

<b>Institution:</b> University of Sheffield
<b>Unit of Assessment:</b> 36 - Communication, Cultural and Media Studies, Library & Inf. Management
<b>Title of case study:</b> Embedding information behaviour in information systems development
<p><b>1. Summary of the impact</b></p> <p>Research in Sheffield since 1993 has focused on developing information-rich systems and services from a <i>user-oriented perspective</i> rather than a more technology-driven approach. This has ranged from the development of theoretical models that describe information behaviour and processes, to the design and evaluation of information-rich systems and services that are based on information behaviour models and that involve end users throughout the design process. The impact includes: (1) enhancements in the practices adopted in systems development within cultural heritage institutions (The National Archives, UK) and libraries (Online Computer Library Centre, US; M25 Consortium of Academic Libraries, UK), (2) improved support for further development and commercialisation of technologies by IT companies (Gnowsis, Austria; Intempra, Italy), and (3) downstream impacts in the form of knowledge transfer leading to new projects to further develop existing technologies and systems (led by Language Technology Centre, UK).</p>
<p><b>2. Underpinning research</b></p> <p>The design and development of effective and usable information-rich systems and services, such as search engines and enterprise knowledge management systems, present different challenges to those encountered in transaction-based systems, such as financial and human resources systems. This is due to the complex and changing environments in which they operate and the unpredictable nature of the tasks and processes that the systems must support. Effective development of such systems requires understanding and modelling of the users' behaviours and practices and their context, with a focus on user-driven rather than technology-driven approaches. Professor Tom Wilson (Sheffield until 2000) was one of the first to recognise the important role of context (e.g., personal characteristics, role, task and environment) on the information behaviours exhibited by individuals, including information use in problem-solving processes and passive forms of information acquisition, such as information encountering. This led to a body of research focused on defining and validating theoretical models of information behaviour which has resulted in greater understanding of the range of interacting dimensions that influence information practices and behaviour [R1]. Building on Wilson's work, user-oriented approaches to the development of information-rich systems have been adopted in two more recent strands of research at Sheffield: i) the development and evaluation of information retrieval systems and search engines; and ii) the development and evaluation of enterprise knowledge systems.</p> <p>Research by Dr Paul Clough, Dr Daniella Petrelli (Sheffield until 2011) and Professor Mark Sanderson (Sheffield until 2011) focused on the development of information retrieval and access systems for various tasks and domains. This included exploring new methods for gathering users' information needs and information about their online search tasks, studying patterns of information searching behaviours (e.g., through the analysis of transaction logs) and developing approaches to evaluate search systems (e.g., using controlled lab-based environments and through crowdsourcing). In the context of information retrieval systems development, Clough and Sanderson collaborated in the EU-funded project SPIRIT (grant n. IST-2001-35047; total funding €2.55M) in which user requirements and preferences were integral to the design and implementation of a spatially-aware search engine for location-based search services, e.g., finding local services when using mobile devices [R2]. In the context of evaluation, Petrelli demonstrated the value of user-centred evaluations as an essential method for designing the user interface of a cross-language information retrieval system [R3] in EU project Clarity (grant n. IST-2000-25310; total funding €2.09M). More recently, Clough and Sanderson investigated the use of crowdsourcing as a means of gathering relevance assessments for search results from search services at the UK National Archives [R4]. The basis of this research was to understand current patterns of use for existing information services and establish future processes for evaluating search technology developments. Users' information seeking behaviours and search patterns have also been investigated in other domains including library catalogues (WorldCat and Search25) and</p>

## Impact case study (REF3b)

photographic archives (PA Images).

While the previous strands of research focus on the user as an individual, research by Vasconcelos on enterprise knowledge management systems focuses on information and knowledge sharing practices in collaborative and dynamic contexts involving group interaction. This has involved the development of a framework for understanding process models (i.e., those focused on behaviour and practices) and structural models (i.e., those focused on the attributes of knowledge) in the management of knowledge sharing practices [R5]. This framework has been applied in the design and evaluation of a knowledge management framework and system to support knowledge intensive practices in SMEs [R6], through the EU-funded project OrganiK ([www.organik-project.eu/](http://www.organik-project.eu/); grant n. 222225; total funding €1.1M). The study involved working with the participating SMEs to identify and model their knowledge management practices and their localised knowledge sharing cultures in order to embed them in the development and evaluation of an enterprise knowledge management system. This system integrates semantic technologies, to support knowledge codification activities, and collaborative social enterprise software (Enterprise 2.0) to enable socialisation and collaboration practices.

