Designing with Values

A designer's framework for delivering personalised media in an unencumbered interactive environment.

Chris Rust* Jeff Baggott* Mark Blythe** Peter Wright* Alison McKay***

Sheffield Hallam University, Sheffield, UK, chris@chrisrust.net
*** University of York, York, UK*
****University of Leeds, Leeds, UK*

Abstract: This paper describes the evolution of a design and development process for a museum exhibit that delivered unencumbered or ambient interactive media using personal values as the main framework for customising interaction and thus for selecting and developing content. The context of the work is the developing field of products and systems that incorporate rich digital content.

The work took place as part of an interdisciplinary research project that explored how people might interact with rich digital media in an unencumbered computing environment. An examination of the historical content of the planned exhibition, and the different stakeholders who influence that content led us to identify a set of ideas based on the different values at work, for example the different motivations and professional focus of the two main curators. This was then used as a reflective framework for the production of visual, video and audio material that could be incorporated. At the same time technical concepts were developed to define the opportunities for interaction and presentation of content in ways that emphasised unencumbered interaction using body movement and sensors rather than explicit computer devices.

A second review allowed the value framework to be re-evaluated in the light of the content that had been created and the content was coded against that framework. An algorithm was developed that allowed a database to track visitors' interactions and maintain a developing profile of each visitor, with the content that they saw both responding to and testing that value profile.

The result was tested in a live exhibition with members of the public and was found to provide an engaging experience. However the main findings presented in this paper will be in the process of development and how it allowed the design group to work with values while accepting that these were provisional rather than definitive. This will be discussed in the light of existing theories that govern the design of museums and their content and also theories of designing including recent thinking which draws on Polanyi's theories of tacit knowledge to describe a role for designers in tacitly processing experience rather than explicitly executing a brief.

Key words: Interactive Media, Museum, Unencumbered, Personalised, Values.

1. Introduction: research topic and context

This paper arises from an interdisciplinary research project that used the development of a public museum exhibition to explore how people's experience of interactive media in public spaces might be "personalised".

The project has been concerned with the implications of future technologies. We are interested in working with large sets of images, sounds, speech and texts, and technologies emerging now will make it possible for such material to be presented in a variety of ways that are 'unencumbered' by today's computing hardware. In theory at least, any surface might display dynamic images, sounds might be directed exclusively to any individual or group in a public space and the precise location, posture and identity of any individual within that space might be known at any moment. We replicated some of these functions, using existing techniques which provided usable, if limited, unencumbered interaction.

The research was driven also by an interest in personalisation or 'mass customisation', important in manufacturing and in web design. For many years technology and industrial management has focused on individualised products or experiences (eg Mather 1988, 192-194, Gilmore & Pine 1997), or designs that allow visitors to find personalised material on websites (eg Kobsa et al 2001). It is widely understood that consumers have diverse tastes and interests, and marketeers have sophisticated ways to describe that (eg Goss 1995), but we do not have equally sophisticated ways for consumers to shape experiences through direct action.

The location was a public museum, the Royal Armouries in Leeds, England, where we designed and installed a section of an exhibition about mediaeval history and historic manuscripts in order to explore the design problems of unencumbered interaction. However we assumed that the work would be valid anywhere that rich and complex material might be available to a variety of people with differing interests and inclinations. Our imagined audience will not be engaged in information-seeking, the "goal-driven rational behaviour" assumed in many studies of interaction as characterised by Torrey et al (2009). Falk and Dierking (1992) explain that some museum visitors may be goal driven but half of the visitors that they encountered were not. In our research we found that some visitors had expert interests in history or calligraphy but others showed no evidence of any specific interest. Instead we assumed that the audience might expect to be informed or entertained but have no explicit goals.

This idea might seem reasonable in the context of a museum visit which is usually seen as a leisure activity but this project has implications for a wider range of environments, particularly in retailing where visitors might be thought of as a task-driven but, as Mathwick et al (2002) describe, a big proportion of shoppers are "motivated by the process rather than by shopping goals or outcomes." Reber (1993, p14) goes further, reviewing research into how people made and justified decisions in real world situations, as opposed to controlled research environments, suggests that intuitive or "mindless" decision making is the norm in most areas of human activity,

During the project we adopted the idea of 'values' as a thinking tool although we did not engage with values as an issue. Rather we used 'values' as shorthand for ways of organising material and interests to reflect the different agendas that individuals and groups bring to a museum visit or other experience. In taking this approach we were mindful that we could not assume any neat categorisation of interests or values that would map onto both the exhibition materials and the interests of individual visitors, we were seeking an approach that would allow future designers and future audiences to influence future software systems (generally thought of as 'artificial intelligence' systems although the concept of artificial intelligence is not universally accepted) that will manage very rich context for very diverse audiences.

