motivated. These essay films are poetic and performative in mode, always reflexive. In the last few years we have seen growth of the video essay or digital film criticism. Films that isolate and reveal the themes and visual language of film makers. Increasingly used within film studies for its power to condense visual information into a found footage, short form film. Part formalist film theory, part education tool. It solves formalism's problem. When writing about the visual and technical elements of a film. The stuff that we see.

In Kogonada's Wes Anderson // Centered [2014] we see animated, broken lines superimposed and integrated into the camera movements and onscreen action. It draws our attention to Anderson's obsession with symmetry. Parallel films, Ozu // Passageways and TEMPO // BASHO work together to make connections between the Anderson's and Yasujiro Ozu's films. Anderson and Ozu both obsessively use symmetry. His interrogation of Ozu's work uses a split screen for us to make comparisons. A diptych, or even a triptych of sequences are placed next to each other consecutively. A condensation and repetition of Ozu's signature motif. The condensation of visual information happens within the frame, this time without diagrammatic overlay. Their repetition implicates Kogonada's own obsessions around these 2 film makers. We are invited to register these obsessions, we actively look for the perfect symmetries in future viewings. We see them differently forever. Another Anderson, this time Paul Thomas Anderson is the subject of numerous online Video Essays. Eye tracing technology reveals how the film maker uses camera movement to lead the eye around the frame. These visualisations show how it is difficult not to look, where Paul Thomas Anderson wants us to look.

Screened, filmed and projected images have peculiar qualities. In an audio interview, appropriated for Sellotape Cinema's documentary FilmBites [2015], Kendal Walton puts it like this. When looking at filmed images, you are not just seeing a picture from the film, but the actual object in front of the camera, the frame is a window, the screen is transparent, is an aperture. When you look at a photograph, or cine footage, of your grandfather say, you are seeing your actual grandfather. It helps to think about when we look at a star through a telescope, another optical device. We don't doubt for one minute doubt that we are seeing the actual star, even if it has long passed and no longer exists in the universe. The unlimited information in a filmed image extends beyond the frame, it become limitless.

In Ridley Scott's Blade Runner, visually referenced in FilmBites, we are introduced to the Esper Machine. An imagined device that processes photographic images to allow seeing around corners and outside of the frame. Likewise, while viewing live action narrative film, we construct the detailed information of the world beyond the boundaries of the screen. We must do this to comprehend a films narrative, because something else is often happening somewhere else in that universe, "meanwhile back at the ranch". We have the "meanwhile" playing in the back of our minds, before we are taken "back to the ranch". We don't do that with say a painting, when we look the painting of whistlers mother, we don't wonder who is in the next room.

Non linear narratives are notoriously difficult to construct, diagrams, flow charts, are often employed to keep track of beats and plot points. Not so with the Essay Film. They are by their very nature digressive. The narrative emerges through an subjective essayistic practice. Concerned with the relationship and interplay of words and image, it is poetic organisation of information. Words are usually narrated or subtitled. Inter-titling, textual and graphic elements, label and arranges themes, offering an opportunity to pause, to raise questions, to assimilate and connect information, ideas and thoughts. Information poetically changes through time. Essay films often use inter-titling,.

I am also interested in an added component. How Essay films might be extended within installations. What happens when they are played along side objects, artefacts, archival material, objects that have had a life of their own. A visit to the Birmingham Museums Collection revealed the process of archiving. Annotations in proximity to artefacts, notes, scribbles, lists and taxonomies. These bring to light an added dimension to the artefact's historical narrative. The cursory nature of these annotations are a form of textual, thumb-nailed palimpsest. We see the archivist's thinking. One can easily see how these objects and settings might augment a story, provide, literally, hard facts, a tactile documentation of the truth.

Through utilising and arranging artefacts and archival material to anchor and inform the narrative, essayistic film is ripe for trans-media story telling. We can imagine taking a single (if narratively complex) story, beyond the spacial confines of the screen. It might digitally persist upon mobile devices across other media channels, employing information design, animation, motion design, interface and user experience design.

How we process, and contextualise knowledge and information, impacts upon our personal and national well being. You can apply design thinking to this problem. The essay film has repeated been use to interrogate a problem

or set of problems. In Keiller's Robinson in Space, 'The problem with England'. We can apply design methodologies to installation essay films, with the explicit intention of the solving how complex information can be delivered through film and it's extension into installation.

The fragmented nature of the essay film affords the implementation of multiple and shaped screens that have a dialogue with the space, it's location and history. Some, like Linsey Seers', Nowhere Less Now, are screened within a constructed space, an upturned boat. Seers essay film (a diptych) is projected onto 2 white globes, like vast eye balls set vertically in a giant reclining head. Looking us right in the eye. The multiplex narratives flit from one screen to the next, an almost hyper-textual breaking and remaking of the narrative information.

These narratives are made singular, through a nearly truthful autobiographical account, woven through the scrim of an historical backdrop. Some bits of information have been remodelled, and Seers tells us this, in her disclaimer accompanying the installation. We suspect this anyway, we are fully aware and accept the films subjective stance. Essay Films often articulate their intentions better, when conflating fact and fiction. When it bends the truth, when information is remodelled. This delineates the boundaries between documentary and essayistic film, the expectation that not all that is revealed are facts, they might be verifiable individual, isolated truths, but in the context of the essay film they are reframed as a subjective take on the world. Things labeled as fact, perhaps are not. We see the conflation of fact and fiction in the films of Chris Marker, Patrick Keiller, and Orson Welles, in his masterpiece F For Fake. Marker and Keiller create fictional narrators to subvert and question the authoritative voice of documentary. We often glimpse the film maker, the back of the head, their hand, they may even address us on screen. We are never in doubt, however, that the author is always present.

One should see these fictional narrators as cultural way finders, declaring their fictional status, addressing us directly, drawing on others personal biographical, autobiographical, diary, information in order to reveal individual lives against the backdrop of grand historic narratives. But they are white lies, they are soft fictions.

Information design, in the ways that it annotates image, presents textual elements, displays and interprets facts, does so ordinarily, with concision and authority. The essayistic film deliberately applies selective and information bias, it straddles, oscillates, hems and haws, between knowledge accessed through subjectivity, and knowledge acquired through experience. The essayistic film, particularly I propose, when delivered within an installation, for exhibition, museums etc, becomes a vehicle for presenting complex, problematic, historical, documentary information and transitory culture. It does not offer a definitive, correct view or consensus. It recognises the increasing complexity of the world. It does not avoid presenting an assemblage of conflicting information. It does not ask the viewer to passively accept, but actively read and interpret. The essay film has a conversation with us, and we inform the film with our silent discourse.

I am now thinking about essayistic information design, how information might be presented and organised to create a relationship with our dialogical self? When I say

'thinking about', I mean that to be, in this instant, within this text, this unmade film. It is you to question.

Biography

Steven Chamberlain is a lecturer in film and animation within the School of Visual Communication at Birmingham City University, and the creator and co-founder of Sellotape Cinema which creates films worked directly onto sticky tape and played through a specially adapted projector. Recent screenings include The Ginsberg Film Festival in South Africa. Sellotape Cinema also collaborated on L219, an installation of light, film, sound, artefacts and dance, at the Dance and Somatic Practices Conference at the LGP in Coventry, The Record Player Orchestra at the A3 project space, and Interactivos Birmingham, a two-week international seminar and innovation prototyping workshop. Steven is also creator of Cyclomation, creating immersive interactive animations using a bicycle as the interface. He has collaborated on a number of interactive exhibits for The Public, notably Heads Up in collaboration with Tim Kindberg of Pervasive Media at the iShed.

Section 5: Information for Wellbeing

The papers presented in the Information for Wellbeing session were:
1/ Zoomable information presentation for managing patient care – Adrian Sutherland
2/ Storytelling for the quantified self: designing information for personal health management – Robert Sharl
3/ Medication alert fatigue – Stephen Boyle

Zoomable Information Presentation for Managing & Prioritising Patient Care

Adrian Sutherland

Abstract

For individual patient care, Electronic Health Records (EHR) have become a critical tool: The ability for multiple clinicians to view a patient's chart reduces the need to guess histories or consult multiple specialists, smooths transitions between care settings, and provides better care in emergency situations1. Information systems for managing groups of patients and coordinating their care are also becoming essential for all care settings. The intensive nature of treatment within the framework of acute hospital care calls for a special kind of approach from a management point of view, with the health care professionals often in continuing alert situations2. The real-time availability of cross-sectional and patient-centric data helps to improve the efficiency of patient flow, create transparency and accountability, optimise information management, and maximise effective communication within and outside of the Accident & Emergency department3. Controlling the often overwhelming flow of information has become progressively more important4. This paper investigates how a "Zoomable" UI information presentation can support healthcare providers by allowing critical information and alerts to be visible across patients cohorts, while allowing a drill down to specific data/observations. The study is supported by a design collaboration between CSC5 and the Design Research & Development team in Visual Communication at Birmingham City University.

[1] 'Improve Care Coordination using Electronic Health Records | Providers & Professionals', http://www.healthit.gov/providers-professionals/improved-care-coordination

[2] 'Management in the Acute Ward', Walton J& Reeves M (1996)

[3] 'Supporting Patient Care in the Emergency Department with a Computerized Whiteboard System', Dominik Aronsky, MD, PhD, Ian Jones, MD, Kevin Lanaghan, BS, and Corey M. Slovis, MD

[4] 'How EHRs can stop information overload, streamline workflow', Mark Byers, June 24, 2014

[5] CSC is a global provider of next-generation technology solutions serving public and private sector healthcare clients in the provider, payer and life sciences markets.

Biography

Adrian Sutherland is a CSC Healthcare Industry Strategist, and part of the global team focusing on next generation technology investments. Adrian has led programs in both the Insurance and Healthcare sectors, working for some of CSC's most high profile clients in UK, Europe & Australia. CSC is a global provider of next-generation technology solutions serving public and private sector healthcare clients in the provider, payer and life sciences markets

Storytelling for the Quantified Self: Designing the Information that drives Personal Health Management

Robert Sharl

Abstract

From *Nike+* to *Zombies, Run*!, and from the *Fitbit* to the *Apple Watch*, one of the key stories of the last three years has been the emerging notion of the quantified self. The clouds of data generated by ultra-personal technological devices herald a future in which individuals have more personalised health informational their fingertips than ever before, and use this to make informed decisions about their dietary requirements, physical exercise needs, and medical treatments. Health systems all around the world are only just beginning to understand what this means, and seeking to integrate more decentralised and distributed technologies within their plans to deal with ageing populations, the treatment of chronic conditions, new forms of medical treatment, and the shifting landscape of healthcare funding. This new paradigm of individual health management — enabled by comprehensive round-the-clock data capture — demands a rigorous, ethically informed, and human-centred approach to the presentation of information in graphical and textual forms. To meet these critical challenges, the UX team within Visual Communications and CSC are exploring design patterns from outside of traditional health care contexts — including storytelling, games design, dashboards, and productivity software. In this presentation we will explore how these non-traditional patterns may reveal deep patterns of behaviour, motivate individuals to build positive habits in their own health management, and offer the potential for wider community benefit and more effective health care.

Biography

Robert Sharl has worked at the intersection of design, technology, and user experience since the early 1990s. He founded the digital consultancy Futurilla, and is developing a Masters programme in User Experience Design for Visual Communication at Birmingham City University. He collaborates on research & development projects related to digital applications with CSC's Global Healthcare team.

Section 6: Performance Enhancing

The papers presented in the Performance Enhancing session were:

1/ Influence of visual information on the effects of medicine – Karel van der Warde
2/ Designing instructional videos using principles of multimedia learning – Koteshwar Chirumalla, Per Erik Eriksson, Yvonne Eriksson
3/ Improving digital literacy through information design – Rupesh Vyas, Sejal Tiwari

The influence of visual information on the effects of medicines

Karel van der Waarde

Abstract

Patients in Europe receive a substantial amount of information about their medicines. This information is supplied on packaging, in package leaflets, and on 'inner packaging' such as blister packs or bottles. Pharmacists add handwritten instructions and additional labels, and sometimes provide printed letters and brochures. Research results show that the effects of medicines on patients are improved by the design of packaging (1), the colour of the medicine (2), and effectiveness claims (3). And, research shows that most patients struggle to stick to their regimen, and that patients really struggle with packaging and labelling (4). About 50% of medicines for chronic diseases is not taken effectively (5). Should the design of information be reconsidered if we know that many patients do not (or cannot) take their medicines in an effective way, and we also know that the design of visual information (packaging, colour, claims) has a real positive effect on treatments?

Three practical examples show such a reconsideration. The design of a label for pharmacists, the design of medicine leaflet, and the design of a ibuprofen-package. Information about medicines directly affects the effectiveness of medicines. Without understandable, applicable, and trustworthy information medicines cannot be taken correctly. The examples show that it is possible to achieve measurably better outcomes through design. Small and unremarkable visual details can have substantial consequences. The examples also show that there are conflicts between legal, financial, and healthcare perspectives. There is not a single common aim and this hampers the effectiveness of medicines. A second reason is that designers rarely have arguments that are strong enough to convince lawyers, pharmacists, doctors, and regulators that a change in visual information really affects a treatment.

Biography

Karel van der Waarde studied graphic design in the Netherlands (BA, The Design Academy, Eindhoven) and the UK (MA, De Montfort University, Leicester; PhD, University of Reading). In 1995, he started a design - research consultancy in Belgium specializing in the testing of pharmaceutical information design. This company develops patient information leaflets, instructions, forms, protocols, and the information architecture for websites. (www.graphicdesign-research.com). Karel van der Waarde frequently publishes and lectures about visual information. Avans University of Applied Sciences (Breda, The Netherlands) appointed him as scholar in Visual Rhetoric between 2006 and 2014. From September 2014, he teaches (part time) at the Basel School of Design (Switzerland).

Van der Waarde is a life-Fellow of the Communications Research Institute (Melbourne, Australia), a board member of International Institute for Information Design (IIID, Vienna, Austria) and editorial board member of Information Design Journal, Journal of Communication Design, the Poster, Visible Language, and She Ji: The Journal of Design, Economics, and Innovation.

Designing Instructional Videos Using Principles of Multimedia Learning Koteshwar Chirumalla,

Per Erik Eriksson, Yvonne Eriksson

Keywords: Instructional video, multimedia learning, instructional design, multimedia instruction, information design, learning, design principles.

Abstract

The purpose of this study is to understand how principles of multimedia learning can be useful in designing instructional videos. Research describing the usefulness of multimedia principles for designing instructional videos especially in Live-action video format is limited. For this purpose, in this study, two modes of video instructions were designed with two different perspectives—point of view and objective—employing principles of multimedia learning. The experiment was conducted with four student groups, each comprising between 8 to 10 participants, to evaluate the design of the video instructions. The findings show that the multimedia principles were useful and supported the design of video instructions in both modes. When comparing the two modes, participants considered the video instruction made with a point of view perspective slightly more usable in spite of this video's perceived stylistic shortcomings.

Introduction

As ease of use digital recording technologies, powerful computers and post-production software have become ubiquitous, several research based instructional media assessments informed by Cognitive Load Theory (Sweller et al., 2011) and Cognitive Theory of Multimedia Learning (Mayer, 2009) currently focus on transient media, i.e. animations and live action videos (Ibrahim et al., 2012; Lowe and Boucheix, 2011; Meij and Meij, 2013). In this vein of research the media format Live-action video earns its special status due to that it is the original photographic and most versatile video format. Specifically live-action videos do not require ample and costly post-production activities and thus have become popular as the primary format of choice in various e-learning platforms (Chen and Wu, 2015). However, the quality of cinematic realism is easily compromised by surface aspects such as poor resolution (Eriksson, 2015). In addition, regardless of type of video genre, researchers argue that transitory information demands high levels of cognitive processing to synthesize the visual and verbal streams of information and extract the semantics of the message (Homer et al., 2008). Yet, the live-action video format's inherent narrative structure compensates for its shortcomings as an instructional medium.