### 3. References to the research

- R1. Wilson, T. D. "Information behaviour: an interdisciplinary perspective". *Information Processing & Management*, **33**, 1997, 551–572. [5-year journal impact factor IF =1.388, 152 citations in *Web of Science*]
- R2. Purves, R.S., Clough, P., Jones, C.B., Arampatzis, A., Bucher, B., Finch, D., Fu, G., Joho, H., Khirini, A.S., Vaid, S. and Yang, B. "The design and implementation of SPIRIT: a spatially-aware search engine for information retrieval on the internet". *International Journal Geographical Information Science*, **21**, 2007, 717-745. [IF =1.984; 14 citations]
- R3. Petrelli, D. "On the role of user-centred evaluation in the advancement of interactive information retrieval". *Information Processing & Management*, **44**, 2008, 22-38 [5 Year Impact Factor: 1.388; Citations WoS: 10]
- R4. Clough, P., Sanderson, M., Tang, J., Gollins, T. and Warner, A. "Examining the limits of crowdsourcing for relevance assessment". *IEEE Internet Computing*, **14**, 2013, 32-38. [Clough, output 1]
- R5. Ellis, D. and Vasconcelos, A. C. Knowledge Management, In Bigdoli, H. (ed.). *Handbook of Technology Management*, vol.1: Core Concepts. New York: John Wiley & Sons, 2010, p. 132-143. [Vasconcelos, output 2., chapter included in the core concepts and theoretical section of a prestigious publication with contributors from leading Universities from around the world].
- R6. Bibikas, D., Kourtesis, D., Paraskakis, I., Bernardi, A., Sauermann, L., Apostolou, D., Mentzas, G. and Vasconcelos, A.C. "A sociotechnical approach to knowledge management in the era of Enterprise 2.0: The case of OrganiK". *Scalable Computing: Practice and Experience*. **9**, 2008, 315-327. [Vasconcelos, output 3, revised and extended version of a previous paper selected as one of the best papers presented at the 11th International Conference on Business Information Systems and 2nd Workshop on Social Aspects of the Web]

### 4. Details of the impact

The significance of the research on user-oriented information systems design lies in the adoption of user models and user-driven approaches in systems development and evaluation practices. This represents an important cultural change in the practices of IT professionals and companies which are usually technology, rather than user, driven. The research has impacted on a variety of projects with multiple beneficiaries in both public and commercial sectors including cultural heritage institutions, health sector institutions, software development companies and companies in the cultural and creative, transport and logistics, and food sectors, in Europe and worldwide. This has led to the following categories of impact:

#### 1. Enhanced systems development and provision at beneficiary organisations

Clough, Sanderson and Petrelli's research on enhancing the performance of information retrieval systems through understanding users' information searching patterns (e.g., through analysis of search logs), the gathering of users' information needs (e.g., through interviews and surveys), and

## Impact case study (REF3b)

evaluating search performance has impacted on search systems hosted nationally and internationally and accessed by users worldwide. Direct impact has been through beneficiary funded research and includes independent projects on WorldCat, Search25, and the search system of The National Archives. Each project has resulted in a technical report that has been widely disseminated within the funding organisation and used to enhance the respective search system. Each project has followed-on from an earlier collaboration, for example: the lead collaborator at OCLC (WorldCat) was a participant in the MultiMatch EU-funded project; the lead collaborator at The National Archives is on the Unit's Advisory Board, contributes to the Unit's teaching programmes and is an alumnus of the Unit; and the Search25 project was initiated by a collaborator who had previously been at The National Archives.

- **WorldCat:** the world's largest network of library content and services used by more than 72,000 libraries in 170 countries, provided by the OCLC, US. *"...The findings and recommendations have been used to support enhancements and upgrades to WorldCat.org, as well as a marketing strategy... An enhanced version of WorldCat is available to member institutions and the changes to the system will impact most of the 25,900 OCLC member libraries, archives, and museums."* [S1]
- **Search25:** a search tool launched by the M25 Consortium of Academic Libraries in October 2012 that provides a single access point to the library catalogues of nearly 60 world-renowned institutions (e.g., The British Library and The British Museum) and specialist collections (e.g., Courtauld Institute of Art). *"The outcome from this work very clearly had a significant impact on the services provided by the M25 Consortium through informing the design of new search services"* [S2].
- **The National Archives:** publisher of the UK Government's official archive containing over 1000 years of history with a remit to collect and secure the future of physical and digital government record and make it as accessible as possible. *"The outputs of the work were provided in such a focused and timely way that they have been able to dovetail with our system development activities this year [2011] and inform critical decisions in designing our new resource discovery system to the benefit of the organisation and ultimately the public that use it"* [S3]

