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Research Project as Boundary Object: negotiating the conceptual design of a tool for International Development

Ann Light¹ and Theresa Dirndorfer Anderson²

¹Sheffield Hallam University, ²University of Technology, Sydney

¹*a.light@shu.ac.uk*, ²*theresa.anderson@uts.edu.au*

Abstract. This paper reflects on the relationship between *who* one designs for and *what* one designs in the unstructured space of designing for political change; in particular, for supporting “International Development” with ICT. We look at an interdisciplinary research project with goals and funding, but no clearly defined beneficiary group at start, and how amorphousness contributed to impact. The reported project researched a bridging tool to connect producers with consumers across global contexts and show players in the supply chain and their circumstances. We explore how both the nature of the research and the tool’s function became contested as work progressed. To tell this tale, we invoke the idea of boundary objects and the value of tacking back and forth between elastic meanings of the project’s artefacts and processes. We examine the project’s role in India, Chile and other arenas to draw out ways that it functioned as a catalyst and how absence of committed design choices acted as an unexpected strength in reaching its goals.

Introduction

The paper introduces Fair Tracing, a UK-led interdisciplinary project to research a bridging tool connecting producers with consumers across global contexts. We offer this work in conjunction with the conception of ‘boundary objects’, introduced by Star (eg: Bowker & Star 1999; Star & Griesemer 1989) as a way of acknowledging and exploring trans-disciplinary and trans-cultural interactions. In this way, we intend to show how the openness of a research agenda in combination with the power of some central ideas came to help embed

propositions from the project in contexts of use. In the process, we demonstrate how the tool's function and even the meaning of the design process became contested as work progressed. And we document the many perspectives that arose as the initial team widened to take in local research and business partners in other countries and as different interests offered their positions with regard to developing and using the projected software. In this way, we explore why, instead of narrowing, as most design projects do when research and prototyping start to reveal suitable constraints, the strength of the core idea turned it into an ever-widening site for multiple (often incompatible) versions of a Fair Tracing system.

This paper has two objectives: first, it seeks to contribute to our understanding of working with ICT across cultures and in a "Development" context. Second, it aims to extract more general value for CSCW from looking at an interdisciplinary research project with money and ambitions, but no clearly defined beneficiary group at start, and how its amorphousness contributed to its impact. These objectives recognise that there are many challenges to meet, including that:

- ICT for/and international development (ICTD) projects have a high failure rate in terms of uptake, even when a functional application is developed;
- Many ICTD projects are initiated without the intended beneficiaries; but are conceived by exogenous parties to improve others' wellbeing;
- Societal contexts, unlike workplace productivity contexts, do not constitute themselves into clear user groups for research teams to collaborate with in defining issues, setting boundaries and doing design;
- In Europe, as elsewhere, funded research is being increasingly required to show impact as well as the potential for it.

Before commencing, one ambiguity must be dealt with. The authors have accepted the convention of talking about 'Development' and 'International Development' to refer to promoting socio-political change in relations between global citizens and engaging in knowledge exchange across cultures. Leaving aside the legitimate discussion of whether such 'Development' is possible, desirable or can be supported with ICT, it is worth drawing attention to the convention used here that 'Development' refers to this domain, while, with lower case letters, it is the standard technological use of making products and services.

Project Background

In this section, we present an overview of the history and goals of the Fair Tracing project, the institutions and researchers and how they came to work together.

The Fair Tracing idea

The idea behind the Fair Tracing system is simple and powerful. It is a publicly-available tool that makes the provenance of any goods more visible by illustrating

the supply chain from producer to consumer and, in so doing, pushes practices towards ethical production and purchase. In particular, it is intended to give visibility to small producers in emerging economies operating in global markets. Indeed, the name of the tool acknowledges its relation to the Fair Trade movement which supports producers in developing countries committed to social investment in their communities. The tool is to improve life for both ethically minded traders and consumers who wish to understand and discuss the origin of their purchases.