In attempt to overcome these challenges, within the context of the Information Design field, Cognitive Load Theory-motivated design guidelines and principles have become prolific and a dominant focus. Yet, in spite of many concerted research efforts that have provided sound evidence for certain design guidelines' relevance, misconstrued visual,

instructional design efforts are still surprisingly commonplace. For instance, it is not unusual that learners experience that instructional videos lack in usefulness because they are obtuse, boring, information overloaded, contain distorted audio, use generic deictic language, contain shaky and illegible footage and, hence, are poorly designed (Ibrahim et al., 2012; Merkt et al., 2011). In part this is due to that previous research attempts have consistently deemphasized media genres specifities and design implementation strategies. As a result, instructional design guidelines tend to be very general leaving designers with too little concrete advice about the best design solutions (Meij and Meij, 2013) and there is a lot more research needed to 'delineate the boundary conditions' under which design principles apply (Mayer, 2014:9). Moreover, existing theoretical models derived from research on multimedia learning is not particularly suited for instructional transient media (Lowe and Boucheix, 2011).

Yet, to create an additional set of completely new design guidelines specifically suited for the Live-action video environment would at the present time are premature. Instead, the present study will provide a first and possibly sketchy rationale for how existing instructional design principles could be used when designing instructional live-action videos. It will do so by adapting Mayer's Design Principles for Multimedia Learning (2014) into a circumscribed and well-defined live-action video-context. Following the above, we pose the following research questions:

RQ1: To what extent are the principles of multimedia learning useful for designing instructional videos?

RQ2: What is the relation between such an instructional video and its users' satisfaction or/and dissatisfaction?

Principles of multimedia learning

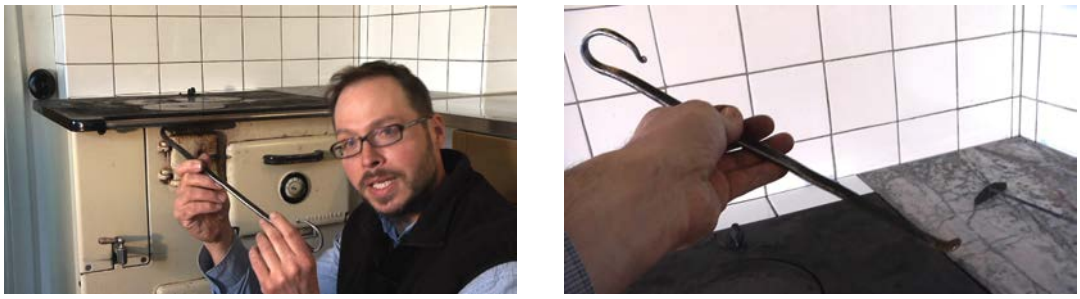
Multimedia instruction is visuals with or without audio that contain words and graphics that are intended to foster learning (Mayer, 2009). Mayer (2014) explains that there is three kinds of processing that can occur during multimedia instruction. Firstly, *extraneous processing* which drains limited cognitive processing capacity without contributing to learning. Secondly, *essential processing* which involves selecting relevant information and organizing it as presented in working memory. Thirdly, *generative processing* which involves making sense of the material by reorganizing it into a coherent structure and integrating it with relevant prior knowledge. This analysis is in concurrence with cognitive load theory (Sweller et al., 2011) that proposes the need for three kinds of instructional design goals—reducing extraneous processing, managing essential processing, and fostering generative processing. These three types of goals form the basis for three kinds of instructional design principles for multimedia learning. Based on this, Mayer (2014) derived 12 research-based principles for how to design a multimedia instruction. These principles and their descriptions are summarized below in Table 1.

Instructional goal	Principle Number	Principle	Description
Reducing extraneous processing	#1	Coherence	Delete extraneous material
	#2	Signaling	Highlight essential material
	#3	Redundancy	Don't add onscreen captions to narrated graphics
	#4	Spatial contiguity	Place printed words near corresponding part of graphic
	#5	Temporal contiguity	Present spoken words at same time as corresponding graphics
Managing Essential Processing	#6	Segmenting	Break lesson into learner-paced parts
	#7	Pre-training	Present characteristics of key concepts before lesson
	#8	Modality	Use spoken words rather than printed words
Fostering Generative Processing	#9	Personalization	Put words in conversational style rather than formal style
	#10	Voice	Put words in human voice rather than machine voice
	#11	Embodiment	Have onscreen agent use human-like gestures and movements
	#12	Image	Do not necessarily put static image of agent on the screen

Table 1. Research-based principles for designing multimedia instruction

Method – The design of stimuli

To make an instructional video, an instruction that conveys how to light a fire in a wood-burning stove was selected. To convey this, two different kinds of live-action videos that represent two distinct and common approaches were produced/designed. One was the Point Of View-Video, which is video shot from the perspective of the videographer. The other one was the Objective-Video, which is more traditionally cinematic in the sense that its perspective represents a bystander's perspective. The Point Of View (hereafter referred to as POV) video mixes footage shot on a tripod with hand-held footage. The objective live-action video was primarily shot using a tripod. The two modes of live-action videos and their differences are illustrated in Figure 1.



(a) Objective Live-action video (b) Point of view Live-action video

Figure 1. Still images from the two modes of Live-action videos that were used in the experiment

The videos were recorded on a HVX201 Panasonic HD-camcorder, 720p resolution and the audio was recorded on a Sennheiser 100-ENG wireless Lavalier mic set. As final versions, the videos' audio-tracks are identical and they were of the exact same length (6 min and 43 seconds). The primary purpose of the videos was to convey key actions in such a way that they may be remembered and, possibly, mimicked. It manifests techniques and design choices that are considered best practice within the field of live-action video and documentary production (Rabiger, 2009). The videos were produced, shot and edited by one of the authors of this paper6. The videos use Swedish as the language of instruction and consist of five sequences/chapters (Introduction, Accessories, Preparations, Light *the Fire* and *Adjust Heat*). They were adapted in accordance with Mayer's multimedia design principles (see Table 2).

Participants and experimental procedure

The participants were 36 students (17 male, 19 female) from Swedish undergraduate Information Design programme, aged 19-48, and were divided into four groups (i.e., G1=10, G2=9, G3=9, G4=8; group is denoted as G). The study took place in the classroom, where video was shown to each group on a big screen with the use of a classroom projector. Before the experiment, the main author explained to the participants about the purpose of the experiment and the importance of paying attention to the video as the video was intended to play only once. In the experiment, Group 1 and 2 were asked to watch an instructional video made with an objective perspective, whereas group 3 and 4 were asked to watch a video with a POV perspective. Finally, a questionnaire was designed to collect individual reactions, reflections and comments with the sole aim to evaluate the design of the videos. The questionnaire included six open-ended, thirteen multiple choice, and twenty-six statement-based Likert scale questions (from 1=very poor to 5=excellent/very well), which were based on previous relevant literature, for instance, Berk (2009), Jeng (2005), Oud (2009), Mayer (2014), and Mestre (2012).

Results – Design principles implementation strategy

Table 2 below shows how the designer implemented the principles of multimedia learning when producing the two video versions. Information on how principles were used to design two modes of videos

6 Per Erik Eriksson is an award-winning editor and videographer (Telly and EMMY awards 2004 and 2005) and now works as the subject area head of Image Production at Dalarna University, Sweden. Eriksson is also an avid wood-burning stove user and is the instructor featured in the videos.

Principle	Objective Live-action video	Point of view Live-action video
#1	*Coherence* is partly achieved via the means of subtle blurring. Specifically blurring is used to soften backgrounds and make graphics and text pop out. Selective editing and a concise script contribute significantly to the overall coherence of the video.	*Coherence* is partly achieved via the use of POV footage that is normally in the form of close-ups, thereby extraneous material is excluded. Selective editing and a concise script also contribute significantly to the overall coherence of the video.
#2	*Signalling* is achieved primarily by including instructor's hand-gestures.	*Signalling* is achieved primarily by including instructor's hand-gestures. In addition, one cue is in the form of text (it reads 'Lyssna!', translated into English: 'Listen!'). Some camera movements also function as cues, such as probing movements ('zoom-ins') that result in that important objects gradually turn greater in size.
#3	*Redundancy* is avoided on screen since captions do not accompany narrated graphics. Graphics are only presented with instructor's voice.	
#4	*Spatial contiguity* is achieved since printed words are placed near (in time) to corresponding part of graphic, i.e. the chapter headings are placed right before the visuals they refer to.	
#5	*Temporal contiguity* is achieved since spoken words are presented at the same time as corresponding graphics, i.e. graphics as well as naturally occurring cues occur simultaneously with corresponding spoken words.	
#6	*Segmenting* is implemented since lessons (main sequences) are broken into learner-paced parts. Both videos feature conventional video segmenting techniques, in this case fade to black.	
#7	Video allows for *pre-training* since instructor presents characteristics of key concepts before lessons. Instructor also systematically presents all new parts of lessons via the means of voice and gestures.	Video allows for *pre-training* since instructor presents characteristics of key concepts before lessons. Instructor also systematically presents all new parts of lessons via the means of voice and gestures. This showing is in part contingent on the camera's movements as it changes the perspective of the picture frame.
#8	*Modality* is allowed for since the videos feature spoken words rather than printed words. The instructor's voice is what primarily divulges relevant information. The videos feature very little text.	
#9	*Personalization* is supported since words are expressed in conversational style rather than formal style.	*Personalization* is supported since words are expressed in conversational style rather than formal style. Camera's movement adds to informal quality of the video, it appears less staged.
#10	The *voice principle* is adhered to since words are put in human voice rather than a machine voice.	
#11	The *embodiment principle* is adhered to since the onscreen agent (the instructor) uses human-like gestures and movements.	The *embodiment principle* is adhered to since the onscreen agent (the instructor) uses human-like gestures and movements, although facial expressions are rare (as face often is out of the picture frame). POV- footage contains very few hand and facial gestures but implied gestures may be considered part of videographer's (and the camera's) movements.
#12	The *image principle* is adhered to since no static image of speaker is used.	

Evaluating Users' Satisfaction

In this study, the existing constructs (or hypotheses) proposed and used in the previous research were selected to evaluate users' satisfaction on the design of video instructions. The following section presents each of these constructs and then summarizes the results.

Learning value

In total, 27 out of 36 participants (75%) stated that the video medium was necessary to convey this instruction about the wood-burning stove. This score justifies the choice of the topic chosen for this experiment. 23 out of 36 participants (63%) responded that the length of the instructions' felt just right (i.e., not too long or boring) and contained relevant information. The six constructs (Berk, 2009)—namely, *grab attention, generate interest, increase understanding, increase memory of content, create memorable visual images,* and *make learning fun*—were used to assess the learning value of the video instructions. The participants were asked to rate their experience after having watched the instruction. As seen in Figure 2, overall, the POV group rated their learning experince as higher than the objective group in most of the constructs. The average range of scores for the POV group was between 3.05 to 4.21 (i.e., moderate to high learning value according to the the defined Likert-scale) and for the objective group it was between 2.45 to 3.6 (i.e., low to moderate according to the scale). The highest scores were recorded for the construct: *increase understanding*, the POV group scored 4.21 (which was the only recorded score above 4, i.e., a high learning value according to the scale) and the objective group scored 3.6 (which was the highest score for this group of all constructs).

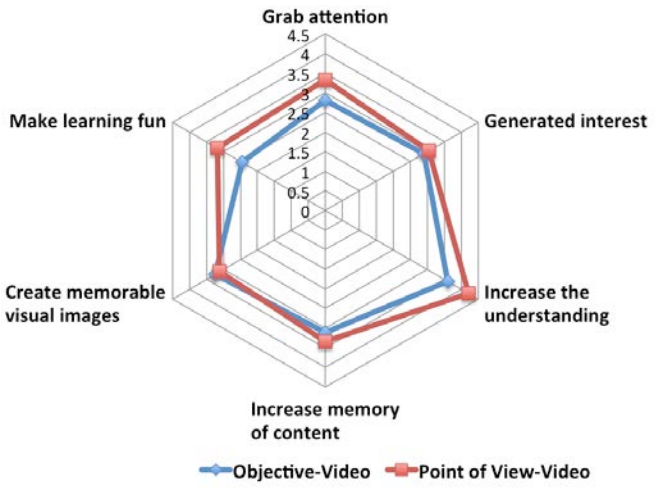


Figure 2. Learning value of two modes of video instructions

Comprehension ability

In order to test users' comprehension ability (i.e., knowledge and understanding gained by the user after watching the instruction) the participants were asked to answer thirteen multiple-choice questions. The POV group scored 11.41 points average out of 13 points maximum. The objective group scored 10.68 points average. There was a

slightly greater range of scores within the objective group (4 -13 points) than the POV group (8 -13 points) and the POV group had the most maximum scores.

Organization and presentation of the content

According to Jeng (2005) and Oud (2009), user satisfaction and effectiveness, among other variables, depend on the organization of information, visual appearance, labelling and content. In line with this, we asked the participants to respond to the organization and presentation of the content, style and images of the videos. These responses are outlined in Table 3. The average range of scores for these constructs was between 3.4 to 4.10 for both groups, which mean that the users' satisfaction was in the range of average to above average, according to the defined scale.

Video mode	Organized and presented the content in a clear, easy way to understand	Arranged the content in logical sequences – start with simple, work up to more complex	The video used consistent style throughout the instruction	The video provided a clear and detailed images
Objective-video	3.72	3.83	4.08	3.42
POV-video	3.81	4.00	4.13	3.40

Table 3. Responses in regards to organizing and presenting content, style and images

Satisfaction related to the instructional goals

Based on Mayer's (2014) three kinds of instructional design goals, statement-based constructs were formulated in order to evaluate the users' satisfaction. The participants responses are outlined below in Figure 3. Overall, the results were in line with the other results on users' satisfaction. Compared to the objective group, the POV group rated their learning experience marginally higher in most of the constructs. In general, the POV group scored the highest average scores (above 4, which means above average according to the scale) for three of the constructs—*division of the content into small segments to improve understanding, having human voice support a sense of social presence, human-like gesturing and movement creating a sense of social presence*—which were related to the principles of segmenting, voice, and embodiment respectively. However, the objective group average scores for these constructs were not that low, around the range of 3.7 to 3.8. The nominal differences between both group scores for these constructs were 0.24 (segmenting), 0.52 (voice), and 0.38 (embodiment) respectively. This indicates that, irrespective of video modes, the above three principles have a positive influence on users' satisfaction in regards to the design of videos.

Overall, between the POV and objective groups' average scores, the highest nominal differences were found in relation to the following constructs: *the experience was personal and relevant* (0.72), *human voice supported a sense of social presence* (0.52), *it directed attention to the most important points* (0.5), and *the presence of speaker in the instruction caused distraction in some way* (0.5). This shows that the mode of video—especially the POV video—had a marginal influence on user satisfaction in relation to the above constructs.

Finally, if we compare three kinds of instructional design goals, principles related to fostering general processing (i.e., #9 to #12) had more influence on specific mode of a video instruction. This is because the nominal differences between two modes of video instructions for these constructs were slightly higher compared to other two kinds of instructional design goals (i.e., #1 to #8).