In that context our exhibition could be viewed as a manageable sub-set of a much wider set of potential material and interactions. This greater set could not be 'managed' or designed by a reductive or atomistic approach but might be controlled by software that can integrate the results of a large number of design decisions and audience interactions to develop an increasing 'understanding' of each visitor and their relationship with the rich materials available, whether the setting is educational, entertaining or commercial.

This raises some difficult ethical questions. It is not possible for a system to provide personalised responses to individuals without maintaining some kind of data profile of each person and many societies regard such monitoring as deeply undesirable. Apart from the danger of individuals being manipulated or exploited by the owners of such data there is great concern today about identity theft and this may take new forms in future.

This issue has been brought into focus more sharply by the rise of Radio Frequency Identification (RFID) technology, providing a means to identify people and record their actions and movements. It was one of the technologies explored in our project and we anticipate that it will be an important technique in future applications of 'unencumbered' computing. Critics (eg Albrecht et al 2003) warn against oppressive use of these "spy" technologies but it is also arguable that they might be enabling if individuals can control when and how they operate. In this project we were not in a position to address the wider aspects of this or the technical solutions that might arise but we started with the assumption that participants must be aware of the techniques in action and have the freedom to influence and subvert them, implying some explicit choice and manipulation by users. One of the questions we wanted to investigate was how well people could recognise how and when our background system was influencing their experience.

2. The Exhibition: material and technology

The arena for this research was provided by the Royal Armouries Museum and their exhibition based on the mediaeval *Chronicles of Froissart*. Jean Froissart was a court poet and historian, connected with both sides of the European 100 Years War (1337-1453) between French and English claimants to the throne of France. He gathered a rich contemporaneous account of the history of the war and ordinary people's experiences in it. This masterpiece of journalism became the text for illustrated manuscripts produced for rich clients by a Parisian entrepreneur, Pierre de Liffol. While Froissart's text was unvaried, each book was produced with an eye to the prejudices of the purchaser, influencing the visual narrative in the stylised illustrations. Like contemporary movies, the books were a product of a network of studios and master craftsmen, with similarly high budgets.

Fig 1. Image from *The Chronicles of Froissart* Bibliothèque Municipale Besançon, ms 864, fol 150.
Reproduced by permission of Bibliothèque Municipale Besançon.

One of the curators, Prof. Peter Ainsworth of University of Sheffield, and a calligrapher/photographer, Colin Dunn, had conducted a substantial long-term project to photograph the chronicles in museums and libraries around the world, primarily to provide the raw material for detailed studies by Ainsworth and other historians and linguists. However these images also provided rich and beautiful illustrations which, together with an original Froissart manuscript and the Royal Armouries' collection of mediaeval arms and armour, provided the raw material for the exhibition, which included physical, graphical, audio-visual and interactive elements.

One of the difficulties of the research was that the main exhibition was unsuitable for unencumbered interaction because it contained a large amount of explicit interactive material, so we had to create new content for the unencumbered area. However this challenge, which was not anticipated at the start of the research, created the main arena for our thinking on how to design for unencumbered interaction.

The technical installation was the result of a review of a wide variety of interactive techniques that might simulate future 'unencumbered' interaction. We found that most of the promising technologies, such as active RFID, were unable, at their present stage of development, to provide precise positioning data in enclosed spaces. Similarly we found that techniques for providing focusing audio content on individuals or groups, were disrupted in our confined space. However we were able to develop a technical 'prescription' using available technologies that gave a sufficiently unencumbered interaction for the research.

Our project team created an introduction to the exhibition in a wide entrance corridor approximately 15m x 2m. We installed a false wall along one side which appeared to be a conventional display of printed graphics showing images from the Froissart Chronicles with some text about the exhibition.

The wall concealed digital cameras, light boxes behind selective areas of images and text printed on the rear of translucent sections, loudspeakers, amplifiers and computers to control these devices and distribute audio content. The key to the interactions was a system of badges worn by visitors, each with a different colour

to identify them. A computer analysed live camera images of the corridor to identify who was standing where in relation to the display which had ten 500mm wide 'stations' along its length.