The idea caught in the Fair Tracing project is immediately comprehensible and has been popular with everyone from designers to producers to consumers. The name ‘fair’ wins instant approval. However, it is obvious there are complexities below the surface, such as, what constitutes ‘fair’: the tool opens up a discussion of design for social justice (Light & Luckin 2008). Practical implementation is non-trivial because of many factors, not least that it incorporates two key human activities (production and consumption), doing so specifically in a contextualised way to allow sameness and difference across the world to be determined. It deals with values and their presentation across cultures; brings issues of information retrieval and architecture; has to accommodate differences in producers’ readiness to contribute information and meta-data about it (which can be automated in IT-mature contexts) so as not to affect the overheads of use beyond tolerance, etc¹.

The project was funded to research the building of such a bridging tool and contribute understanding of its potential for implementation and use *in context*, beyond individual technological components², over a three year period till 2009.

Genesis of the Idea

The Fair Tracing idea was conceived in a workshop on socio-technical ways of “Bridging the Global Digital Divide” (BGDD), run by the UK’s Engineering and Physical Sciences Research Council. Because of this birthright, the thrust of the project was using information technology to put small-scale producers in emerging economies in touch with their markets overseas. Four researchers grouped round this idea in the workshop, later to evolve into the project’s management team. The four comprised a political scientist with links to India (M1); an economic geographer with Chilean experience of participatory practices (M2); a social informatics/HCI specialist concerned with the politics of design (M3) and a computer scientist into security and ethics (M4).

¹ There are other complicating factors, such as the way that products change nature en route, e.g. grapes from multiple vineyards becoming wine, or become other products, like cotton and buttons becoming shirts. There is the sheer number of elements to be recorded and manipulated if every instance of a product is to get a moment of analysis through all stages of production.

² So, for example, it was clearly possible to organise a value chain tracking system using the assignment of numbers and chronology to each producer and production event, but no one knew how far this process would be of use *in situ* along the value chain and for interested third parties.

Driven by the research interests of the team, the project took shape: to provide user-generated economic, environmental and social information about each leg of the supply chain (Porter 1985), showing production practices and actors at every stage of the process as far as purchase and with opportunity for purchasers to add experiences too. Its context was defined as the global network, where the identity management of goods using technology such as RFID could give large companies advantage over others. Thus the tool being researched was conceived to address a growing divide between networked players and those for whom business would become relatively more difficult, not because their production conditions had materially worsened, but because a new competitive practice has been introduced.

The technological focus of the project was determined by the funding. The funders had implicitly decided that a tool would ensue and that, in exploring existing socio-technical systems, workshop participants would be assessing how to make interventions. The multidisciplinary team forming held a range of views on this: some more interested in research overview, some keen to show a gadget and initiate change; some functioning at an abstract level and some keener to understand a workable assembly of interactions. After debate, it was agreed that the tool would be conceived as generic, “Open Source” and supported by an infrastructure that would make it robust and cheap enough for everyone to use. It would offer low bandwidth multimedia for sending stories and facts attached to individual instances of items. It was recognised that it would not be viable to build and test such a tool as part of the project: not only was the project short on development time, but as research it would be unethical to put an end-to-end prototype into small producers’ infrastructure. Instead the team decided to build relations with producers as partners: bringing them in as informants to a theoretical investigation to consult on ideas, prototypes and uses.

Key Players

When we refer to ‘participants’ in a research project, we often mean people who are brought into the process for the purpose of collaborating upon or evaluating an artefact’s design. Because we are looking at the research project as an artefact in this paper, we view all players (the researchers, funders, intended beneficiaries) as participants creating the research process and determining the structure.

In addition to the management team of the four researchers (M1-4) mentioned above, the project committed to working with two case study partners (to include small-scale producers and their contacts along the chain), and, further, to fund:

- Two PhD students with CS and IT/HCI backgrounds (PhD1 and 2);
- Other students building interfaces based on the research data for projects;
- A local social researcher at each site of the case studies (LSR1 and 2);
- A research assistant, initially drawn from the social sciences (RA1) and subsequently (covering maternity) bringing interaction design skills (RA2).

Subgroups met and collaborated as follows: management overview: (M1, M2); research overview: (M2, M3, RA1/2, PhD1); technical overview: (M4, M3); infrastructure: (M4, PhD2); design: (RA2, M3, [M2]); Chile: (M2, M3, LSR1); India: (PhD1, M3, [LSR2]); consumer study: (M2, M3, RA1/2). Responsibility was devolved within these subgroups and it is indicative that the team rarely spoke through one mouthpiece when together but kept the distributed feel of the project by presenting the research serially to the BGDD network and others.