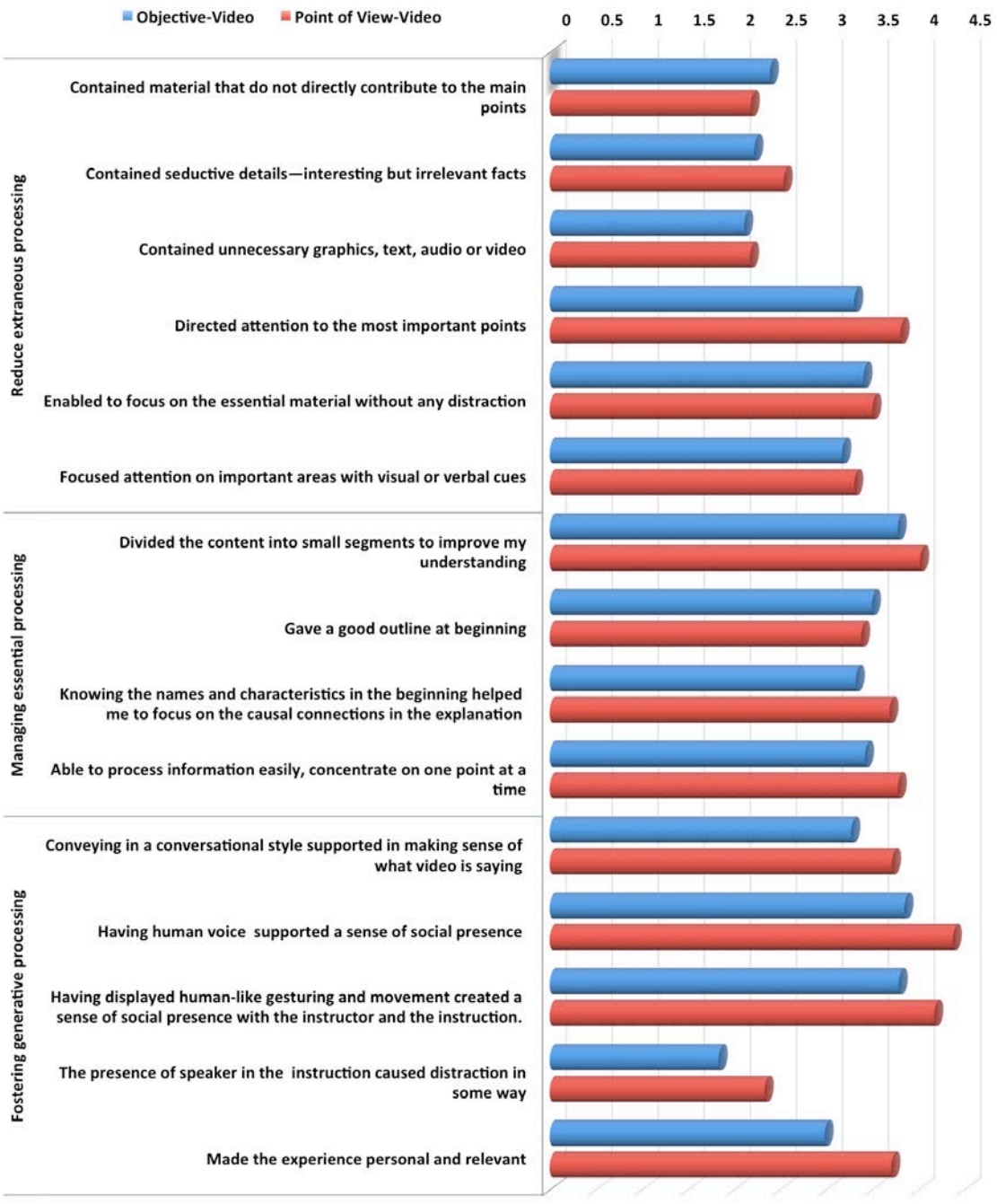


Figure 3. Users responses related to three kinds of instructional design goals

Concluding remarks

The design principles supported the overall design approach as they in effect made the designer highly aware of the Live-action videos' semiotic potentials and multimodal

qualities. In other words, the design guidelines indirectly fostered a constructivist, learner centered, designerly mind-set. However, although in this study such an awareness must be considered purposeful, it is also for certain that some apparently sound design principle implementation strategies were more contingent on the designer's knowledge of conventional cinematic techniques than the multimedia design guidelines per se. For instance, selective editing, scriptwriting, high quality sound recordings, timed gestures and utterings, meaningful zooms, controlled camera movements that imply certain signaling body movements are integral to an any adept videographer's toolbox regardless of what content he/she produces. In order to learn more about the implications of the findings from this study and to more fully understand to what extent the video examples of this study merely could be unusual examples of a successful mixed designerly approach further research is needed. Further research is also needed in order to answer to what extent the design principle guidelines proposed by Mayer may be tweaked or/and conformed without losing their cognitive engagement.

From a user perspective it is rather obvious that the videos came off as two concerted, instructional, purposeful mediated efforts, not just some ad hoc, video taped lectures. In this regard the POV version seems a little better, in spite of its sometimes unnecessarily shaky, hand held images (as some participants commented upon). This version also worked slightly better in terms of retention, although the test results for retention of both versions must be considered to be very high. A surprising result is that the videos scored so high on social presence and other affective related ratings since it is exactly this that mediated instructions normally lack in comparison to conventional 'live', face-to-face lectures that, in theory at least, allow for a more direct and unfiltered experience of affective states and social presence.

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Biography

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Improving Digital Literacy Through Information Design

Rupesh Vyas and Sejal Tiwari

Keywords: Digital Adaptability, Digital Literacy, Service Design, Interface Design, User Experience, Digital India

1 Introduction

1.1 Present Context

Common understanding of literacy has no meaning in the present day context. What is taught to us growing up is that if you learn a language, perform your tasks using that language, you are literate. In digital literacy, programs are supported by big software companies to hook the young minds early in their formative years which teach them the so called digital literacy tools like Word, Excel, Powerpoint, to name a few. In the present day context due to access to technology through mobile devices and increasing computing powers in the hands of all economic strata, the work phenomena are changing dramatically and people are doing certain productivity tasks on these devices.

1.2 Importance of information design interventions

Currently the Government service sector works on legacy systems, which is paper-based and requires authentication at all levels of tasks by approving authorities, who in turn are dependent on a chain of subordinates to authenticate concerned information. This leads to red tapism and unnecessary delays in the execution of said tasks. It also leads to corruption thereby causing leakages of resources and money, which are detrimental to the overall progress and development of the country. Digitization of public services is an isolated vertical and is not connected to other services. Thus every government department works in isolation, duplicating efforts for the same tasks.

2 Literature Review

2.1 Information and Communications Technology (ICT) in Rural India – Technology-centered developments

The ICT development approaches have mainly been technology-centered, rather than user-centered (Heeks 2002; James 2005). This is because the ICT development agencies are mainly focused on finding applications of existing developed interventions for the rural context rather than understanding the user needs and context. Examples of ICT projects involving users from an initial project development phase are rare (Walsham and Sahay 2005; Kumar 2007; Gorla 2009). This leads to low usage of the deployed ICT interventions by rural users and a negative influence on the ICT adoption process.

Information content and transfer mechanisms: Most of the ICT interventions see rural users only as information consumers, and information is often 'pushed' by the service providers. Moreover, interfaces to access information are poorly designed (Ashok and Beck 2007; Medhi et al. 2007), which makes it difficult for rural users to access the information they require.

2.2 Study on Low Literacy Users

The research conducted on the concept postulated in Menon's Beyond Strict Illiteracy, Abstracted Learning Among Low-Literate Users, concludes that when designing ICT material for low-literate users, there is need for a perceptive sensitivity that goes beyond the inability to read per se, to the cognitive differences among these users, particularly skills of conceptual abstraction. The attention to cognitive differences can have far-reaching influences on the design of user interfaces as well as organization of content for low-literate populations.

2.3 Government Digital Services, UK

This venture was created with an intention of bringing all government departments together on one platform. It is not just content brought together; it also demonstrates how well GOV.UK meets its users' mainstream and democratic needs through this platform. It indicates that a dramatic improvement in information browsing, search and guiding formats for various tasks can help create a deeper understanding of how to explore user needs –to find out what exactly these needs are and how one can address them. GDS is implemented considering not only design in isolation but also with building digital strategy, exemplary platforms, service design manual.

In Indian Context: We are a large population with a wide variety of cognitive abilities, a vast bank of languages are used by our diverse population, we are more visual and verbal than text friendly. Governance models also have to consider the rampant corruption at all level, which makes systems very difficult to comprehend and access for common people.

2.4 Government Services in Estonia

It is an interesting subject matter how Estonia has transformed its governance process through e-Estonia. e-Estonia deals with services like paying taxes online in an easy and simplified tax return filing process. Using a secure ID, a taxpayer logs onto the system, reviews their data in pre-filled forms, makes the necessary changes and approves the document with a digital signature. The digital public Service is second nature to the youngest generation of Estonians.

In Indian Context: In the Indian context we have quite a few challenges to implement digital literacy on a large scale and have it adapted by the larger mass of its population. Very complex tax portals makes people feel afraid of filing online, most of them they feel that filing tax is very complex and they cannot do it themselves.

3 Design Methodology and Approach

Our information design approach is based on an iterative design process using a systems approach, starting from extensive user study, contextual inquiry, learning from local context, consideration of cognitive theories, applying service design concepts, agile processes, scalable and modular features ready for permutation and combination that can be used in the building of various public service interfaces.

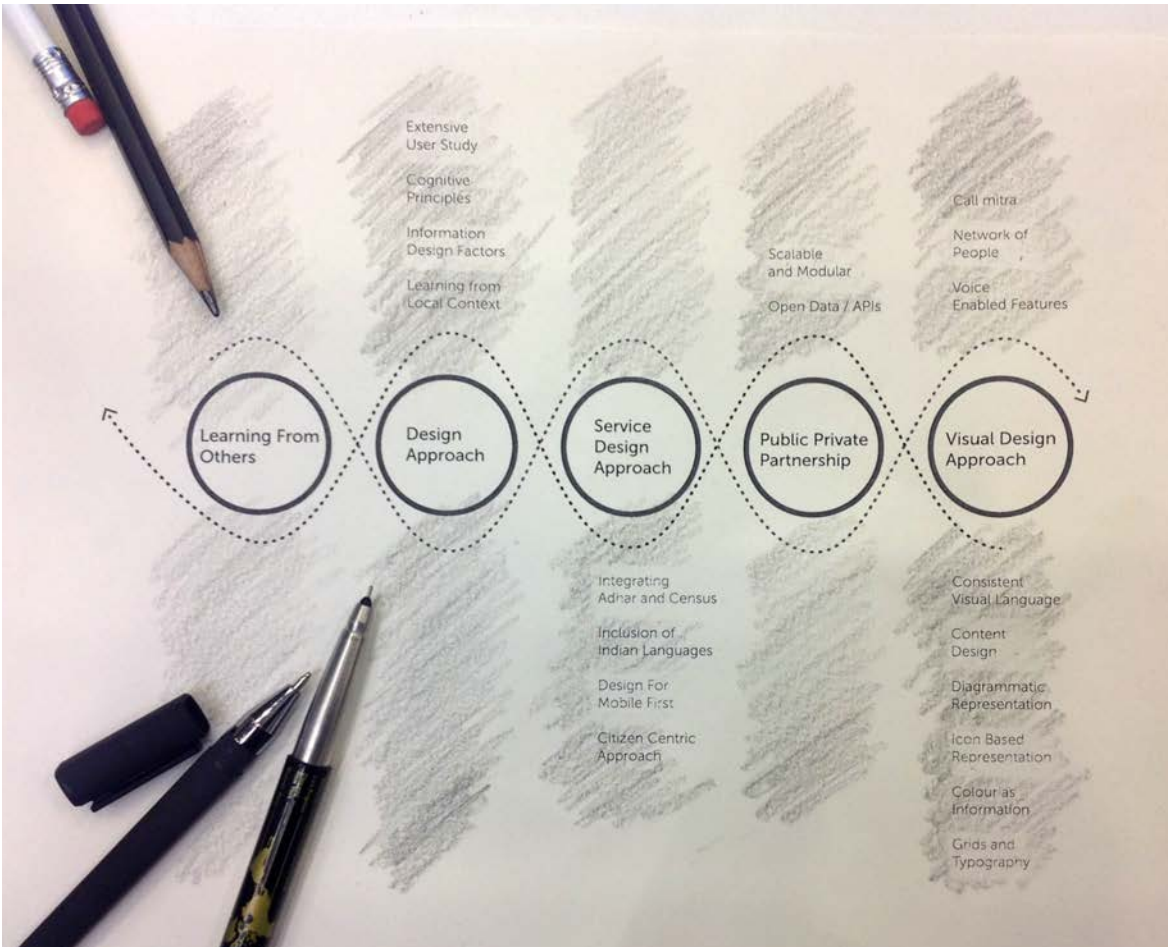

Fig 1. Overall Design Approach Diagram

3.1 Extensive User Study

The following set of users personas evolved as result of the studying major categories of pattern sets, which are followed by a wide range of citizens. Various cognitive abilities and types of users were considered in the Indian context.

User Type who Need Assistance:

1."I do not fill tax myself"

User 1 is 38 years old, teaches at the National University To fill without errors as she is well aware that errors and incorrect details can lead to further complications hence she let an experienced person fill it.

2."I'd rather take help."

User 2 is 33 years old, he is young CEO. Tax filing comes to him as a completely new task to perform, he says it will be faster and easier for him if he can learn from someone who has done it before and clear his doubts also because he feels the interface is very confusing.

3. "I don't know how to do it."

User 4 did not go through formal schooling after class 6, she can read numbers and selected English words and phrases, which is enough for her to manage basic calling from mobile phones. She shy away from performing any other task.

User Type who is Go-getter:

1. "He is my hero."

User 1 calls the school drop-out 22 years old(user2) man, his hero as he can figure out everything even after low literacy level.

2. "I read all the instructions."

User 2 is 19, a student, and she reads the website information meticulously. As a result she has to read multiple times, which causes multiple lags at various stages.

User Type who is Prone to errors

1. "Dude! I know everything, I can do it."(and eventually falter in the process.")

Takes decisions quickly, almost in hurry and never keeps double mind.

2. "I only Browse through." Looks for key-words to proceed further because he is of the opinion that descriptive text is unnecessarily kept at these places.

User Type who Does not Want to Do Themselves

1." My assistant will do it."

Has employees do the job for him.

User Type who prefers Local language and voice assistance

1. "I prefer in my own language."

User 1 is not so fluent in English and prefers interaction in Local language.

2. "I prefer voice-based assistance."

User 2 mentions that it would be much easier for him to comprehend the process a little from text and a little from voice-based information.

User Type who uses No/Slow Internet Connection

"I don't have good Internet"

User does his task by downloading and filling up at his own time as he do not have good internet.

3.2 Cognitive principles for design consideration

"Let's make human error less likely."

While Fitts said that the average duration of responses is directly proportional to the minimum average amount of information per response, careful decisions made on visibility of information at a given response can help in preventing obvious human errors.

"Bother less about the Technology Glitch"

Moore said that '*the growth of technology is a function of time*'. It is good idea to design ahead of present day technology constraints, one must not completely get stuck in design decisions owing to limitations in technology in the present times.

"Design For Human Understanding"

Buxton Law states that the promised functionality and benefits of technology will increase directly with Moore's Law. God's Law states that humans' capacity is limited and does not increase over time. Use of technology should be comprehensible to human mind and should have a sync with understanding capacity of human brain before deciding to utilise new technology features.

Reduce Confusion by Giving the Right Number of Choices

Hick's law, the time it takes for a person to make a decision as a result of the possible choices he/she has: increasing the number of choices will increase the decision time logarithmically. In layman terms, less the number of choices, lesser would be the time taken by user to think on them.

Nature information grouping(Chunking of Task) and information disclosure (Progressive Disclosure) should support effortless navigation.

Miller said that If individual information is organized into 'chunks' (meaningful patterns) of information, they are easier to store. The working memory can then, hold 7±2 of these larger chunks of information.