This system was sensitive enough that a person could trigger the different stations to perform by swaying from side to side across the boundary between them, or could trigger the system to start or stop by turning towards or away from the wall, providing bodily interaction that might be become 'intuitive' in a short time. Initial evaluation with Royal Armouries staff indicated that this was a very engaging form of interaction and the exhibition curator was quick to become interested in its potential.

This hardware was controlled by Max/MSP software widely used in interactive artworks and the main designer of the technical system was an artist/programmer with experience of creating technical interactions or dynamic behaviours in exhibition spaces. This 'front end' system, which gathered data and operated the 'outputs' of the exhibition communicated with a 'backroom' system, using more traditional MySQL database software, designed by a software engineer, that managed the personalisation process as described below.

3. Content Development and Personalisation

One of our challenges was to provide tacit interaction but build also on the experience of engineers designing database systems to support explicit customer choices in the mass-customisation environments outlined above. Other research investigates how consumers might shape products for themselves (eg Atkinson et al 2008) but we aimed to operate at a visceral, tacit level, allowing individuals to reveal interest without making explicit choices.

Our main interactive content was a large set of audio recordings, including experts discussing aspects of the history and the objects in the main exhibition, actors performing scenes from the Chronicles and readings from Froissart's text. These were produced by members of the research team following preliminary readings and discussions of the Chronicles within the team and with the expert curators. From these discussions we recognised some distinct personalities and passions of people, historical and contemporary, who influenced the exhibition. The journalist's instincts of Jean Froissart, the glamour and pride of Sir John Chandos, a key figure in the war, the forensic insights of Karen Watts, Curator of Armour and the scholarly passion of Professor Peter Ainsworth all illuminated the exhibition and seemed to represent different values that visitors might associate with. We identified a set of 7 working 'values', particular to this exhibition, to inform development of content and personalisation.

Passionate
Historical/Clinical
Personal
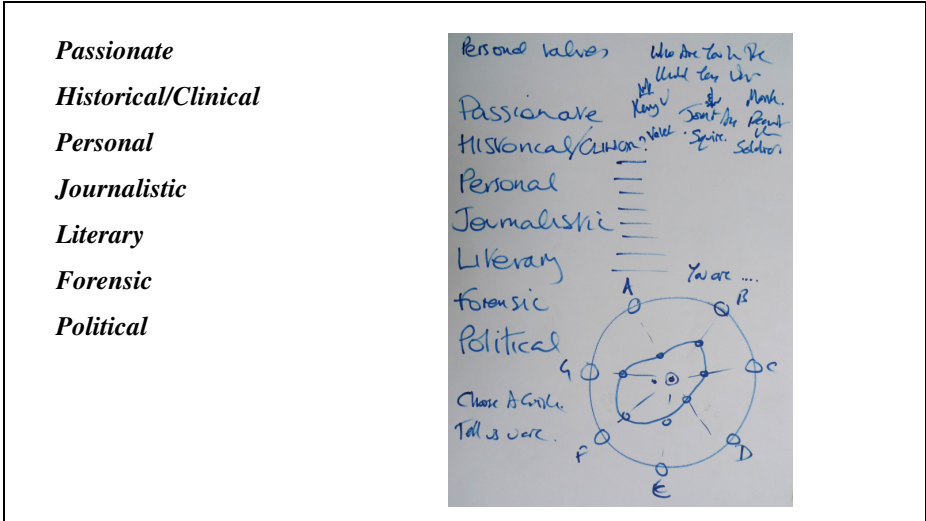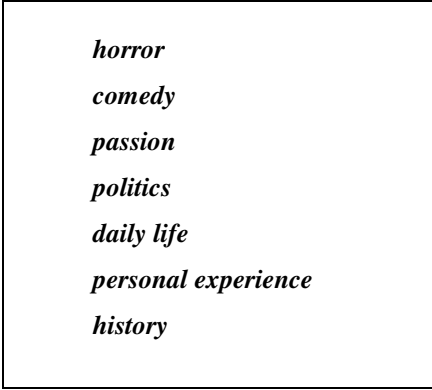*Journalistic*
Literary
Forensic
Political

Fig 2, initial list of 'values' and concept sketch of a user profile

These values did not define 7 separate types of visitor but might form the basis for a wide variety of profiles to help create individualised experiences. Cultural researchers, such as Hofstede & Bond (1984) and Smith et al (2002) have sought to identify relatively fixed frameworks of significant values that might predict the behaviour of people in communities. In contrast we used the term "value" as a working concept, not related to any particular theory of values or culture, but simply shorthand for the particular focus or interest that an individual or group brought to the material in the exhibition.