Extending the team, the management subgroup chose its case study partners pragmatically, reusing existing cultural knowledge and relationships. This resulted in pursuit of partners in Chile in the Fair Trade wine industry and in India to work with the shade-grown coffee of Karnataka. However, there was a resulting lack of symmetry in partners and dynamics with them. The value chain of Chilean Fair Trade wine is straightforward to follow and has few steps³. Not so that of Indian coffee: only some coffee estates in India are marketed discretely and these are not the small ones; none have Fair Trade certification; the beans of the smaller producers lose their identity in an anonymous pile at the curing works where they go to be graded; quality crops and those with an ethical story are buried along with inferior beans; multiple traders get involved. The team could choose between following a traceable coffee line, or staying true to working with small producers - and untraceable goods. The team chose the latter, partly to increase the design space investigated. That said, the political nature of the Indian coffee sector intruded so there was no clear boundary about who was involved: arguably the whole Karnataka coffee industry.

Decisions such as these were negotiated at face-to-face team meetings, which routinely excluded, because of distance, some members of the wider team who needed information. Augmenting this stuttering flow of information, a broader email list received a weekly update of activities through the central point of the project manager (M2). Supplementing the email stream was a shared project blog.

Scope and Method

Fair Tracing's studies lasted three years and were distributed across a wide set of possible enquiries. Specifically, the team set objectives to gather understandings of the value chain actors about the chain, to learn about actors' working practices and use of ICT, to explore the needs and desires of the different chain actors and what they thought a Fair Tracing type tool would be and do. The team also sought to establish how much work actors would put into developing stories for it, inputting data into it and preparing their material for the different cultural contexts it would be shown in – since it was conceived to be a Web2.0 style tool.

³ Although the politics is never simple: when first approached the subsequent partners referred the FT team up the chain to their importers for approval before agreeing to collaborate, who in turn required permission from their distributors, a major supermarket chain. Once the supermarket had agreed, each previous stage accepted the collaboration and a collaboration agreement was drawn up.

Overall, they hoped to gain an overview of what the two case study chains wanted, as far as the consumers and to do so in a collaborative way, with long-term partners so that relationships could be established. A flavour of the research is provided here. The detail is outside the focus of the paper (but see, for instance, Light et al 2009).

Research activity: what the subgroups did

At the producer end, the relevant subgroups built a relationship with the partners in Chile and India and visited them to conduct together:

- scoping of ICT use, views and knowledge of value chain, collaborative identification of key elements of production processes to communicate, willingness of local people to collect and share stories, and design workshops to explore turning knowledge into representational material,
- reporting on the project, testing ideas from consumers, evaluating changes in interpretation/desire for a tool, trying out contrasting prototype interfaces as an elicitation technique to learn more about information to share, how and why.

The research subgroup then mapped the use of relevant tools and implications this had for input of data, while the consumer subgroup concurrently conducted:

- accompanied shopping trips with a diverse range of British consumers,
- a survey of shopping priorities,
- interviews with consumers in front of interfaces, representing spatial, temporal and social metaphors for the presentation of value chain information.

So extensive investigative work was undertaken and, in addition, the wider team:

- explored IT platforms for peer-to-peer robust storage,
- built prototype interfaces for different platforms, such as Web and iPhone,
- analysed the complexity of the value chains and their implications,
- ran a seminar for other organisations interested in tracing technologies,
- wrote the blog and gave a number of talks, largely in the UK and Europe.

Most data were collected through semi structured interviewing and also some limited ethnography with the business partners. Most exchanges were recorded in audio files, though some were videoed and some sensitive speculative meetings were only recorded in written note form by the members of the team present. The research subgroup also made records of planning conversations and meetings.

Now that we have presented the project, we will situate our discussion by looking at the literatures on Development, participatory design and designing for appropriation and use these as a way of teasing out some issues facing the project.