Here, giving information progressively also making the navigation effortless and friction-free. Jakob Nielsen describes progressive disclosure as '*a technique that defers advanced or rarely used features to a secondary screen, making applications easier to learn and less error-prone*' but care must be taken here that only that information should be kept for later disclosure which does not require any kind of pre-preparation from the users' side.

Consistency in Visual Language can Reduce Reaction Time.

Newell's law of practice states that the logarithm of the reaction time for a particular task decreases linearly with the logarithm of the number of practice trials taken. It is an example of the learning curve effect on performance, hence here consistency in design language can affect reaction time. If all services follow a similar grid structure, family of icon and universal language of color then it affords a second-time user ease of browsing since he/she would be familiar with the navigation in his/her first attempt.

3.3 Information design factors

Co-creation and collaborative design approach

Liz Sanders suggests that one cannot design experience, one needs to consider the co-creation and collaborative design approaches for user participation for a better adaptation of the system.

Quick Prototyping

It is very important to follow an agile process in designing to gain a good user experience and test out the design in its early stages, to get user feedback and apply the feedback in the designs. As Nielsen Norman guidelines suggests that 'whatever we working on isn't going to be perfect and users don't think the same way as designers do, it inevitably may get into design issues. A feature might be broken, confusing, or frustrating for users'.

Information Architecture

Usage of some tools like Affinity Grouping and Card Sorting leads to achieving seamless information flow and better user experience. The Affinity Diagram is a simple tool that can be used to organize ideas into naturally occurring groups. By allowing the groups to emerge naturally, designers can avoid their preconceived understandings or assumptions about how things 'should' be organized and instead arrive at a natural hierarchy and structure.

3.4 Learning from Local Context

Interfaces of present government services are as diverse in experiences as are the streets of the country. No single street would match with another in its elements and the space structure. Every place has something new to offer which is pleasant while travelling, when this metaphor is applied to interfaces of government services, the effect of this diversity has the contrary effect.

Figures 2,3 and 4 show examples of different existing public service portals with different visual language and huge cluttered information.

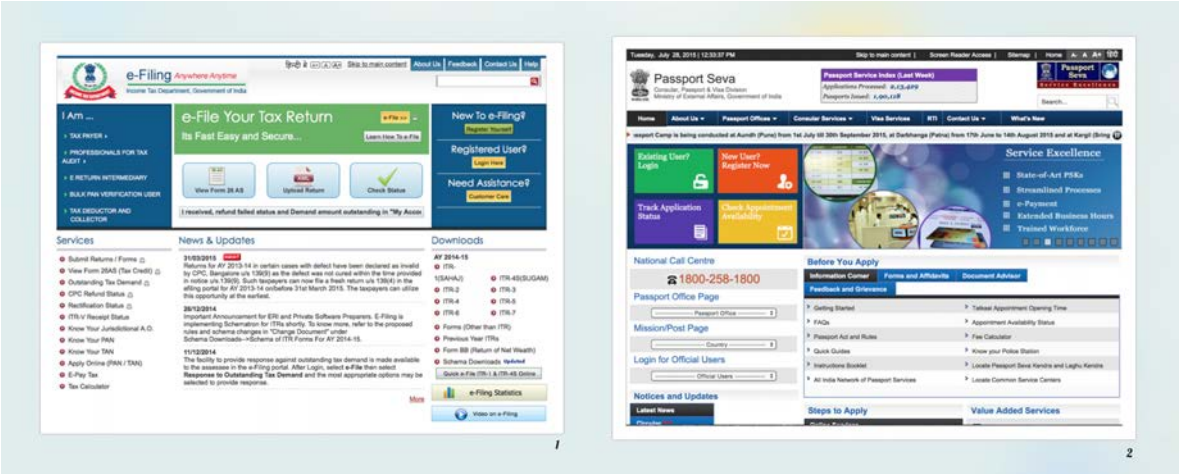

Fig 2. Screen Capture, https://incometaxindiaefiling.gov.in/
Fig 3. Screen Capture, http://passportindia.gov.in/AppOnlineProject/welcomeLink

Fig 4. Screen Capture, http://www.indianrail.gov.in/

Manek Chowk, in Ahmedabad is 150 years old eating hub, but customers do not go to separate shops to place orders. They sit in the common sitting area at the center of the premise.

It is important to mention this indigenous phenomenon from which one learns how one can adapt cognitive working processes of heterogeneity of country it in a design approach, **'Manek Chowk' Model.**

Fig 5: Photograph Manek Chowk, Ahmedabad; Example of multilingual population and number of services functioning at one platform with more visual-verbal nature of service.

4 Citizen Centric Service Design approach

Existing Governance models are top down which is more like the waterfall model, where citizens have to approach governments to get access to services or information. They should actually be *upside down* models where the government is reaching out to citizens for various services and information. This delivery of information to the citizens could be dealt with a service design approach.

Design For Mobile First

Use of mobile phones is phenomenally increasing in India. New users who have never used any kind of computing devices now have access to much more computing power as compared to that which was offered by desktops. In India even small-time grocers prefer to place orders via WhatsApp and using such kinds of social media networks for distributing, collecting and purchasing.

Government plans for 'Digital India' mission, its focus is on 'Mobile First' for delivering various government services and utilities, the use of mobiles has entered another league of its own.

5 Open Data and Public Private Partnership

Sharing of civic data following data and metadata standards can help citizens and in turn their cities to function smoothly. In India today, there are rapid growth plans on making new smart cities and converting existing towns into smart cities. The common understanding of smart city is that of providing Internet access to citizens. However, it has to be looked at as a cohesively connected and seamless transfer of data from one public service to other.

Adopting data formats also gives governments access to the world of open-source, civic apps (which are often available a little or no cost) that enable their public agencies to improve service delivery and do more with less.

Public services like transport, the data of the timetables could be shared in a common format, which could be used through public private partnership for better service to user with nominal cost.

6 Visual Design Approach

As Steve Krug, author of the book 'Don't Make Me Think' mentions that the way we think people use websites is different than how they actually use them. When we design we think that users are going to slowly read all of the information, and once they've considered all of their options they'll make a rational choice that's best for them.

However, most of the time, users glance at the page, scan some of the text, and **click the first link that catches their attention** or seems to resemble what they're looking for. As suggested by Steve, **design for scanning instead of reading**, **creates a visual hierarchy** that guides users to certain tasks first – **use of grids** to align the elements, **getting rid** of redundant information, formatting text to support scanning, use of plenty of headings, keeping paragraphs short and the use of bulleted lists.

Feature that came up to be useful in enhancing service as per as analysis of the literature study and extensive user study.

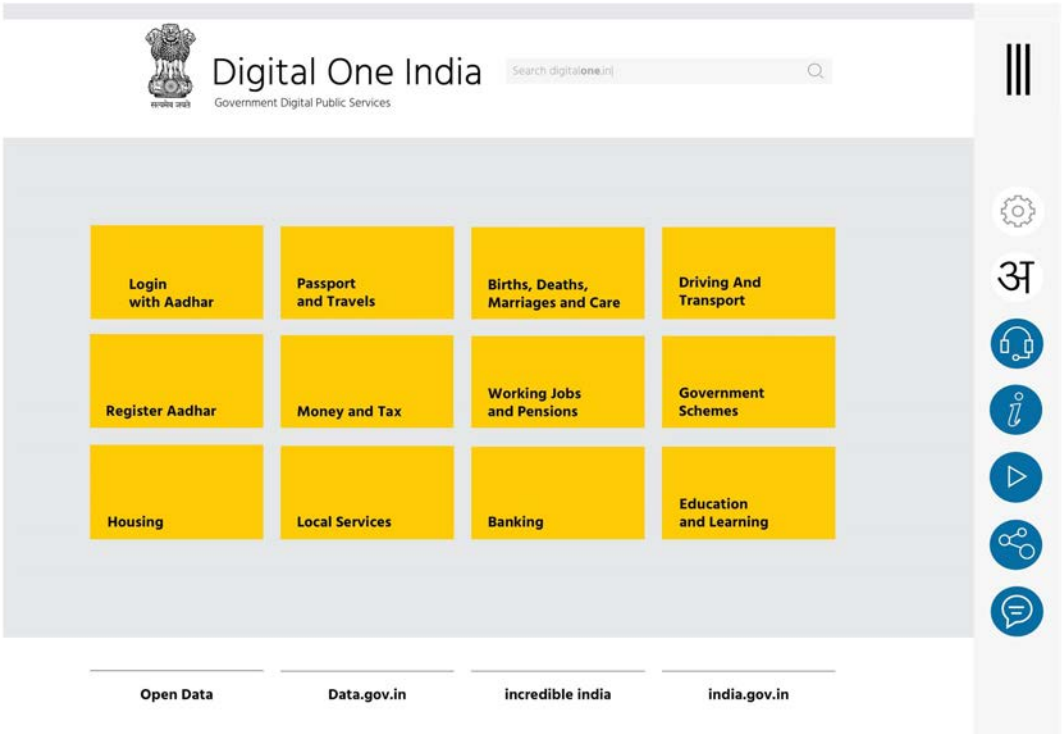

Fig 6: Screen, unified portal for major public services.

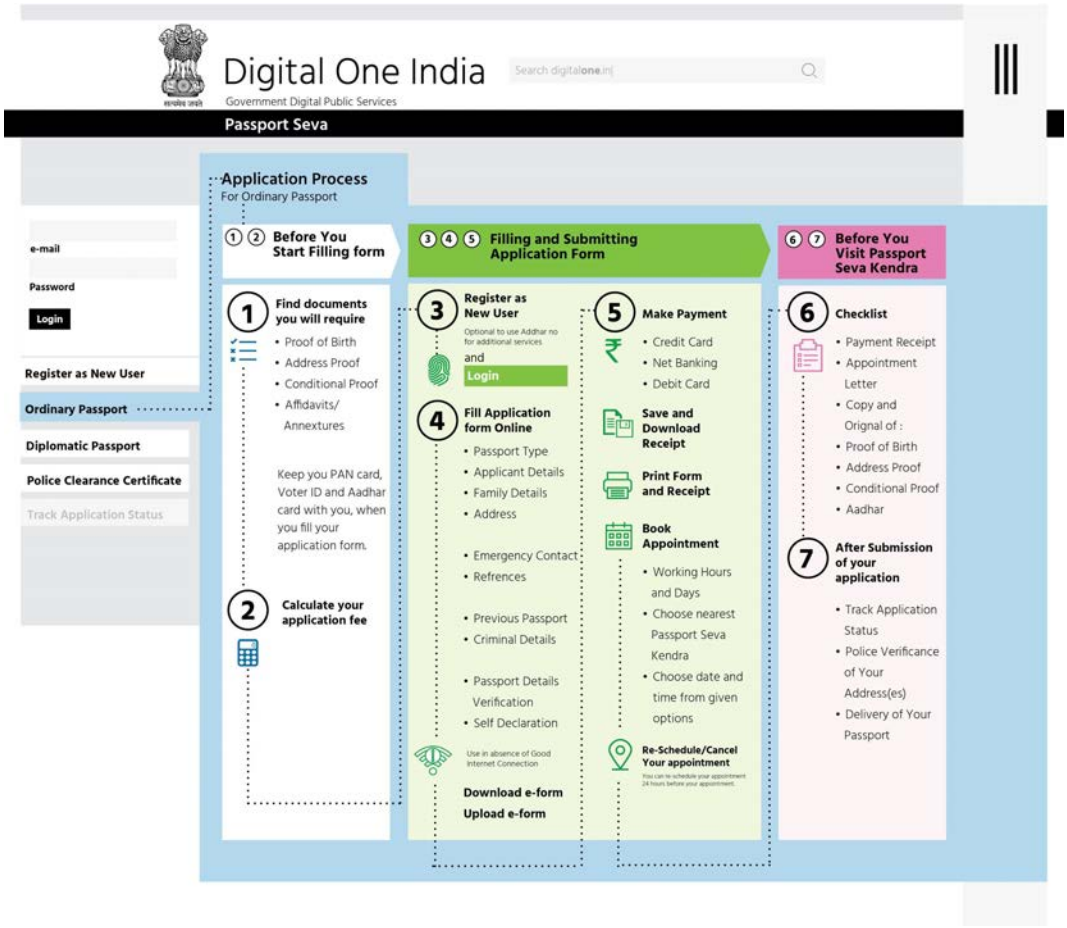

Fig 7: Screen, Diagrammatic mapped out page showing overall service task flow at a glance. Follows George Miller's Principle of Chunking information in number 7±2.

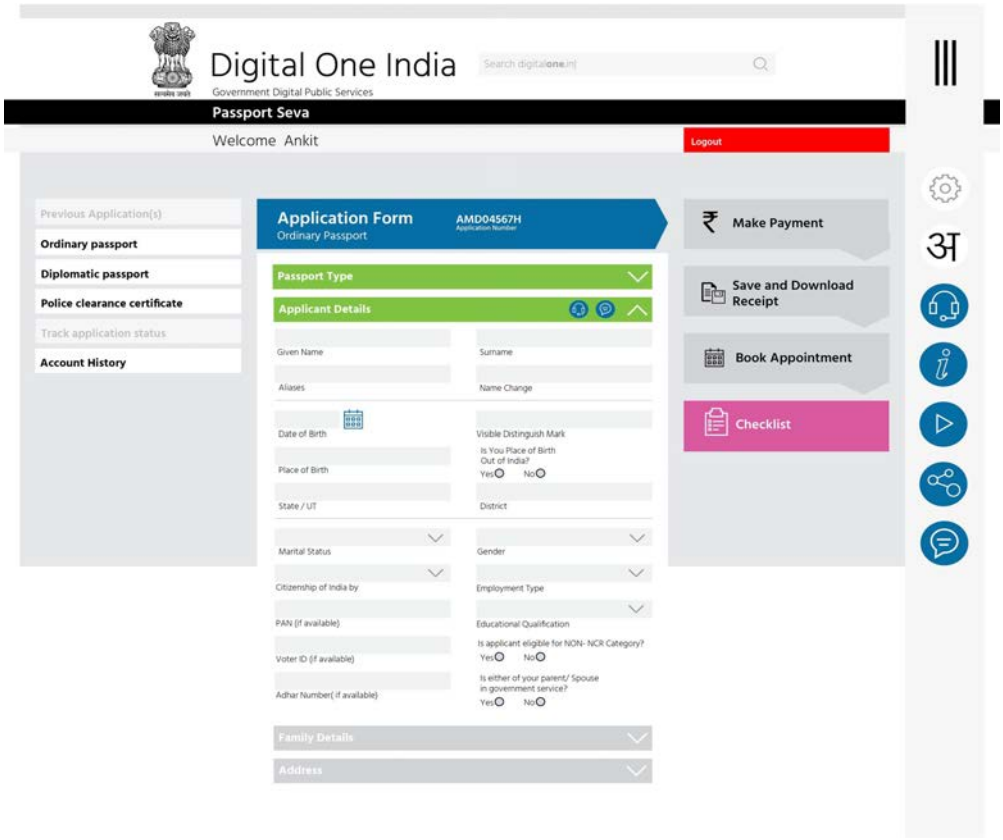

Fig 8: Screen, Progressive Disclosure of Form, Chunked Information, Colour classifying Information.