This led into development of content which included the main audio recordings and a smaller quantity of video content that allowed us to explore further technical possibilities for future research. The initial set of values were not applied in a highly specific or narrow way, rather they formed a point of reflection for the production team to help them identify useful directions in development, when planning recording sessions or as the material emerged. As discussed below, in this creative work we wished to allow space for the insight of the design team to work, informed by the value framework but not explicitly driven by it.

This material was then re-coded (considering the initial value scheme as a tentative first coding) as ethnographic material might be coded using content analysis. Broad categorizations were identified similar to the original set of values but with some variations and the initial coding was then checked and modified with another coder (inter-coder agreement was high). This led to 7 new categories or 'values'

---

horror

comedy

passion

politics

daily life

personal experience

history

Fig. 3 Second list of 'values' from coding the actual content

The first five categories are perhaps self explanatory, others require more explanation. The "personal" code indicated a focus on particular characters and their individual stories rather than broad movement of battle or people; the "historical" code indicated a more scholarly focus.

To manage this content we developed a database that used the value scheme to build profiles, an array of linear scales indicating a visitor's interest in the different values we were using. An initial profile of each visitor entering the exhibition was created using explicit means, by offering a way of moving forward and back through short animations with a physical dial to find a location in each animation that felt 'comfortable' to them, matching a point on one of the value scales. This was done in an explicit and humorous way, eg an execution scene which became progressively more gory, introducing the visitor to the principles at work. However, having

developed this tool, we will have the opportunity in future to explore more subtle ways to use visual material to represent a range of ideas or scale of interest since any sequence of images might be combined to provide a progressive scale of options.

Once the visitor enters the exhibition, the software is able to update these profiles, depending on the level of interest shown in different content. Initially the software presented material with a profile similar to the visitor. As the visitor moves back and forth between the different stations, if they pay particular attention to certain material their profile can be adjusted to give greater weight to the most significant values in the content they are viewing. Similarly the software can begin to introduce material that might not be predicted by the visitors' existing profile to discover whether they will show an interest..

4. Evaluation

The main evaluation of the system in action was conducted over a period of three days during a busy school holiday period, Visitors to the museum were recruited as research subjects, most people approached were willing to take part. Initially the subjects were accompanied around the main Froissart exhibition and asked about their reasons for coming, how often they visited galleries and what other cultural activities they enjoyed in order to establish their agenda (Wright and Monk 1991) and "habitus" or cultural background (Brown et al 2003) Participants were then taken to the experimental exhibition corridor and asked to take part in a co-operative evaluation (**Error! Reference source not found.** 1986) of the work. Eighteen visitors took part in co-operative evaluations, four museum hosts were interviewed about the exhibit in general, and the co-curator Karen Watts also took part.

A diverse range of visitors were interviewed including family groups with young children, young couples, middle aged couples and single elderly visitors.

Although the system was working for the first two days a technical problem developed on the third which meant that some visitors saw the system breaking down. However, this in itself was interesting as explained below.

The initial profiling exercise, where participants made explicit judgements of the values in several entertaining animation sequences, was generally found to be amusing and engaging by all of the participants although one commented that children might enjoy it more than adults. Some of the visitors found certain categories confusing, for example it was not clear that "personal" meant a focus on particular individuals. Others offered incorrect interpretations of the visual material and there is a need for further work to explore the relative usefulness of explicit and intuitive interaction. As discussed below, Reber (1993) has suggested that the tacit aspects of decisions are pre-eminent in all human activities and theorists tend to put too much faith in explicit factors.

The unencumbered interaction mode was immediately clear to all participants. Moving along the corridor to trigger sound was immediately understandable. The stations were very close together and very slight movement would trigger the system to switch to an adjacent station with its own content, although participants quickly understood that if they moved backwards again it would take them back to the previous track at the point where they had left off.

All of the participants were enthusiastic about the idea of personalizing the content. Although the system failed to work as intended for three groups of visitors the partial performance gave a clear illustration of

how it would work and they could all see great potential for such a system. The most enthusiastic visitors were in family groups containing children. A niece and uncle visiting from Birmingham were positively gleeful about the interface and the interaction mechanism. They visited galleries together regularly and looked forward to the day when all collections would be personalisable in this way so that they could "get rid of the boring stuff". Although there was a degree of enchantment with technology for its own sake they also responded positively to the stories and improvisations they heard.