Processes and Principles

There is a long history of participatory design (PD) in developing ICT, and, although many of these projects address tightly defined workplace problems (Muller 2002), there is a political sensibility to involving potential beneficiaries in the design of their tools (Greenbaum & King 1991) in sympathy with the

inspiration for collaboration at the heart of the Fair Tracing research process. In spite of shared history, the nature of beneficiary participation varies and can mean co-designing research structure and defining challenges or can mean helping with predefined goals set by others. To complicate this, participatory practices in ICT are not well established for contexts without organisation and structure (Muller 2002, Irani et al 2009). The PD movement comes out of trade unionism and workplace automation, from socially and technologically coherent environments. PD projects have tended to operate in contexts where there is collective representation for local experts and where defined professional activities exist to address (though see Dearden & Rizvi 2008 on PD in a Development context).

“Before designers can solve a problem, they first must define what it is. How do designers of new technologies begin when they are unsure of what they are making, what it should do, or who will use it?” asks Erickson (1995). This uncertainty must underpin any new research project to initiate a design, but is particularly apparent with projects that seek to serve the wellbeing of others. The next two sections consider the particular challenges Development projects bring, and how these relate to design practices and beneficiary engagement, so that we can draw out how these issues impacted in the Fair Tracing project.

“Development” and designing

ICTD (or ICT for/and [international] Development) projects bring all the challenges of implementing any new system but add a few of their own: they tend to involve working across cultures, often with limited access between designers and intended beneficiaries, and use specialists from more industrialised countries to do design on behalf of communities whose understanding of technology may be very different from theirs (Irani et al, 2009). As Donaldson observes: “Remote design (design from afar) and parachute design (design from afar with visits) do not lend well to capacity building, let alone product sustainability.” (2008:37). Just as the Fair Tracing project was conceived in the Global North, with exogenous research team and funding, so many Development projects come from outside the region to be “developed”. Worse, the systems to be designed often live only in the heads of funder and funded party and have no mapping to existing needs, processes and organisations. Nonetheless, there is the imposition of specifics from funding regimes that need assurances before they support work.

At best, both funding and design team are flexible and will find emergent solutions to ‘problems’ or ‘opportunities’ with locals. However, without a clear idea of either intended beneficiaries or the function of the tool being funded, there is potential to loop. How you cast your net for participants will determine what you build, but shifting your gaze slightly might introduce quite another set of beneficiaries with a different problem to solve or opportunity to exploit. The ‘who’ and the ‘what’ become shifting sands in the project, with no means to prioritise, since local knowledge of conditions is greater than that of the incoming designers. One way of dealing with this exogenously is to move slowly and engage extensively, but funding does not often support this approach.

The Fair Tracing proposition is unusual in Development contexts: it was not predicated on the idea of taking technology to aid a community, but implicates the many ends of an international 'bridge' in choosing to learn new things from each other. It is the primacy of this bridging role for the tool that first calls to mind the notion of the boundary object, a device that (conceptually at least) is rigid enough to be identifiable across contexts, and yet plastic enough to take on a local role and context-specific meaning. We will return to this point later to discuss the bridging function of some of the other boundary objects identified in the project.

A big challenge for Fair Tracing, with the world of producers and consumers as its users, was identifying the stakeholders that own the problem being defined. The partners' view of project activities would be highly determining – in that their thoughts would form the basis of everyone's understanding of the issues – but were also less informed by research into the behaviour of the British consumer (the project's defined end point), than the project team's. This gave the team responsibility as *project* owners to share insights from both ends of the bridge and not give too much authority away to any single group.

The team's authority as informants emerged in another Development context. One justification for introducing specific functions from outside is to assert that there are types of tool available in highly industrialised countries which might be of use in less developed regions where they are not available in suitable form. This position of helping others with their "deficiencies" can be justified by what Sterling (2005) calls the 'Line of No Return', past which a technoculture cannot voluntarily return to an earlier technocultural condition, and the 'Line of Empire', where 'the imperial technoculture can spew its objects and processes abroad, more or less at will' and 'those who lack the productive capacity are forced into colonial or defensive positions' (2005:10). Taking this perspective, it is an act of assertion for colonised regions to develop their own forms of artefacts and processes to level the playing field. If enough of the conception and embedding of these artefacts and processes can be handled by the intended beneficiaries, in theory at least, it is possible they can also avoid being colonised by the *values* of dominating technologies – although this is a particularly fraught argument in the context of commerce and international capitalism. Fair Tracing was predicated on this type of position, in that the identity management of products is joining a worldwide network of information and control strategies, and the system would be a tool with an identity management function for small traders to adopt, adapt and use, either to compete with or to plug into new systems of accountability.