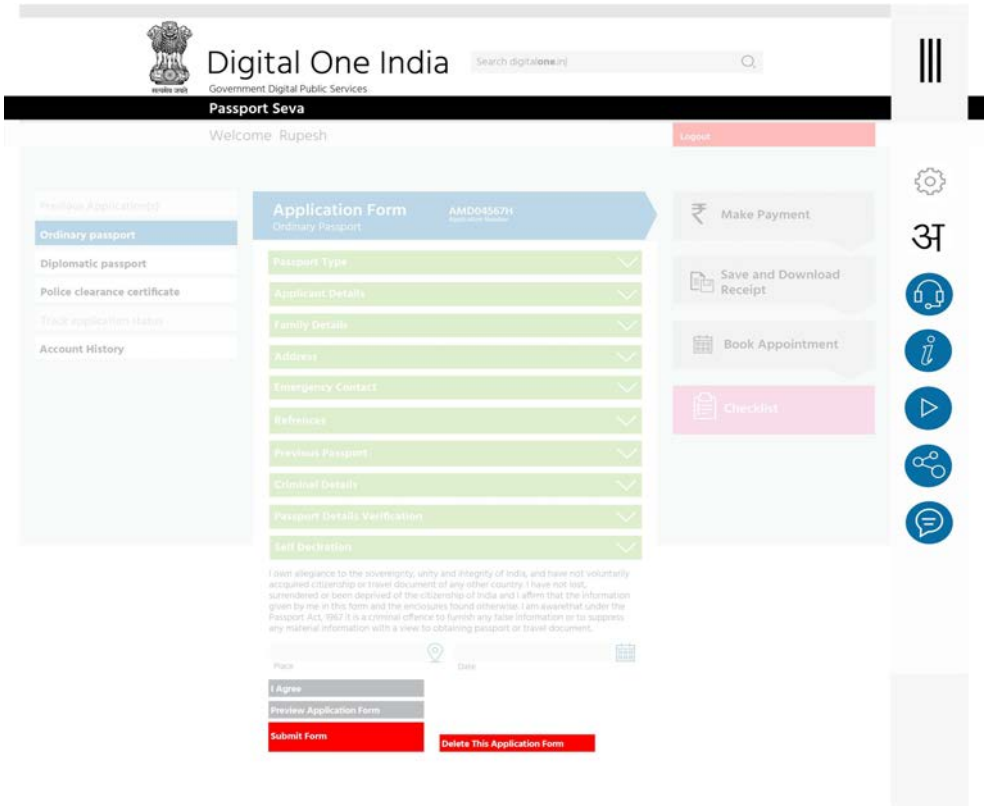

Fig 9: Screen; example reducing probability of human error by making error prone fields less readily reachable.

Consistent Visual Language across all service portals, which will reduce reaction time dramatically thereby making access to new service interface more intuitive in nature.

Modular Design Approach that offers sets of information chunks which could be used in other public services.

Chunking of Tasks to divide and keep individual sets of information in small groups of 7±2. Elements of similar nature so that users can go through them with a higher degree of comprehension and at reduced reaction time spans.

Progressively Disclosing the information, which is not required to be given at earlier stages, thereby reducing delay in flow of navigation. It facilitates users to see only required set of information at one given time.

Redesign of Existing Workflow with clear division of tasks in accordance to pre-, on- and post-nature of the services and providing the user with document check-lists and important points to remember and taking care of various check points of the process.

Saving History and Linking different accounts of a user to facilitating pre filled information that reduces human error.

Diagrammatically Mapped Out Approach for Instructions and More Readable Tone of Language. An overall mapped out chart of service that tells users how to go about the service from beginning to end.

Network of People a pop up/modular platform provided to users facilitated with opportunity to ask questions from old/ existing users.

Call Mitra – an option for users to for voice-based assistance straight from service providers, at any stage.

Voice Enabled Functions and their Icon-based Representations- that provides less text-friendly users an option to continue with minimum reading of numbers, selected basic words, icons as function identifiers and voice for in-detailed descriptions.

Reducing Errors-Critical information where the user could fail to understand and make mistakes, needs to be highlighted by color codes. The user also needs to be informed about the stage of the process, which can be depicted through color code.

Redesign of Print Forms, Receipts, Document Checklists, Instructions – Proper information hierarchy and chunking of information should also be applied to the set of print requirements of the same workflow considering the factors of print productions, including typeface and variable information through barcode, thereby improving the overall clarity of information.

Conclusion

Our study and analysis of three major services suggests that user participation and adaptability of existing digital systems is very low and leads to unclear ways to approach the public utility. Hence many users want to discontinue using it or get it done by expert users or agents. There are major apprehension of adapting to digital process, which is also aggregated as newer generation and older generation adaptability. However, it has

major implication of dropping out the user or not attempting is due to poor design considering the user centred design approach.

Government services are not developed and designed with the consideration of a user-centred approach; it has always been technology-centric and based on an analogous ways of handling tasks. Efforts are made to convert the analogous work flows only for the government's convenience.

Our design approach brings into consideration the cognitive theory, an in-depth user study and inspirations from local patterns of interaction, all which can create a positive change in the attitude of the common man to adapt to the use of government digital service.

This scalable design can be applied to all high volume transaction public services and any new government schemes with the aim of reaching out to the masses. Information design based approaches of building digital services can create better digital adaptability which in turn would help reducing leakages of resources and money. The people India will get easy access to government services and this will eventually help elevating the economic status of many a common man.

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Biography

Rupesh Vyas is a Senior Faculty in Communication Design, Activity Chairperson Online Programmes at NID. In recent past he has been Head of Information Technology and Coordinator of Graphic Design. He is taking lead role in developing Information and Interaction Design as emerging domain under Communication Design and IT Integrated Design Disciplines at NID. He is a Board Member of International Institute of Information Design (IIID) and recently been nominated as World Regional Representative for India. He has contributed significantly to some of the major consultancy project having National importance like Information Design for Census of India 2011 Data Collection and Digitization processes and Multipurpose National Identity Card for Citizens of India from Ministry of Home Affairs, Government of India, Smart Card based Indian Union Driver's License, Standardizing Visual Design for National level implementation, by Ministry of Road Transport and National Informatics Center, Government of India. He was key planner and Chair for "Vision Plus 2010" conference in India hosted at NID. "Vision Plus" invited national and international Scholars and experts from 14 countries, covered a wide range of engaging issues in the domains of Communities, Healthcare, and Mobility.

Sejal Tiwari is doing her undergraduate programme in Graphic Design from National Institute of Design. She is school-graduate with Science, Mathematics and Hindi Language. Her interests are in Spacial Design, Information, Inter-action Design considering Cognitive aspects of Information processing. She is also interested in experimenting with Geometric visualization. She has done extensive design project on Information Signage system for educational institute. She has done in depth study of Italo Calvino’s Six memos for next millennium and came up with Information visualisation to interpret his chapters Lightness,Quickness, Exactitude, Visibility, Multiplicity.

Talking diagrams: how information design thinking can help win business

Oliver Tomlinson

Abstract

Large organisations who bid for multi-million pound construction, maintenance or service contracts need to explain their processes, methods and organisational structures as part of their proposal. This talk explains how we use information design thinking to help subject matter experts (authors) portray their concepts to readers using diagrams. Proposal documents provide a mass of information, sourced from a variety of people and collated to strict timelines. The information is portrayed in text and diagrams produced by authors who may be managers, engineers and subject matter experts, using the tools of their trade such as Word, PowerPoint and Visio. The document authors are experts in their field, but not 'designers' and may have difficulty translating their knowledge to a reader; this is where we as information designers can help. Information designers work in partnership with authors to translate and transform their knowledge into clear, understandable diagrams for the reader. They are not starting a project thinking it must look beautiful, they are starting a project by saying "what does this mean, what does it need to communicate?" In my talk I will provide real-life examples/scenarios of the process we use. Examples where information designers and authors have worked hand in hand to create diagrams that are engaging, informative and concise, ensuring the reader is fully engaged. Many organisations have realised the benefits of information design in enabling them to communicate clearly and concisely how they can win, and deliver, contracts. By working through an information design approach to diagram design, we have gone beyond transforming diagrams, to establishing a greater understanding for bid teams, a quality checking element of concepts, holding entire documents together with 'hero-diagrams', and even altering engineering solutions due to new evidence being highlighted by our designs.

Biography

Oliver Tomlinson After studying psychology and product design, Oliver has worked on bids and tenders with large corporate organisations for over 8 years. In that time, he and his team at TDL London have used information design to enable experts in a multitude of sectors, from prison managers to nuclear engineers, to turn their thoughts and visions into diagrams that everyone can understand. Oliver believes that being based with client teams and experiencing different sectors of work first-hand, can hugely influence your approach to design. This wide breadth of knowledge enables him to share concepts across sectors to promote innovative solutions to challenges, empathising with the requirements of clients and end users.

Section 7: Symbols and Standards

The papers presented in the Symbols and Standards session were:

1/ ISO symbols: the key to global safety communication – Geoffrey Peckham
2/ RutaCL: development and testing of a typeface standard for highways in Chile – Rodrigo Ramirez
3/ Communication support board: standardization through application design – Keiichi Koyama, Hitomi Horiguchi,

ISO Symbols: The Key to Global Safety Communication

Geoffrey Peckham

Abstract

Nearly every activity in business and in our personal lives involves risk. While risk can never be zeroed out, societal expectations are that it should be reduced whenever possible. That's the role safety signs play in the world's workplaces, public spaces and built environment. For safety signs to be effective, they must communicate their messages across language barriers. This presentation will illuminate: 1) how the new vocabulary of graphical safety symbols established by the International Organization for Standardization (ISO) has become an effective tool for safety communication and 2) a vision for how the increased use of these ISO symbols worldwide will benefit humanity. Twenty years ago, almost to the day of this conference, ISO Technical Committee 145 – Graphical Symbols was reconstituted and had its first meeting in Berlin, Germany. Its goal was nothing short of daunting: to establish standards for an international language of graphical symbols to convey specific meanings related to public information, safety, and equipment functions. The two-decade-long accomplishment of this 18-nation committee has been, in a word, spectacular. The standards – and the graphics – developed are providing a much needed global foundation for visual safety communication. As the head of the U.S. delegation to ISO/TC 145 (1995 to present), I helped to shape the words and ideas embodied in this committee's standards. This 20-minute lecture will draw upon ISO/TC 145's accomplishments and how they are being put to good use throughout the world. The visual communication of safety information has been my life's work. I look forward to sharing this information at your conference in a fast-pace presentation, which will use photographs and video clips taken this past year in New York City, Brussels, London, Katmandu, Tokyo, and Berlin.

Biography

Geoffrey Peckham is CEO of Clarion Safety Systems, the premier company in the field of safety markings, supplying best practice product safety labels and facility safety signs to thousands of companies worldwide to reduce risk and protect people. An industry

innovator and thought leader, Peckham has 25 years of experience in actively advancing safety communications. He has led and continues to lead U.S. and international efforts to harmonize standards for safety signs; this includes contributing to the leadership and direction of ANSI, ISO, OSHA and NFPA safety codes. His recent accolades include leading the NYC building code expert taskforce for skyscraper evacuation markings post-9/11, and spearheading OSHA's 2013 revision to its workplace safety sign rules to align with the best practice ANSI Z535 standards. Peckham currently serves as chair of the ANSI Z535 Committee for Safety Signs and Colors and chair of the U.S. TAG to ISO/TC 145 – Graphical Symbols.

RutaCL: Development and –initial– testing of a typeface standard for Highways in Chile

Rodrigo Ramirez

Abstract

Safety is a necessary condition for an optimal performance driving through a highway, and legibility in visual information signage is a key part of this. Historically originated in a combination of form, ergonomics, and technical production the design of typefaces for this context is worldwide extended. In Chile RutaCL, the typographic standard for national highways was developed in 2011-2012, to gradually replace the former roughly based in US-FHWA standard, and offer a visual resource that functioned better than before. However, is RutaCL more legible than the former standard? Until now, the national authority is not able to know about the performance in legibility and perception was accomplished. This paper explains the original development and initial testing of this design project, originated in a scheme on innovation in Public Goods in Chile. Initially, international cases were a good opportunity to visualise, compare and communicate functional and formal features in similar initiatives around the world. During 2012, after the typographic product was delivered –based on 3 fonts, it was observed the convenience of measure the perception/legibility performance compared with the former typeface, and support this by evidence before to start a national-scale implementation. However, this was not considered until 2014, when it was proposed to design an experiment that sets an answer to the question below. A set of user-scale experiments was initially developed working with a team of Chilean Ministry of Public Infrastructure (MOP). After a first pilot experience it was obtained a quantitative index and observed an interesting approach from information design field. Additionally, a testing kit and good practices guidelines is becoming a necessary tool to produce and distribute with the implementation policy.The project was patronised by the National Commission for Transit Safety (CONASET in Spanish) and the Ministry of Public Infrastructure (MOP).

Biography

Rodrigo Ramírez, studied Graphic Design in the Valparaíso School (PUCV), Chile. In 2008 he completed the MA in Information Design, at the Department of Typography & Graphic Communication, University of Reading, UK. His expertise areas in academic and professional fields are Information Design and Typography. Working with different teams (DET, SDG, AGR), he has been involved in the development of information systems for public transport in places such as Santiago, Concepción, Bogotá, Rome and the UK, working in typeface development, pictograms and map design. Currently he works as academic and is the head at Master in Advanced Design (MADA) in PUC School of Design, Santiago de Chile. Also, he owns a design studio (Frescotype), working as a consultant in brand design, custom typography and information design projects.

Communication Support Board standardization through application design

Keiichi Koyama, Hitomi Horiguchi

Abstract

The “Aeon style” shops are one of the greatest shopping stores in Japan. The challenge is to introduce the “Communication Support Board” at the service counter of all major shops to establish trusts and securities between shops and their customers. Because of visit Japan promotion and new tax-free shopping policy, foreign visitors from Asian countries have been increasing year after year. They enjoy daily necessaries shopping at supermarkets and department stores as well. By using “Communication support board”, we are able to stimulate their purchasing power and also express Japanese OMOTENASHI mind naturally. The capability of these boards is estimated not only for people who have hearing disabilities but also for foreigners, seniors and children. A three-piece board is designed to establish Questions and Answers communication between customers and shops using pictorial symbols with multi lingual supplemental texts. Pictorial symbols and board design are based on “JIS T 0103: Design principles of pictorial symbols for communication support” and “ISO CD19027: Design principles for communication support board using pictorial symbols”. Conversation starts by pointing at the pictorial symbols and ends by the same way without relying on the specific language. ISO TC 173/SC 7 is a committee which establishes many standards regarding accessible design. Under SC 7 committee “WG 4: Communication support board” was set in 2013. This WG (Working Group) is now tackling with ISO Draft CD19027 which is expected to be IS: International standard this year. The Aeon style “Communication Support Board” will be the first example which introduces these standards. In this presentation we would like to express how the actual communication boards apply ISO standard and how ISO standard accepts the feedback from realities then improve to be the useful standard.

Biography

Keiichi KOYAMA Company: Managing Director, i Design inc.. Profile: Signage and Information designer. Member of Japan Industrial Designers Association, Japan Sign Design Association, and the Sign Design Society. Teaching at Chiba University and Nagaoka Institute of Design. Koyama specializes in signage design of public facilities, such as Airports, Railway stations, and Environmental design fields. Main objective is to communicate information by developing and providing user-friendly signage systems. Past presentation: IIID Visionplus 10: Pictorial symbols for communication support and their relation to Tachikawa City. IIID Expert forum 2006: The focus of terminal signage with an inclusive/universal design. IIID Expert forum 2008: Personalized Information Systems in Japan featuring QR code and IC card & R/W. IIID Expert forum 2009: Pictorial symbol for communication support boards. IIID Expert forum 2011: How Information Design and Social Media influenced railway use, mobility and life on the

occasion of the recent disasters in Japan. IIID Visionplus 2014: Pictograms featuring Japanese hospitality “OMOTENASHI”.