The visitors spent around fifteen to thirty minutes listening to content though it should be noted that this was interrupted by co-operative evaluation conversations with the researcher. Although the young children enjoyed the interface they spent less time listening to the content than the adults.

There was some discussion about how best to trigger the personalisation and whether badges were appropriate. Some visitors reacted well to the idea that dressing in relevant clothing might be an interesting way to participate, but one said that would make them self-conscious and preferred a badge.

Four of the visitors had expert interests in the exhibition, an amateur expert on Froissart, a calligraphy enthusiast and two academic historians. The amateur experts were less interested in the interactive content, the calligrapher wanted to see more calligraphy and the Froissart expert was very familiar with the material in the audio performances already. The professional historians, in contrast, expressed the view that the personalised system would be a much better way to exhibit historical material for a wide audience than conventional museum displays.

When the technical system failed to work as expected it was notable that the participants were still able to recognise how it would work and how they could use it, allowing them to speculate on the potential of the system and express positive attitudes towards it. Most participants demonstrated a degree of 'enchantment' with the interaction, they they understood how it worked technically but that did not prevent them from enjoying its 'magical' properties.

5. Discussion, Conclusions and Further Research

The project has demonstrated an approach to developing personalisable content and delivering it within an unencumbered interactive system. It has explored how the idea of 'values' might be used to align content with the agendas that individual participants bring with them, it has examined how participants experience, understand and interact with such an unencumbered system. Other aspects of the project not described here have investigated the use of literary pastiches as a tool for human-centred design, supporting the evaluation of concepts and design detail for the technical system.

At the start of the project it was not clear to the various members of this interdisciplinary research group how we might combine our different approaches. In particular we had two quite different and apparently opposed views of how customisation might be achieved. From the engineering perspective, informed by experience with industrial systems that support customisable manufacturing, we had a well-developed approach which used the skills of software engineering to capture the explicit intentions of stakeholders to manage complex choices. From the point of view of the art and design group this was too directing and did not acknowledge the tacit nature of many human decisions as discussed above (eg Reber1993). However, at that point, we lacked ways to systematise that tacit engagement.

By reflecting on the nature of the materials in the exhibition we were able to identify an initial framework of 'values' that could guide the design development, and that in turn indicated a possible 'system' that might support software development as indicated in the sketch, from an early brainstorming session, shown in Fig 1. That concept of 'value profiles' provided a basis for the project's software engineer to develop a database system that could support the personalised exhibition while the design group were exploring the problem of content and values in a relatively tentative way.

It seems to be a vital part of the exhibition design process that we treated the value framework as tentative and negotiable. One of the working assumptions of the project was that designing deals with "wicked" problems as characterised by Rittel and Webber (eg 1984) and that our design methodology should reflect that. Rust (2009) has discussed how wicked problem theory might guide design methods, starting with Rittel and Webber's characterisation of the process of resolving wicked problems:

> *…an argumentative process in the course of which an image of the problem and of the solution emerges gradually among the participants, as a product of incessant judgement, subjected to critical argument.* (Rittel and Webber 1984)

Rust (2009) pointed to research by Bowen (2009) that demonstrates this principle in action. Bowen uses Michael Polanyi's theories of tacit or personal knowledge in action to explain the principle that designers can tacitly process experience into new designs without explicit analysis or commitment to narrow design aims (ibid 171-173). This also reflects the work of Henrik Gedenryd (1998) who pointed out that classical models of designing and other complex thought imply a progression from analysis to synthesis, whereas in practice designers move quickly into ideation as a means of thinking through a problem. Rust (2009) argues that Gedenryd, Rittel and Webber and Bowen together provide a model for designing in which, in Rittel and Webber's words, *an image of the problem and of the solution emerges gradually among the participants.*

This project has followed that path. The initial 'values' gave us impetus to start developing a software framework and also develop content. From the content a new set of values emerged and were subsumed into the software but we did not assume that these were in any way final or definitive, simply an organising method that enable us to "prime the pump" and allow future systems to evolve a much richer framework for interaction with much richer content. Our assumption is that such a complex system would arise from a combination of individual design projects providing new sets of 'value-based' content, and future software having the means to infer much richer profiles (for both content and users) from users' engagements with the system.