Underlying other concerns in Development is always the question of values. Designing and installing a new system and convincing people to use it is, in itself, a huge undertaking. Yet the act of enhancing wellbeing cannot be expressed in terms of equipping people with levelling tools. These are merely the means to an end. Wellbeing must be expressed in first order terms (Holden 2004) and who chooses what that definition will be? This raises one last Development issue to discuss. Since the proposed tool is a link between different worlds, it not only has a bridging function, but inevitably also a representational function. Representation across global divides and cultures is profoundly political. And not only are there politics in representing a socio-technical system across players, but

the act of doing so has within it the making of changes to that system (see Light 2008). So, who decides on the representation(s)? How far is the system open enough to allow the matter to be decided by actors themselves in use-time, rather than being a legacy of the designers' vision? And, without a single editorial voice, how do multiple different actors establish what is in their best interests as a representation for marketing themselves as ethical, not least as ethical trends change repeatedly?⁴

Participation, openness and indeterminacy in designing

In the section above, we observe how sensitivity to Development's particular challenges, such as the desire to avoid alienating local people, can result in open, ill-defined starting points for projects and varied and under-defined contexts of use. And we have noted that every design has elements of uncertainty in it, certainly at outset. Dorst suggests design is complicated because one partly creates the landscape one will travel through (2003). Fischer asserts that, among other factors, '[c]omplexity in design arises from the need to synthesize stakeholders' different perspectives of a problem' (2007). Drawing on the work of Rittel & Webber (1984), who point out that one cannot understand a "problem" without having a concept of the solution, Fischer (2007) also observes that emphasizing the integration of problem framing and problem solving casts design as a search for a problem space rather than just within a problem space. Further, this emphasizes the importance of problem owners (for whom an artefact is designed) as stakeholders in the design process because they have the authority and knowledge to reframe the problem as the problem space is understood (2007).

For a system to work across multiple or under-defined contexts, it must be open to adaptation. Designing for end-use appropriation, or beyond that, end-user customisation, requires an underdetermined artefact. Fischer suggests a: 'primary challenge of underdesign is in developing environments and not the solutions, allowing [problem owners] at use time to create solutions themselves. This can be done by providing a context and an interpretive background against which situated cases coming up later can be interpreted' (2003). In this way, he unites a participatory philosophy with a pragmatic response in the spirit of distributed use.

If we look at the Fair Tracing system, it is a tool that potentially embeds completely into the context of production, coping with the very different priorities and practices worldwide so that items can be tracked from source to destination. This kind of tool must get out of the way of its users rather than dictate behaviour (a medium rather than a mechanism, in Bentley & Dourish's terms, 1995). The Fair Tracing tool can be seen as something of a hybrid then: with many highly situated voices engaged in problem definition, design and use, on the one hand, and the need for a wide open system for local appropriation as an outcome, on the other. As noted earlier, no single group had sufficient knowledge to design for engagement with others and the project team took the role of mediator but had no

⁴ FT got caught out in an early prototype with a map interface by the sudden emphasis on food/fuel miles at the expense of other ways of recording environmental impact (see Light 2008).

clear mechanism to prioritise functions or representations. All of which left the research wide open.

Discussion of openness in this literature has been concerned with the resulting technological artefacts and not so much the design approaches for making them. In another set of discourses, anthropologists and information science researchers – to name but two examples - have reflected on the interpretive flexibility of a wider range of design phenomena. In the social sciences, the work of Denzin (1989) and Lincoln & Guba (1989) has been influential with regard to taking a more interpretive, emergent approach to research. Design discussion framed in this social science discourse has been shown to value the open, indeterminate, interpretive approach similar to that presented here. In the information sciences, the work of design anthropologists (e.g. Nardi & O'Day 1999, Suchman 1987) has further influenced researchers to develop interpretive, flexible approaches to reveal a richer sense of the socio-technical context. Within design practice, the closest one comes to the Fair Tracing research style is the use of cultural probes, sent out as a research tool to enquire into local meanings (Gaver et al 2004); Critical Design which, like art, serves to challenge people's perceptions rather than be used in the form conceived (Dunne & Raby 1999); and designs that trade on their ambiguity as a way of investigating potential use (Gaver et al 2004). These have in common with Fair Tracing their desire to solicit multiple and contrasting understandings rather than pin down a single designable angle. However, they have not been focused on the Development context and all have been conceived as an elicitation stage, informing designers through the involvement of users, rather than as a means of engaging user-designers in building their version of the self-same project.