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Section 8: Performance: 'The completion of something designed'

The papers presented in the 'completion of something designed' session were:

1/ Design for understanding: creating open-world, open-ended design experiences for undergraduates Susan Verba, Sarah Perrault
2/ Start with the basics: understanding before doing Sheila Pontis, Michael Babwahsingh

Design for Understanding: Creating Open-World and Open-Ended Design Experiences for Undergraduates

Susan Verba & Sarah Perrault

Introduction

As design moves towards more interdisciplinary models of engagement, design education faces new challenges: designers must learn to meet the needs of varied audiences, work on open-ended and complex projects, and perhaps most vitally "be more malleable and willing to surrender creative control and work collaboratively toward a final product and […] focus on process rather than final output" (Blair-Early 212). One solution to these curricular challenges involves integrating "wicked" and messy problems into design education. In one such attempt we connected a large-scale, long-term project to a senior capstone class, inviting students to work on part of the "Communicating Pain Project," a cooperative venture between a university's new design center and its medical school.

Context

Design 159 "Design for Understanding" (DES 159) is an elective upper-division capstone course for design majors, taught biweekly during a ten-week term. It was designed and is taught by one author (Susan); the other (Sarah) visited at the start of the quarter to lead a workshop on literature reviews and at the end for student presentations. Students in DES 159 learn principles of effective information display, conduct user-centered research, and develop iterative design prototypes. The quarter is divided in half: students do weekly information design exercises for five weeks, then spend five weeks on a final project either individually or in self-selected groups of 2 or 3 students.

The Communicating Pain Project (CPP)

The Center for Design in the Public Interest (DiPi) at the University of California, Davis was founded in 2014 to bring together interdisciplinary teams to solve community problems through research-based design. One of the Center's first projects, the CPP, seeks to address problems related to the experience and under-treatment of chronic pain (any pain lasting more than 12 weeks), a condition affecting about 100 million Americans. Because pain is difficult to communicate, and pain perception and communication vary across ages, genders, and cultures, pain communication is a "wicked" design problem. In the CPP, we are working to engage diverse patient and provider communities in the participatory design of tools to help evaluate and better manage chronic pain.

The challenge: Bringing a "wicked" problem to class

During the first four weeks, students "Collect information design examples from everyday life that are faulty or confusing and need to be reimagined. These will become raw material and inspiration for your final project" (DES 159 syllabus). In week 4, the class chooses a few finalists that could work as a 5-week project. In 2014, Susan included the CPP as an option. Students explored potential ideas and created and discussed a "diagram of fears", an activity that gave students a way to explicitly address uncertainties they may face and to discuss possible strategies. Ultimately, six students chose to work on the CPP, and seven decided to work on "Wandering," a project to introduce students to hidden gems on our campus. On the CPP:

- Team A (one student): developed a personal pain log, "LOGit"
- Team B (two students) designed studies on pain communication in working toward a new pain scale
- Team C (one student) explored a tool for visually communicating pain
- Team D (two students): developed a prototype tablet app to self-assess pain

All teams spent two weeks on secondary research, user research planning, and concept development and three weeks on design development, user testing, revisions, process book design, and final project presentation. Each final presentation included a "next steps" section outlining what the team would do to move the project forward if they had more time.

Student experiences

What we saw confirmed what other studies (e.g. Jaenichen, Riley et al) report: a higher-than-usual level of student engagement with aspects of design not experienced in other classes. In CPP teams, students thought deeply and widely about a complex, real-world problem, one with many different aspects and nuances (spanning expertise across multiple disciplines), and with many possible opportunities for design investigation/interventions. They asked provocative and insightful questions, and sought answers to those questions in multiple ways: they conducted secondary source research; did primary research via interviews, surveys, and other user-centered

research activities; learned from classmates via discussion, feedback, and reviews; and made experimental prototypes and captured responses to those prototypes from themselves and others.

While these activities were expected of all students in DES 159, those working on the CPP faced unique challenges as they engaged in what Lave and Wenger dubbed "legitimate peripheral participation" (LPP), summarized by Hasrati as a situation in which "novice members are given enough credibility to be considered as 'legitimate' members of their target communities and are given 'less demanding' practices to perform to learn the craft" (557). Legitimacy, Hasrati explains, can come from "being useful" by contributing to solutions that will be implemented outside the classroom or campus context, while "peripheral" refers to the fact that students do not face all the risks, or garner all the rewards, of a practicing designer. Our focus here is on how the CPP teams experienced the kind of LPP that is the goal of integrating real world problems into design education.

Open-ended project—boundaries of discipline and scale

Perhaps the biggest challenge CPP teams faced was the project's open-endedness. Aeschbacher & Rios note that "[c]rossing boundaries of discipline and scale is the first step in enabling emergent forms of collaborations to flourish" (86), and compared to teams working on the "wandering" project, the CPP teams faced a much larger and less bounded problem space. While other teams worked on creating apps for exploring the campus and mainly researched existing apps, CPP teams had more opportunities for research exploration in the sense that
a) there were many scholarly articles available, as well as artifacts such as existing pain scales and b) the project audience—people who have suffered from chronic pain—was wider than the audience of people who might wander the campus. Their work was therefore more cross-disciplinary, and also spanned a greater range of primary and secondary research.

CPP teams also struggled with the problem of scale; much of their class time was focused on this issue, arising regularly during weekly research check-ins and design check-ins. At the same time, their broad scope also exposed them to possible solutions; Team B, for example, found that the Stanford group's (Jang et al) approach and methods were a useful guide to understanding how designers impose limits on exploration and engagement in moving a project forward. As they noted in their project book, they were surprised that the study tested only eight people.

Unbounded projects

In addition to being open-ended, the project was unbounded, meaning students were drawing on work from others whom they might or might not know, and were feeding their own findings and ideas back to an interdisciplinary, non-peer group (DiPi). These actions are essential to real-world design practice; Pentland, for example, found that in good teams "[m]embers periodically break, go exploring outside the team, and bring information back" (65), and that "[h]igher-performing teams seek more outside connections" (Pentland 65). While all students in DES 159 were expected to reach

beyond their groups and the class by choosing three IDEO Method Card user-centered research methods, the CPP group was initially worried about their people-centered research because they thought they should talk with medical providers, something that could be hard to arrange. However, when they discovered that many people experience chronic pain, they focused on the patient side of the issue. This experience with audience identification and narrowing had greater scope than their peers' process.

Lack of finalizing

CPP teams also did not know what effect their contributions might have on the longer-term project. Possibilities ranged from no impact at all to having their work folded into eventual design artifacts. Even within the constraints of the class itself, the CPP teams generated a broader range of artifacts, and with differing levels of closure, than their classmates on the "wandering project." Teams working on the campus app project had an easier time launching into developing quick prototypes, possibly because their project was, from the start, more concrete; they moved more quickly towards identifying the final form of the outcome as being an app, and all students working on this ended up creating apps. Open-endedness is common in design work (see, for example, Dorst), and learning to manage the process aids students in joining a field for which such skills are vital.

Benefits to the project

Student work also helped the CPP. Although not everything they did was of benefit to the project, even so, they moved the project forward on a number of fronts. First, students helped us test out a new file-sharing repository, Box. We had been looking for a way to collect research and were trying Box in a small group at DiPi. Having the students use BOX was 1) a mini test to reveal some of the issues that might come up when using it as a shared research repository – e.g. how to develop a new habit of posting to BOX, and how to organize the resources on BOX so that they might be easily found by others – and 2) a positive development for the course in terms of finding a workable way to share research among students working on similar projects.

Second, students helped move the project forward in more substantive ways, such as finding articles the DiPi team had not found. For example, the team working on a new pain scale (Team B) found articles about work being done at Stanford (Jang et al) and found an online pain exhibit (http://painexhibit.org/en/), while Team C found an interesting pain scale tool, a folding pain assessment card (http://www.partnersagainstpain.com/printouts/A7012AS9.pdf).

Third, student work helped us demonstrate project options by producing work we use, with credit, to engage audiences outside of UC Davis. One group created animated text studies of pain words, studies we used in our application to attend the week-long DesignInquiry workshop in Vinalhaven, Maine. Also, the DiPi team had an idea about a flipbook-style pain tracker that people could use to record their activities and pain levels several times each day; building on this, Team A developed "LOGit," a prototype pain log booklet that, if one used it consistently, one could flip through to see an animation of changing pain levels. We have found this, along with other artifacts created

by students and by DiPi, to be very useful in demonstrating to non-designers the kinds of things design can do.

Overall findings

Overall, our recommendations are to make careful choices at all levels.

Make sure students have choices. Given the challenges described above, it was essential that students be able to choose this project rather than have it imposed. Students chose to work on the CPP knowing they were getting into something open-ended. Students also knew their work might be adapted and incorporated into the Center's designs; giving them a choice to opt out of this was important.

Choose a project students can connect with. Aeschbacher & Rios talk about the need for designers to see themselves as "citizen designers," that is, "both members and enablers of communities" (86). Students will not have time to enter deeply into another world, so the project should be something they can connect with; students in DES 159 had not necessarily had experiences with severe or chronic pain, but pain is a universal experience[7] and even those who have never suffered from serious pain know people who have.

Choose a project at a stage where undergraduates can make meaningful contributions. To have legitimate peripheral participation, tasks must be "challenging but not defeating" (Hasrati 560), and in this case that meant making sure students had the chance to find their own way through an open-ended project. By Spring 2015 when DES 159 was offered again, the CPP had progressed significantly as our understanding of the problem space and possible design interventions evolved. Given this progress, the project would have to be rescaffolded and "chunked" differently if the experiment were to be repeated. Pedagogically, we can understand this in terms of Vygotsky's notion of the zone of proximal development in which "Teachers need to offer instruction higher than the lowest level the student is at currently, but not so high that the student fails" (Bourelle 186). Thus, if a project is too high, it's out of reach. If we make it artificially low, we lose authenticity.

Choose a time or course when you have bandwidth. Finally, it is important that faculty integrating real-world, open-ended projects into a class have the time and/or extra support needed for the higher-than-usual workload that results. Susan found that teaching this took more time and energy than an ordinary project would, for a few reasons:

1) She did not find and assign all the readings. Students added readings as they found them, which meant that she was reading, evaluating, and assessing the usefulness of texts for the first time as the quarter progressed.

2) As with other forms of case-based learning, a "wicked" problem works best pedagogically when introduced gradually and with scaffolding, which required more than the usual amount of preparation.

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[7] With the exception of those who suffer from congenital analgesia, also called congenital insensitivity to pain, an extremely rare condition in which individuals are unable to perceive physical pain.

3) Students needed to make more in-stream adjustments than they would have with a more bounded project, calling for more input and on-the-fly scaffolding from Susan.

Ideally this level of input decreases as the teacher models an activity, coaches students, then moves into the background (Hasrati, 39). However, the constraints of the ten-week quarter, combined with the need to scaffold students' movement into case-based learning, means that with such a complex project there is not enough time for the "fading" stage to happen.

Thus, it is vital that faculty who opt for this kind of project have the time and/or support they will need.

Conclusion

Overall, integrating the CPP into DES 159 was a successful experiment. Although workplace experiences cannot be fully imported or mimicked in the classroom (Bourelle 184), we nevertheless found that both students and the project benefited from this halfway-step of having students work on a "wicked" real-world problem within the scaffolded, supportive environment of the class.

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Biography

Susan Verba (Department of Design) and **Sarah Perrault** (University Writing Program) are UC Davis professors who co-direct the UC Davis Center for Design in the Public Interest (DiPi), which brings together teams of creative people from different fields to solve problems through better design and to study how interdisciplinary groups work, investigating the question: what does democratic design look like? Susan, who has a BS in Mechanical Engineering (Stanford University) and an MFA in Graphic Design (Yale University), also is principal and co---founder of Studio/lab (where she leads research---based projects and advocates for the value of design in corporate, nonprofit, and government communications). Sarah's academic background includes a BA in Anthropology (Reed College), an MFA in Nonfiction Writing (Northern Michigan University), and a PhD in Rhetoric and Composition (University of Nevada---Reno) and her research interests include rhetoric of science, pedagogy, and the curricular challenges of general education classes.
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Start with the Basics: Understanding Before Doing

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Keywords: conceptual design, design process, understanding, information design, education, practice, performance

Abstract

Technological progress may be expanding our capabilities to create, store, analyse, display, visualise, and share data and other content, but our ability to make sense of what we generate, and effectively structure and communicate it remains limited. All too often, information design solutions favour visual appeal or interactive wizardry, enabled by novel tools and techniques, while losing sight of the core goal: to communicate clearly to the intended audience. This recurring phenomenon highlights a key problem facing information design education and practice: there is an overemphasis on the production of design outputs and little attention paid to fundamental understanding.

We assert that information designers are not effectively making sense of situations in order to appropriately investigate problems before developing solutions, primarily because of a lack of rigour in the conceptual stage of the design process, in which information designers construct a deep understanding of a situation and its related content. To ensure effective solutions, information designers first need to define *what* problem they are solving and understand the context it lives in. With a clear starting point established, information designers can construct a mental model of a situation in order to identify key pieces and uncover patterns.

In this paper, we argue that in order for information design to help improve performance across different fields and industries, information designers need to address a core challenge: how do we 'begin at the beginning' of the design process, and reinforce thinking—and understanding—before doing. We will provide methods, approaches, and tools to help information design students and professionals achieve the essential understanding to make sense of problems, big and small.

1. INTRODUCTION

Over the past 50 years, the sweeping technological advances of the information age have proven to be both a blessing and a curse: with more, better, and faster access to and production of data and information come the challenges of filtering relevant from irrelevant information (Pontis et al., 2015) and locating the 'right information as needed at a given time' (Saracevic, 2009:2571). Paradoxically, as the need for information design skill grows more urgent to address these challenges, the quality and performance of many information design outputs often falls short. Frequently, these solutions present 'prettier pie-charts' but with less understandable and harder to use information (Wurman, 1996; Katz, 2012). This recurring phenomenon highlights a key problem facing information design education and practice: there is an overemphasis on the

production of design outputs and little attention paid to fundamental understanding. Creating effective information design 'requires more than a computer drafting programme or cut-and-paste template' (Heller and Landers, 2014:7). Effective use of technology is governed by 'a disciplined process of logic and common sense' (Wurman, 1996:5).

This paper seeks to raise awareness of the earliest part of the information design process—the conceptual design stage—in which key activities help construct the central understanding that determines the quality of the end product and ultimate end user/audience outcome. We focus specifically on methods, approaches, and tools that support understanding, sensemaking, and decision-making. Due to space constraints, we introduce the core areas of our study and indicate further relevant references for more in-depth discussions.

First we set the context with an overview of the information design field, the process, and types of projects. Next, we unpack the concept of performance and discuss conceptual design, its role in the design process, and how to support this part of the process. Then we present conceptual design aids that can be adopted by information designers and conclude with implications of using these tools in education and professional practice, indicating further lines of exploration.

2. SETTING THE CONTEXT

Information design

Information design is a field of study and practice informed by graphic design, journalism, interface and user experience design, cognitive science, behavioural and applied psychology, and information science, among other fields (Waller, 2011). Within the field of information design, there are numerous specialisations and sub-fields, such as data visualisation, visual journalism, infographic design, document design, signage design, and interactive design. Increasingly, information design skills are gaining relevance in the realms of organisational change and social innovation (Frascara, 2015), thus signalling the evolving role of the field beyond visual artefacts and towards the design of strategies, experiences, and outcomes. Information design problems come 'in all shapes and sizes' (Wurman, 1996:142), ranging from the well-defined and highly framed (e.g. infographic, bus timetable) to the ambiguous and unframed (e.g. organizational strategy, social change initiative), and often involving close interaction with individuals from other disciplines, rather than independent work alone.

Given the multi-disciplinary and multi-faceted nature of information design, it is challenging to arrive at a concise definition that accurately captures this breadth and depth (Gobert and van Looveren, 2014). However, at its core, we recognise that information design work of any kind seeks to facilitate understanding—of a situation, concept, space, place, time, quantity, phenomenon—for an intended audience (Wurman, 1996). For the purposes of this paper, we broadly define information design as the process of facilitating understanding in order to help people achieve their goals. We hasten to add that the domain of information design problems need not be limited only to the complex; even the simplest of concepts can be miscommunicated and call for no

less rigour and attention to be conveyed clearly (Siegel and Etzkorn, 2013; Pontis and Babwahsingh, 2013; Frascara, 2015).