So by working with tentative values, arising mainly from their tacit interpretation of the material, the designers were able to create a framework for personalisation that has potential to grow with use. The most important thing about the values is not the explicit labels attached to them, but the way they allow the designers' insights to shape the software sufficiently for people to interact with the exhibition. In time the effect of those insights will probably fade as a more "intelligent" future system identifies more relevant patterns emerging in people's interactions, but our approach provides a tool for designers to create material and insert it into such a system.

To develop this work further the technology has been built into a set of portable "black boxes" that allow such exhibits to be set up more freely in a variety of settings. A project workshop has explored how this might be used to present an existing oral history archive owned by the English Heritage organisation and future

plans include more in-depth exploration of user interaction with the system using this equipment in a laboratory setting allowing greater technical control.

Albrecht, K. and 51 others (2003) *Position Paper on the Use of RFID in Consumer Products,* online at http://www.spychips.com/jointrfid_position_paper.html

Atkinson, P. Unver, U. Marshall, J. Dean, L (2008) Post Industrial Manufacturing Systems: the undisciplined nature of generative design, *Proceedings of DRS2008, Design Research Society Biennial Conference, Sheffield, UK July 16-19 2008*, online at http://www3.shu.ac.uk/Conferences/DRS/Proceedings/Papers/A/Atkinson_et_al_DRS2008_194.pdf

Bourdieu, P (1986): Distinction: a social critique of the judgement of taste. London, Routledge and Kegan Paul

Bowen, S. (2009) *A Critical Artefact Methodology: Using Provocative Conceptual Designs to Foster Human-centred Innovation* PhD Thesis, Sheffield Hallam University [online at http://www.simon-bowen.com/?page_id=40]

Brown, B. MacColl, I. Chalmers, M. Galani, A. Randell, C. Steed, A., (2003) Lessons from the lighthouse: collaboration in a shared mixed reality system CHI 2003 577-584

Falk, J., & Dierking L., 1992, *The Museum Experience* Whalesback Books, Washington DC

Gedenryd, H. (1998) *How Designers Work: Making Sense of Authentic Cognitive Activity* PhD Thesis, Lund University. [online at http://www.archive.org/details/HowDesignersWork-MakingSenseOfAuthenticCognitiveActivity]

Gilmore, J.H. Pine, J. (1997), The Four Faces of Mass Customisation, *Harvard Business Review, Jan-Feb 1997*

Goss, J. (1995) "We Know Who You Are and We Know Where You Live": The Instrumental Rationality of Geodemographic Systems, *Economic Geography,* 71, 2, 171-198

Hofstede, G. Bond, M.H. (1984) Hofstede's culture dimensions, an independent validation using Rokeach's value survey, *Journal of Cross-Cultural Psychology* 15, 4, 417−433

Kobsa, A. Koenemann, J. Pohl, W. (2001) Personalised Hypermedia Presentation techniques for Improving Online Customer Relationships, *The Knowledge Engineering Review* 16, 2, 111-155

Mather, H. (1988) *Competitive Manufacturing* Prentice Hall

Mathwick, C. Malhotra, N.K. Rigdon, E. (2002) The effect of dynamic retail experiences on experiential perceptions of value: an internet and catalog comparison. Journal of Retailing 78, 51-60

Reber, A.S. (1993) Implicit Learning and Tacit Knowledge, an essay on the cognitive unconscious, New York, Oxford University Press.

Rittel, H. W. J. & Webber, M. M. (1984) *Planning problems are wicked problems.* In Cross N [ed] Developments in design methodology (pp 135-144). J Wiley & Sons, Chichester

Rust, C. (2009) *An Argumentative Process*, Sheffield Hallam University Art and Design Research Centre discussion paper [online at http://chrisrust.wordpress.com/2009/03/02/an-argumentative-process/]

Smith, P.B., Peterson, M.F. Schwartz, S.H. (2002) Cultural Values, Sources of Guidance, and their Relevance to Managerial Behavior: A 47-Nation Study, *Journal of Cross-Cultural Psychology* 33, 2, 188−208

Torrey, C. Churchill, E. F. Mcdonald, D. W. (2009) Learning how: the search for craft knowledge on the internet. In *Proceedings of the 27th international Conference on Human Factors in Computing Systems (Boston, MA, USA, April 04 - 09, 2009)*. CHI '09. ACM, New York, NY, 1371−1380

Wright, P.C. and Monk, A.F. (1991) Cost-effective evaluation methods for use by designers. International Journal of Man-Machine Studies 35.6, 891-912