Boundary Objects at Play

To sum up, when we look at Fair Tracing we are examining the interpretive flexibility of an idea. This is distinct from looking at flexibility in implementation of that idea – i.e. in the tool - or using instances of that idea as a probe for informing on other ideas, as is more common in design. The idea has become the design artefact. We now look at how the idea - and various other aspects of the project, such as the metaphor of the value chain - became situated and crossed boundaries. To do this, we first outline the concept of the boundary object.

Boundary Object: concept defined

Star (Star & Griesemer 1989) introduced the boundary object to explain objects inhabiting multiple contexts at the same time whilst having both local and shared meaning. The notion is further explored in Bowker & Star who describe boundary objects as “those objects that both inhabit several communities of practice and satisfy the informational requirements of each of them” (1999: 297). Such an object appears robust enough to travel across contexts and between communities of practice in an identifiable form, yet flexible or “plastic” enough to take on the

meaning of the local context. Different groups can and do inscribe different meanings on the information represented in a specific artefact or process. Thus, a boundary object can serve a key role in developing and maintaining coherence across communities. Further, the boundary object as an analytical device draws attention to the possible form such “objects” might take. This conception of boundary objects has received wide acceptance in a number of disciplines (see Anderson 2007 for further discussion). For Roth & McGinn (1998) boundary objects are inscriptions used across communities of practice and constitute embodied representations. They serve as ‘interfaces between multiple social worlds and facilitate the flow of resources (information, concepts, skills, materials) among multiple social actors’ (Roth & McGinn, 1998: 42). The focus turns from representation as mental activity to inscription as social activity. We build on these conceptions to examine ways artefacts, processes and players in the project served such functions within and across the communities involved.

Research Project as Boundary Object

What we have in Fair Tracing is an attempt at maintaining a logical but awkward space of spaces. There is value in keeping openness in many dimensions because of the type of tool being proposed, yet when these are considered cumulatively; it is to produce a potential miasma. In particular we can identify:

- the openness of meaning necessary for Development work across business processes, cultural boundaries and understandings of knowledge to be valuable to any participant;
- the openness of approach necessary to ensure that everyone from different research and practice communities can contribute ideas and perspectives;
- the openness of participation boundaries to ensure that all related chain actors can contribute their defining perspective and seek their own representation;
- the openness of the design solution so that all the learning from the project may be finally bound into one unifying system or many distributed ones;
- the openness of the technology so that the knowledge/code can be adapted.

Clearly, this creates a highly indeterminate problem space. This would be a weakness on a development project, but this was a research project. We can regard this indeterminacy as an opportunity. To make this point, we have selected three contrasting perspectives on the project to review for their implications.

The Los Robles version of the Fair Tracing idea

The Fair Tracing partner in Chile was the Los Robles winery collective⁵ and their suppliers and owners, 44 vineyards of whom four are Fair Trade certified. Producers in Chile serve goods to supermarkets in Europe and America that have stringent accountability demands. Because they are part of these supply chains as well as others, Chilean producers have to meet global standards for exported goods, even if they are not required to meet them domestically. Producers are

⁵ Unfortunately, the collective was dissolved in 2008 because of economic pressures.

dependent on major distributors for their livelihood and it becomes in everyone's interests to be able to isolate any batch quickly and eliminate any problematic items (and *only* those items that are problematic or might be contaminated).