Regardless of context or project type, information designers' goal is to maximise benefit and value for the client and end user by driving the performance of their intervention and solution. As we discuss in the following section, the effectiveness and impact of any work of information design depends on the orchestration of a number of factors.

Performance chain

Performance is the 'extent to which we can measure the degree of success of the design process' (Lawson, 2008:63). There are a number of aspects within the process than can impact the overall performance of a solution. Frascara (2015:47) discusses the role of evaluation in information design to measure 'the degree to which the new design improves upon the performance of the previous one, or where no previous one exists, it achieves the performance expected'. He makes a distinction between measuring the use of a design solution by observation (measuring output) and a final evaluation quantifying the actual improvement of something after the implementation of the design solution (measuring outcome), such as a reduction of effort in performing a task, time decrease in achieving a goal, or increase in the efficiency of a device.

This suggests that performance in information design can be assessed at different moments in the process (Figure 1):

- *Performance 1.* How the designer does their job? (measuring designer's work)
- *Performance 2.* How effective the design solution is? (measuring output)
- *Performance 3.* How successful the audience/end user is in achieving their goal? (measuring outcome)

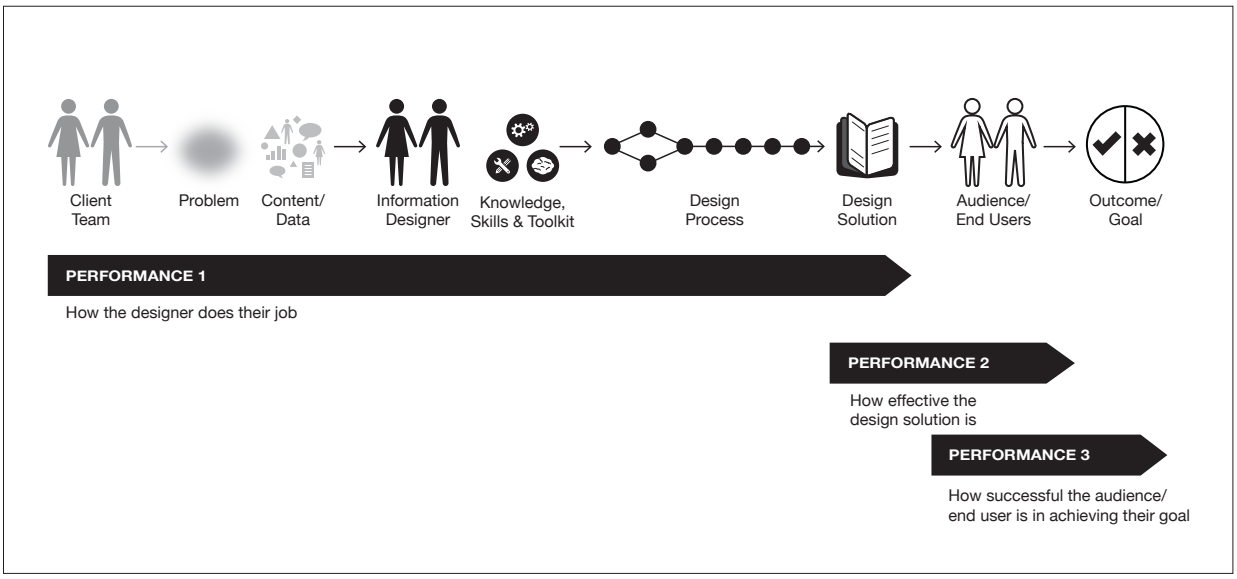

Figure 1. The three types of performance used to measure the degree of success of the design process.

Although there is 'enough knowledge today to produce good information design', repeatedly, information design solutions display basic problems which indicates that 'this knowledge is not getting to where it should be' (Frascara, 2015:49). Building on Frascara's viewpoint, we argue that there is no need to create new knowledge or techniques but to reflect, revise, and put the knowledge we have into practice. By shedding light on the very first steps that designers need to perform in order to solve a problem, designers' awareness of fundamental issues will increase. We propose the adoption of conceptual design methods, approaches and tools to help designers develop the necessary sensitivity to become more aware of the consequences of their ideas before they start prototyping them or putting them into practice. This attention to the beginning of the process will enable designers to 'recognise and appreciate deficiencies, shortcomings and loopholes in ideas' (Parnes, 1967:29). Ultimately, this change would cascade to the other two types of performance, and the overall performance of the process would improve.

The Information Design Process

Prior studies indicate that the design process, as with many problem solving processes, begins with a need or a situation in need of change and typically ends with an improvement of that state. Additionally, the design process is not strictly linear or sequential, as certain steps may cycle or iterate (Simon, 1995). Many models representing this process have been introduced (e.g. Parnes, 1967; Treffinger et al., 2006; Lawson, 2008; Pontis, 2012; Frascara, 2015); stages and phases included in those models can be grouped into two broad parts to solving information design problems. 'First is to "engineer" the solution correctly, focusing on the invisible infrastructure until the raw concept emerges. Second is to provide a visible "architecture" which communicates how the system works and engages people to try it, trust it and ultimately rely on it' (Wurman, 1996:142). We refer to the former part as 'conceptual design' and the latter part as 'prototype design' (Figure 2); each involving a 'sequence of operations' (Lawson, 2008:119). We explore the first part in the next section.

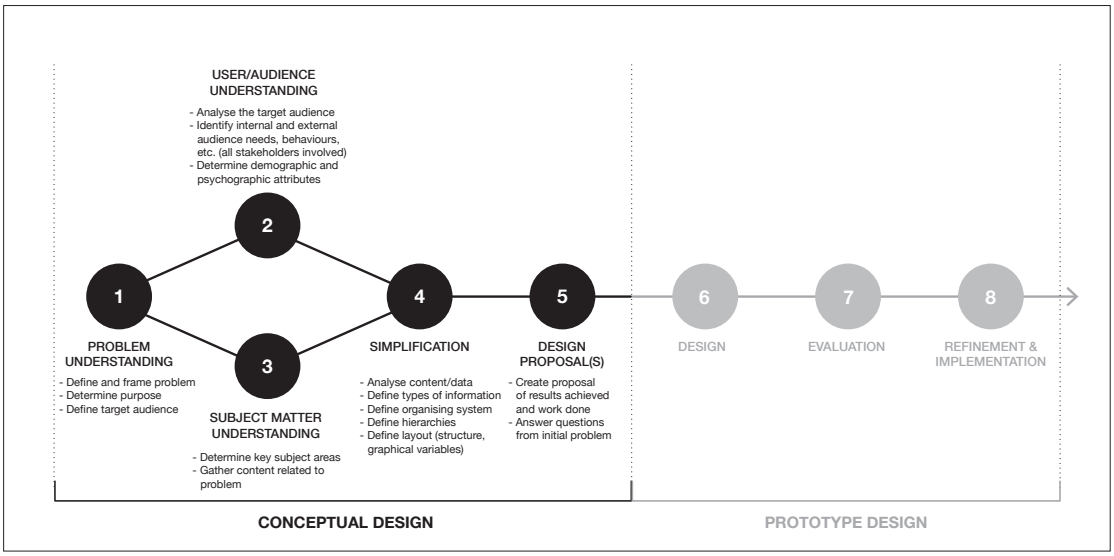

Figure 2: Overview of design process based on idX, (2007) and Pontis (2012).

3. STARTING FROM THE BEGINNING: Conceptual Design

Conceptual design is the part of the process where the definition and exploration of the design problem, and conception of ideas occur (Ware, 2008; Pontis, 2012). It consists of five core phases and a series of actions to analyse, simplify, and compile content into an understandable and usable form (Figure 2). The goal of the conceptual design stage is *understanding* and involves:

1. Understanding of the **problem itself** (what needs to be fixed)
2. Understanding of the **content or data** (what will be translated and communicated)
3. Understanding of the **audience** (who is at the centre of the problem and what their level of visual literacy, education, needs, behaviours, and familiarity with content are)

The first phase requires considerable effort in identifying, understanding, and framing the problem (Ware, 2008; Lawson, 2008). In some cases this phase 'is explicit and well-defined'; in other cases it can 'be quite informal' (Ware, 2008:156-7). In both cases, Ware (2008) stresses that the aim of this phase is to 'understand and define a problem before attempting to solve it'. Designers' explicit and implicit knowledge have a key role in gaining all forms of understanding (Bektaş et al., 2008). To make sense of the problem and understand its requirements and relevant content, designers move through information cycles (Wang et al., 2002), first relying on their implicit knowledge (past experiences, principles, strategies, and tactics) (Klein et al., 2007; Bektaş et al., 2008), and then supplementing it with explicit knowledge obtained through external sources of information (e.g. clients' input, research, etc.).

Ideas generated and decisions made during conceptual design affect further decisions along the process more related to formal execution of the solution (Jones, 1992;

Wurman, 1996; Senechal, 1997; Ware, 2008; Pontis, 2012). It can be hard to 'compensate or to correct the shortcomings of poor' conceptual design decisions later in the process (Wang et al., 2002:981), because they can have strong repercussions across various aspects of the project: time management, budget estimates, solution quality, overall performance, audience's responses.

Although the relevance of this part of the process has been highlighted, conceptual design actions are often underestimated, and some designers 'go to the computer sooner rather than later' (Heller and Landers, 2014:302). In addition, growing demands for faster results and tightening time constraints on the design process make designers less tolerant and patient to work with their hands and away from the computer. Jones (1992:65) argues that designers are 'far too speculative' at the beginning of the process and this is why they 'fail to see the point of fact-finding' before making key decisions or understanding 'what it is they are looking for'. For some designers, this understanding crystallises while they are 'working with real elements—typography, dimensions and data' (302), and exploring 'problem and solution space together iteratively' (Heller and Landers, 2014:308). Lawson (2008:182) asserts that this is common behaviour among designers—unlike scientists—because they tend to focus more on 'reaching a solution rather than understanding the problem', even if this way of working can increase the risk of creating ill-conceived solutions and having to deal with major changes later in the process (Ware, 2008; Mueller, 2009). This indicates a need to support the phases of conceptual design and make designers aware of the impact decisions have on the whole process (Mueller, 2009).

The adoption of conceptual design aids can provide that support.

4. SUPPORTING CONCEPTUAL DESIGN: Methods, Approaches, and Tools

Conceptual design methods, approaches, and tools aim to support designers' thinking process by providing guidance or a logical structure on which to support decisions, minimising the risk of making arbitrary decisions (e.g. trying out random solutions, making choices based on personal tastes) (Jones, 1992; Cross, 2000; Conley, 2004). These aids can enhance implicit knowledge, deepen designers' thinking and understanding, and strengthen their information management skills. Bektaş et al. (2008) refer to these types of aids as 'knowledge management tools' because they aim to externalise implicit and explicit knowledge, the sharing of this knowledge with others, and the reuse of 'knowledge in future projects'. However, these aids do not replace creative thinking or professional experience.

When conceptual design aids are used regularly in professional practice, designers can make better-supported decisions than they would if they relied only on their implicit knowledge (Conley, 2004; Pontis, 2015). Similarly, Parnes (1967:7) asserts that merely having the expertise or 'knowledge does not guarantee the formation of new patterns' and creation of effective solutions. Designers must expand knowledge by adding new facts, and combining and rearranging all facts into ideas. Externalising ideas either as sketches or lists in a way that they can be contemplated, reorganised, restructured, and reinterpreted promotes the generation of new ideas (Zahner et. al. 2010).

There are many types of conceptual design aids based on their goal and the conceptual design phase they support (e.g. Jones, 1992, Wang et al., 2002; Bektaş et al., 2008; Pontis, 2012). However, Wang et al. (2002) and Pontis (2012) argue that within the conceptual design stage, there are more IT-based tools (e.g. digital drawing, 3D modelling, statistical data analysis) available which support the later phases (simplification process and design proposal) than earlier phases (problem understanding, audience understanding, content understanding). The earlier phases involve imprecise and incomplete information, and concepts, which are hard to 'capture, visualise or communicate electronically' using specialised software or other IT-based tools (Wang et al., 2002). Towards the later phases, concepts start to crystallise into more tangible ideas as designers move into the prototype stage of the process.

In Table 1, we present methods, approaches, and tools that do not require digital devices or advanced technology. The list is not exhaustive and most aids are not novel but provide an overview of how the thought process can be enhanced. Case studies illustrate ways in which these aids can support different conceptual design phases. While these case studies are a representative sample of non-traditional information design challenges from service design, wayfinding and website design, they capture the range

Table 1. Proposed methods, approaches, and tools to support conceptual design, and their application in case studies.

of activities involved in the information design process, and their methods, tools, and approaches can be tailored to support information designers' needs.

METHODS, APPROACHES AND TOOLS FOR CONCEPTUAL DESIGN

1 PROBLEM UNDERSTANDING	2 USER/AUDIENCE UNDERSTANDING	3 SUBJECT MATTER UNDERSTANDING	4 SIMPLIFICATION	5 DESIGN PROPOSAL(S)
PROPOSED BY THIS PAPER				
- Fact finding: e.g. Six ways of seeing and showing (Roam, 2008) - Visual facilitation (Sibbet, 2010)	- User studies (Lupton, 2014) - Usability methods (Schriver, 1996) - Background research (Baer, 2008) - Personas and scenarios (Stickdorn & Schneider, 2012) - Design probes (Mattelmäki, 2008)	- Literature review (Frascara, 2015) - Cross-disciplinary meetings (Treffinger et al., 2006) - Stakeholders analysis (Schriver, 1996) - Subject matter experts interview (Schriver, 1996)	- Visual thinking (Ware, 2008) - Mind mapping (Buzan, 2002) - Sketching (concept models, frameworks) (Zahner et al., 2010) - LATCH (Wurman, 1989) - Creating information fields/panels (Doorley & Witthoft, 2012)	- Wireframe/schematic (Baer, 2008) - User journey/service design blueprint (Stickdorn & Schneider, 2012)
USED IN PROFESSIONAL PRACTICE				
CASE STUDY 1. Fit Associates & MAYA Design (USA, 2005)				
Goal: Make The Carnegie Library of Pittsburgh a preferred destinationfor knowledge, entertainment, and social interaction by improving users' experience of human (librarian, community), online (internet, databases) and physical (books, facilities) resources.		- 'Walk a mile in customer's shoes' - Shadowing: learn librarian and users' behaviours, issues, needs - Observation - Usability studies	- Exploratory techniques for basic and targeted wayfinding queries - Website interface analysis - Documenting - Brainstorming sessions	- Breakpoint analysis - Definition of personas and use case scenarios - Definition of underlying information architecture: components of the library experience - Annotated point-of-view photographs - Rapid prototyping	- Library user journey - Customer experience cycle - Information needs models - Information blueprints	**Solution:** Redesign of library website, design of wayfinding system to orient and direct people into and to the library, and design of elements to support library use and provide direction at decision making points. *Sources:* www.slideshare.net/mrettig/rettiggoelux-week82505, Fit Associates and Maya Design presentation (2005)
CASE STUDY 2. Davis Associates (UK, 2005-2006)						
Goal: Create principles for station signage to help address inconsistent and confusing wayfinding and signage information across UK rail stations by understanding the needs of station users.		- Journey shadowing - Observations - Capture user decisions: verbal protocol, information they are looking for, information found and used, physical cues used	- Literature review: wayfinding theory, other transport systems, emerging technologies, academic sources, railway documents and standards, good practice guides and standards from other industries - Field research	- Cross check of observations with journey shadowing and literature review - *Categorisation of information:* people, environment, and information factors	- User journey - Good practice guide draft - Stakeholder discussion topics	**Solution:** Design of 'Good Practice Guide' to be distributed to stakeholders in the UK rail industry. *Sources:* Baker (2007) and www.davis-associates.co.uk/)
CASE STUDY 3. Government Digital Services (UK, 2011-2012)						
Goal: Transform the quality of the UK's government digital services, starting with the creation of a single website bringing all government content under one domain name (Gov.uk), upgrading the user experience, and developing systems to make maintenance easier for government staff.		- Qualitative research approach: panel of young and old, experienced and novice users - Usability testing on alpha and beta versions	- Quantitative research approach: analysis of users' search analytics across central government websites based on automatically generated logs of the last 10 years describing frequency of use and content sought - Additional data from a variety of sources	- Visual thinking - Data analysis - Personas or user story cards	- Design of alpha (2011) and beta (2012) live website prototypes - Proposal to use everyday users' terminology - Layout redesign	**Solution:** Design of one single website presenting all UK government content. *Sources:* Boyer et al. (2013) and www.gov.uk/
CASE STUDY 4. Sense Information Design (USA, 2014-2015)						
Goal: Help a multidisciplinary team develop shared understanding on current project, and gain alignment on strategy, goals and key work streams for the development of multi-channel marketing system.	- Exploratory meetings - Fact finding (face-to-face meetings, calls with client) - Visual facilitation	- Open-ended questionnaire for team members	- Review of existing content: literature review, client-owned sources - Fact-finding sessions with client team - Visualisation	- Information panel creation - Diagramming	- Report - Diagrams	**Solution:** Design of information panels, facilitated session with team members, and session summary with project overview (goals, present and future state visualisations, action plans, timeframes).