## 2. Development and commercialisation of new technologies and systems

Vasconcelos's research in the EUFP7 OrganiK project stemmed from PhD research funded jointly by the University of Sheffield and SEERC (South-East European Research Centre) in Greece during which Vasconcelos formed a new collaboration with SMEs in the IT sector that already had a relationship with SEERC. Impact was explicit within the funding scheme (EUFP7 Research for the Benefit of SMEs) which required that the participating SMEs co-own the IP and drive the development and commercial exploitation of the project. The research led to the development and evaluation of a knowledge management framework and system that has impacted directly on the SMEs. It has also led to further development and enhancement of the framework and system in different contexts in which the adoption of user-driven approaches and methodologies continue to be key. The technology is also being exploited commercially by two of the SME partner organisations who, under the terms of the funding, co-own the intellectual property rights, and have formed start-up companies. The clients of these companies are also beneficiaries of the research and include companies in the IT, creative and cultural industries, as well as the construction, transport and logistics, and food sectors. The two start-up companies that are exploiting the technology are:

- **Intempra** ([www.intempra.com](http://www.intempra.com)), an independent company that has its origins in SME beneficiary Syria Informatica, is further developing and localising aspects of the OrganiK system in the south of Italy, supported by the Regional Government of Puglia. This includes the development of Enterprise 2.0 solutions (i.e., the use of social media/software for internal and external enterprise-level collaboration) with incorporated semantic technologies. Implementations of Enterprise 2.0 solutions were carried out within companies in the automotive industry (Baldassarre Moto) and food sectors (Italian Cupcakes) in Italy and can be found at [www.intempra.com/it/portfolio.asp](http://www.intempra.com/it/portfolio.asp). *"The whole OrganiK project (not simply the*

framework) had a real strong and live impact on our companies, giving us more awareness about the next year market trends, how to manage the evolution of the web applications, how to help and drive customer needs, giving us the right company vision and mission to drive the change on the market, and being a successful company in this critical market situation.[...] What I learned ... was the methodology and the way to approach things” [S4] [S5]

- **Gnowsis** ([gnowsis.com](http://gnowsis.com)), spin-off of the leading German research institute DFKI, is a semantic web company whose main product is Refinder ([www.getrefinder.com/about/](http://www.getrefinder.com/about/)), a knowledge management system for small businesses (marketing agencies, artists, web-companies, technology start-ups and other companies in the media and cultural industries) in Germany and Austria, to enable better productivity of knowledge workers through personal information management. This system currently has c. 2500 registered users. *“The technology of the OrganiK project was an inspiration for what we are doing in Refinder [...] The benefit is in a better productivity of knowledge workers and in a cultural change, towards a self-controlled information management under the direction of the individual worker, away from a manager-controlled information management. This is also a cultural change.”* [S6]. The cultural shift from manager-controlled information management to self-controlled information management promotes much more stream-lined work processes. Refinder users and Gnowsis clients state: *“A lot of times information was left in e-mail inboxes or we wasted time with useless one-to-one e-mails - now we can focus on projects and activities instead of searching for missing pieces. Refinder improved the way we communicate as a global organization and gave us a structure to continue our growth.”* [CEO, FMX World] and *“We exchange tasks and documents with marketing and creative freelancers. Refinder helped us to keep track of them and increased the quality of our marketing activities. It saved us a lot of time already so that portatour can save time for sales reps.”* [CEO, portatour] [S7]

### 3. Downstream impacts

OrganiK partner, the Language Technology Centre (LTC), a language technology development company, has adopted and extended the OrganiK platform and system in the EU funded project MorMed ([www.mormed.eu](http://www.mormed.eu)) to *“[...] combine the semantically-enhanced social networking and content management OrganiK platform with technologies enabling machine translation and post-editing by human experts to make content available in multiple languages”* for medical communities. The OrganiK development approach has been adopted in this project. The system (available at [lupus.mormed.eu](http://lupus.mormed.eu)) has been developed for a community dealing with Lupus (Antiphospholipid Syndrome) and involves a reported c. 1000 users (researchers, medical doctors, general practitioners, patients and carers), at the following centres of excellence in Lupus treatment: Hospital Clinic Barcelona (Spain); Medical and Health Centre, University of Debrecen (Hungary); Universitaet Medecin Johannes Guttenberg (Germany); & Kings College London (UK).

### 5. Sources to corroborate the impact

- S1. Senior Research Scientist, OCLC Inc. can corroborate the enhancement of the performance of information retrieval features of WorldCat.
- S2. Chair of the M25 Consortium of Academic Libraries corroborates the enhancement of the performance of information retrieval features of Search25.
- S3. Head of Digital Preservation and Resource Discovery can corroborate the enhancement of the performance of information retrieval features at the resource discovery system at The National Archives.
- S4. CEO Intempra can corroborate the adaptation and localisation of the OrganiK platform for firms in the construction, transports and logistics, fashion, food sectors in Italy.
- S5. User stories from Intempra on Enterprise 2.0 solutions at [Intempra website](#)
- S6. CEO Gnowsis can corroborate the adaptation of aspects of the OrganiK technology into Refinder, and its use by small businesses (marketing agencies, artists, web-companies, other companies, mainly in the media and cultural industries and technology start-ups) in Germany and in Austria.
- S7. User stories from Gnowsis at <http://www.getrefinder.com/about/content/user-stories>).