The winery has a precise audit trail. The logistics manager writes in log files that trace each bottle of wine back to a date of production, a vat of fermentation and a batch of grapes. The log files exist in large bound books that reside behind him in his office and that can be cross-referenced in a matter of minutes if there is an issue with any of the bodega's output. Upstairs the oenologist is blending wines and recording her results in a dedicated database called Kupai, which she shares with the reception centre that grades producers' output into A, B and C category grapes. In the next room, the lab staff are measuring acidity and putting the chemical analysis into a Word document that is then printed and stored in a folder. In other words, the use of ICT for mapping the supply chain within the bodega itself is fractured and involves multiple types of record. Only some are in a form that can be manipulated. The story is much the same for the growers. Some have spreadsheets for recording data; some, a book. One foreman records information in an Excel spreadsheet for himself, then takes the data out of it to interact with the rest of the vineyard's production processes.

Although the bodega employees were interested in the idea of a marketing tool for communicating with consumers and prepared to consider what kind of information they might enter into it (Fig 1B), they talked about tracking technologies. They saw a means of putting data into a Fair Tracing tool from each stage of production and in so doing bypassing the fragmentation of their internal systems. For them, the real value of the tool was for logistics management.

The Indian coffee sector's version of the Fair Tracing idea

The Indian coffee sector is not of one mind. Industry bodies such as the Indian Coffee Board, a national government organisation, and CoMark, a marketing cooperative of coffee growers from the three coffee-producing Indian states, each have an agenda. Speciality coffee growers, and the federations and many self help groups that support very small growers (with land of 10 hectares or less) have their place. Economic circumstances such as falling coffee prices, poor harvests over 10 years, deregulation of the industry and the tax situation (if you sell over the gate of the estate you pay no tax, but if you take produce to the curing works you pay 25%) determine growers' willingness to take some actions and not others.

Two trends are relevant here. Indian organisations are keen to use technology, in keeping with India's mission to be a country at the forefront of science and technology. They are also aware of a trend to go it alone, without international (and particularly global multinational) intervention.

Following coffee from the small plantations to the curing works, as noted above, is to watch it lose its identity immediately. Whereas Los Robles wine is accountable to the last drop, much coffee makes its way from plantation to sack to curing works – often already in the hands of an independent small trader – and from there into multi-source instant coffee powder (roasted and packaged, but not in such a way that a thread unites a producer with the jars on supermarket

shelves). Small paper chits record the amount of different grades of coffee so that growers can be remunerated. Mechanisation of data is very limited. To all intents and purposes, the Indian coffee sector did not look ready for the tool, with no records to grab automatically as part of constructing a chain and no traceability.

The impact of the Fair Tracing project in India was unexpected then. Without much interest in the research project, the different interests in the sector came together to work on tracing. United by the efforts of one PhD student to understand and affect the conditions of coffee production, as of December 2008 a working party involving people up to state government was investigating tracing technologies for the whole industry. There was no intention (at time of writing) of widening the remit to other sectors beyond coffee, extending its scope beyond India, or of involving the research team in the development of the tool.

The Ethical Consumer Information System (ECIS) version of Fair Tracing

In late 2008, researcher M2 hosted a research seminar on “Ethical Consumption, Traceability & ICT”. Many members of the team were there, joined by others interested in ethical consumption. Presentations during the day involved several not-for-profits, Web2.0 outfits and a small commercial company active in the tracing space. A major topic was that no organisation had solved the problem of representing ethical information in a form that indicated at a glance what was being meant by ‘ethical’. Each system seemed to have met only part of the challenge. Some had user-generated recommender modules; some had scoring for different ethical conditions. The Fair Tracing project brought ideas of provenance in the form of working with producers and representing the value chain.

At time of writing, thirteen British, European and American organisations with an interest in promoting ethical consumption were meeting virtually in a bi-weekly phone conference to discuss data standards. Some of these groups had been at the seminar, but others became interested through word-of-mouth over the following weeks. Many participating organisations are not interested in research as such, but are pooling knowledge and ideas about a consumer tool and common data/information standards. Drawing on these speculative discussions, participants with the try-it-and-see philosophy of Web2.0-cum-agile-methods make a working prototype between meetings. Approaches are evaluated and modified. Most of these projects are fuelled by individuals’ private passion and it is symptomatic that the commercial company could not afford to take part. The outcome will not be Fair Tracing research; it will be the joint discoveries of the ECIS.