5. IMPLICATIONS

The use of conceptual design aids has strong implications for information design education and professional practice. However, experienced practitioners and junior designers or students will approach these aids in different ways. Experienced design practitioners are most likely to have developed a robust body of experiences to determine when and how to move from one conceptual phase to another, make confident decisions, critically evaluate their outcomes, and reassess unsatisfactory situations (Kennedy, 1987; Dorst, 2004; Pontis, 2012). On the contrary, most junior designers and design students have not yet gained enough first-hand work experience to deal with a design problem without external supervision and are still in the process of developing skills to critically analyse their own actions (Dorst and Lawson, 2009). These differences influence how the methods, approaches and tools presented here are used.

Design Education. Working with conceptual design aids will provide a more structured approach to this part of the process, thus facilitating the externalisation of the thought process and development of deeper awareness of its different phases. Externalising the process in some kind of visual or textual form would help design students make 'inferences that would be difficult or almost impossible to make without [the visuals]' (Simon, 1995:249). These inferences make it easier to understand why something works or does not work, and how decisions were made.

Conceptual design aids aimed at supporting the third and fourth phases can provide a systematic and structured way to collect, analyse, and make sense of data, helping information design students develop information management skills and learn how to identify trends and patterns in the data. Both sets of analytical skills are considered essential for information design education (Gobert and van Looveren, 2014). Appreciation of conceptual design phases would encourage self-reflection, increase knowledge about the conception of solutions, enhance understanding of how to make more confident and independent decisions, and enable students to start working with less supervision much earlier in their careers.

Professional practice. Although more experienced designers argue that they do not need a conceptual design aid to support their practice because they have already acquired the necessary skills (Cross, 2000), Parnes (1967:15) explains that 'each acquired attitude or habit, useful though it may be, makes [a designer] a little less receptive to alternative ways of thinking and acting. [The designer] becomes more competent to function in [their]own environment, less adaptive to changes'. Using conceptual design aids in professional practice will 'oblige designers to look outside their immediate thoughts for relevant information, and minimise the tendency of falling in love with 'the first idea that comes up' (Jones, 1992:70).

Furthermore, as 'the impact of design decisions is initially very high, and declines steeply as the design matures' (Wang et al., 2002:981), well-supported 'design decisions early in the design process create high project value with relatively low amounts of effort' (Mueller, 2009:104). By supporting the beginning of the process, the overall process benefits.

6. CONCLUSIONS

Supporting the initial part of the information design process—conceptual design—is one way to enhance the overall productivity of the process and quality of solutions. The adoption of conceptual design methods, approaches, and tools could benefit both information design education and practice: students would develop a strong foundation in the design process which would promote more thoughtful information design problem-solving practices in the professional world, and practitioners would enrich their existing approach with complementary techniques to improve their decision-making. Future lines of investigation would involve further studies with information design practitioners and students working with conceptual design aids in their respective environments to determine their impact.

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Biography

Sheila Pontis is an information design educator, researcher and consultant. She studied Graphic Design at University of Buenos Aires, and went on to specialise in Information Design, receiving her PGDip and MPhil at University of Barcelona, and her PhD at University of the Arts London. She began her career in design practice, but gradually shifted towards the conceptual side of the problem-solving process, pursuing academic research on sensemaking, and information interactions at University College London. Her work has been published in JASIST, ICOGRADA, IADIS, and Malofiej. She has extensive experience teaching and leading undergraduate and postgraduate programmes on information design, design research and design thinking

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The Designers and the Users of Manual Assembly Instructions

A.-L. Carlsson and N. Svensson Harari

Abstract

In information design theory the importance of the user's experience is frequently stressed. In this paper we argue that practice shows that the user and the producer furthermore can dwell in the same role. Based on observations, interviews, and functional text analysis, we found that the designing is linked to the functions of the manual assembly instruction within manufactory industry. Wittgenstein's (2009) theory of language-games is then used in discussing the questions of "good" information design.

INTRODUCTION

We have studied manual assembly instructions in a manufactory industry, concerning the designer and the user's roles in relation to function, from an information design perspective and Wittgenstein's (2009) theory on language-games. Our questions are: *Who writes the instructions?* and *How does the language in manual assembly instructions function in relation to the user?* We attempt to contribute to theory by showing that: 1) There is not always a distinction between designer and user in information design practice (as emphasised by Frascara, 2015). 2) "Good" information design does not always consist of "correct English" and "consistent writing style" (as stressed by Pettersson, 2002). Our study shows that the user-participation in design is considered a quality improvement. Our contribution for practice is to support a human centred perspective on language in context of use; to create an awareness of the benefits of user-participatory in design of assembly instructions in an eventual transferring of paper instructions to screen.

THEORETICAL PERSPECTIVES

Human experiences are in focus in Human centred design, rather than a design driven by technological development disregarding the needs of the user (Krippendorff, 2006). This is to "make sure that (1) the user can figure out what to do, and (2) the user can tell what is going on" (Norman, p.188). The Information design research group at Mälardalen University, Sweden, also situate the user at the centre of research projects on informative images, texts, spaces, and their interactions (see Eriksson, Johansson, Björndal, 2011; Schaeffer and Carlsson 2014; and; Chirumalla, Eriksson, and Eriksson 2015). In *Information design as principled action*, however, Frascara (2015) makes an "ethical" point of *separating* the designer and user in information design. The user is the "the other" to be considered by the designer (p.5). Our study questions this distinction

(see also Carlsson & Schaeffer, 2012 and Schaeffer, 2014).[8] We also question the notion of good information design, through Wittgenstein's (2009) challenging of the perspective that every word has one meaning and that "[t]his meaning is correlated with the word" (§1). Words and sentences instead get their meaning through the *context of use*: "In the practice of the use of language […] one party calls out the words, the other acts on them" (§7). The process of gaining meaning through the use of words is called a language-game (ibid.). To make oneself understood through language thus requires an agreement on definitions through its context of use. Consequently, if a context of use thus defines a term different from a dictionary, the term functions for the users.

METHODS

The methods used are interviews, observations, and functional text analysis. Observations took place at one assembly line (2013-11-25). Using a semi-structured guide we deep-interviewed two operators (O1 and 2), a team leader (TL), an assistant team leader (ATL), and a production technician (PT). The functional text analysis was conducted on three types of texts linked to assembly. We looked at the text's situation, function, and style (Hellspong, 2001). The Element sheet was singled out as a consequence of analysis, mostly affecting the roles of designer and user, and 11 sheets were studied further.

THE COMPANY AND STANDARDISATION WORK

The line studied is in a factory belonging to a multi national company. Lean production and standardisation work has been implemented since 2011. The operators worked in groups (Observation 2013 and ATL). In standardisation work the operators participate in writing the existing standard of an operation, i.e. the method used, so that another operator can read it. According to Liker (2004), standardisation work is not a fixing of a final method, but a starting point from which one continuously improve. Standardisation is part of the company's stable processes (XPS, 2013).

EMPIRICAL FINDINGS

The Documents

Three types of documents linked to assembly are located in a binder at the balancing board of each station on the line (Observation, 2013): The *Work instruction* is the oldest type of document, used before standardisation; an abstract drawing of components, with arrows, and article numbers, showing the design of the product (PT and XPS, 2013). The *Standard Operational Blade* (SOB), and the Element sheet, was introduced in standardisation. The SOB includes order of operations, times, a layout of the operator's movement, and variants. It has short sentences on "what" to do, pictograms on safety,

[8] The digital era's possibility of, for example, text participation has established an acknowledging of the reciprocal communication (see Jacko, 2009 and Kweon, Cho, & Cho, 2009). The designer is then dislocated from always being an expert in contrast to the non-expert user. In Information design theory this perspective is lacking.

critical moments, quality, and ergonomics, and it hangs at the station (XPS, 2013 and Observation, 2013). The *Element sheet* contains the best known agreed upon practice, the standard, of "what, "how", and "why" in assembly. It follows the same table form in the whole factory, as does the SOB, and shows one activity linked to a certain time (tempo); the smallest standard time in the production cycle. It contains information required to perform a safe work with the right quality on the right time (XPS, 2013). Photographs are used "to facilitate understanding" (ibid.) and they sometimes have arrows marking movements and circles showing focus points. It also includes pictograms, as in the SOB (ibid.). If there are options, there is a sheet of each variant. Article numbers are not allowed in the Element sheet (ATL).

The Functional Analysis

The ideal is not to use documents during assembly (ibid. and PT). When they *are* used, they occur in four situations: 1) If *a need of information arises* one firstly turns to a colleague, thereafter to documents (ATL and O2). The Assistant team leader notes the importance of checking the standard in the Element sheet (ATL). The SOB is the text quickly looked at for time, order, and special attentions (Observation, 2013 and O1). The main function of the Element sheet here is to be a correct instruction. 2) In daily *work observations,* the Element sheets are used to see if standard is preserved or needs improvement (XPS, 2013). Operator participates in the re-writing (ATL), small discrepancies are found frequently (ibid. and O1). The main function of the sheet in work observations is to be the standard (the SOB is updated if affected by an updating). 3) In *education,* when an operator is new, or if there is a new model, the operator reads the binder and works under supervision (up to two weeks) (ATL). The main function of the Work instruction in education is to teach about the design of the product, which is relevant for memorizing actions, linked with articles. The main function of SOB during training is to teach sequence, time of operations, and movements of the operator (XPS, 2013). Another function is to teach when safety, quality, a critical moment, and ergonomics are highlighted. The main function of the Element sheet here is to clarify the standard. Relevant for cognition, is the reason for a method (the "why") (O2). 4) To *seek/solve a problem* in production. If standard is followed it should not be a problem with that operation (ATL). If there are discrepancies it will be discussed, checking if updating is missed or if the operator needs to be informed of standard (ibid. and O1).

The documents are then used if question arises during assembly, in work observations, training, and in problem seeking/solving. They have different functions in these situations, but only the Element sheet has the functions of being *documentation*; an *instruction*; and *education* material. It is the knowledge of the operators that enables establishing a standard and sustaining these functions. The problematic document is the Work instruction, not continuously updated, needing the operators to memorise the article numbers – its main information – from training (PT and Observation 2013).

Concerning the production of the documents, a preparer and production technicians create the Work instruction, before a new model is introduced (ATL and PT). Production technicians, assistant team leaders, and team leaders write the SOB (PT). Operators can participate, through the technician. In an earlier phase of standardisation, the operators

updated the SOB's themselves, which created problems with the times (O2 and PT). Element sheets are, however, "owned by production", i.e. assistant team leaders and team leaders creates them, when a new model is introduced or takt-time is changed, *together* with operators. This is initial a heavy work (ATL). From the beginning the Element sheets were written by the production technicians, i.e. a top-down design, but they were not used by the operators (PT). The product technician and the assistant team leader insist on the importance of involving operators in writing; it is regarded as quality work (ibid. and ATL). The multiple authorships, however, result in that the 11 sheets studied have seven authors (or combinations). This user-production affects the style, as we shall see, not in a direction that matches theory on "good" design.

There is a standardisation of some terms (PT) making it easier for a trainee having worked in another group. The similarity of the table form throughout the factory also supports a learner. But there are no meta-texts, no explanations of concepts. Only a few headings can be seen as guiding the reading. In that sense, the text is a weak compromise of being an instruction and an educational material.

The main parts of the Element sheets are: "What", "How", "Why", illustrations, and time. There are also possibilities of writing the history of safety and quality problems. All parts of the text participate in all functions (documentation, instruction, education). In interviews, it is stressed that the functions are sustained (ATL, O1, O2, PT), but all informants stress that updating requires a lot of work.[9] There is a shortage of text on "why" affecting the educational function. Most text is on "how" something is done, sustaining all the functions. This suggests that the Element sheet in practice is the work instruction; a text that "describes how something is done" (Instruction, 2015).

To determine the *style* of the text, we looked at the relation between the language, the functions, and the target group. The functions being document, instruction, and educational material and have the reader group: the operators. The language is a mix of technical, instructive, formal (specific concepts, imperatives, old-fashion/formal words) and of everyday language. Examples of technical terms are "reversing alarm" and "check valve". Imperative sentences are: "Assemble the lower clamp" and "Dismantle the plug in the engine." The Swedish old fashion "ej" (E. "not") is used, not the everyday word "inte" and the verb "control" is used instead of the spoken language "check". We also found recurring verbs, such as "fixate" and "install"; examples of standardisation. A frequent loss of punctuation in single sentences and at the end of paragraphs, spelling as well as grammatical errors and together-writings of words can be seen as an everyday character of written language. One word is both spelled correct and wrong, possibly caused by the multiple authorships. A both local and technical used expression, "Anthra the nut" [Swe. *Äntra*] is used, in Swedish a word for "boarding" or "climbing on to" something. Here the imperative is used for placing a nut on a screw before fasten it. A metaphor, "the stomach" of a tube, is used for its convex bending. The Assistant team leader stresses that the operators, before standardisation, used more metaphors (ATL). He argues that the groups' own language can be good information: "If you have 40 differently marked tubes, you might need a way of remembering. This is not allowed in

[9] The binder has post-it notes; updates not yet written in the standard (Observation, 2013).

the documents anymore […]. A 'yellow-pink' tube going up was called 'China' and a 'blue-pink' tube going down was 'USA'. This is still used orally, for the memory in training (ATL).

Although a mix of styles, with the ambition of standardising language along with using the operator's own – not grammatically correct, spelling and punctuation errors, and the local vocabulary – they are still texts well functioning in the context of their use.

Result

We asked whose language is used in the instructions and how the texts functions? As we have seen, the closer the instruction comes to operator's practice of assembly, the more influence the user has over the text production. The integrated producer-user role regarding the Element sheets suits the functions of being documentation, an instruction, and education material. The least functional document is the document, the Work instruction, furthest away from the operator's participation in designing. This practice of producing and using the assembly instructions does then not subordinate under the theory of the user as the "other" than the designer. That the mixed style of language and home-grown words used is functioning well can be understood through Wittgenstein's (2009) theory that words and sentences gain meaning in its context of use. Language in "good" information design does then not always consist of correct grammar or coherent style.

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