Analysis: the project as player

It is clear from the stories above that the ‘bridging’ function of the Fair Tracing idea – particularly in the shape of the value chain – proved a powerful device around which local narratives could form. The chain metaphor worked in two ways across contexts: to make explicit the production process as both a physical and virtual phenomenon and to stress the connection to trade and consumption activities. We might say that the value chain functioned as a ‘meaning probe’.

Other features, such as the rhetoric of “Open Source” were also persuasive, and reflect the moral commitment of Development. In short, the idea proved a tractable representation of a series of categories, or system, with the correct moral gloss to evoke interest and win alignments – a catalyst. The focus on inscription offered by the notion of the boundary object helps us appreciate this meaning-making as social activity moving across and between these communities.

Other Boundary Objects

Looking at Fair Tracing is like staring at a fractal picture. With the degree of openness yet definition apparent in this project, it is possible to show how almost all aspects were boundary objects of one form or another, but here we pick two more to analyse in detail. The first, the value chain, is a major part of the project as both process and artefact, while the second, the blog, is a minor component but shares the symptomatic characteristics of the whole.

Value Chain as artefact and process

Returning to the value chain, we now explore its function more closely. It is possible to see this production and transportation process through the purposes of players in the project. One of the main participatory exercises conducted (for instance, during a Chilean design workshop, Fig 1B) was asking partners to draw a version of the value chain and annotate it with information they collect and would consider of interest to pass on to consumers. The following hopes for computer-supported collaboration appeared during discussions:

- To represent the value chain as a means of educating the consumer
- To represent the chain as a means of educating the players in the chain
- To connect the end-producer to the consumer (and vice versa) for dialogue
- To connect the production actors in the chain to each other
- To give (easier) accountability to producers in dealings with distributors
- To give specific social, environmental and economic information on products
- To identify *individual instances* of items and track them across their journey
- To alter power relations between actors in the chain
- To eliminate parts of the chain which add no value but take resources.

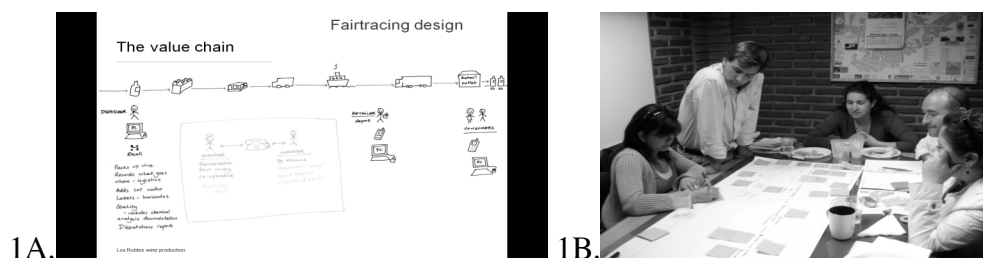


Fig 1A: the interaction designer’s interpretation of the stories told her about the chain. Fig 1B: Bodega employees in Chile draw out the value chain and annotate it for a consumer audience.

We might note that, while no two items are mutually exclusive, their range is impressive. Even designing an underdetermined artefact would make the final tool potentially very complicated. And taking the value chain as a design stimulus didn't simplify matters for the team, as their multiple perspectives reveal:

From computer science: the chain is a series of sequential events that can be bounded, identified and ordered in terms of time and duration between transitions. Transitions occur at each point that value is added, ownership changes or movement initiated. Each product and actor can be given a discrete number that will allow products to be mapped and assembled in chains. Information can then be attached to any event in a variety of multimedia forms through the creation of fields. (design meeting, UCL, London)

From economic geography: "The term value chain describes the full range of activities which are required to bring a product or service from conception, through the intermediary phases of production to delivery to final consumers, and disposal after use (Kaplinsky 2001). Different value chains are characterised by processes and actors involved, by the nature of linkages between these actors, and by the overall governance structure of the chain (Gereffi et al 2005) [...] including the related power relations, information flows and discourses". (Kleine 2008:110)

From interaction design/HCI: a series of physical journeys between stages in the production process involving the use of multiple technologies and different information systems, which more or less efficiently ensure the translation and perpetuation of information as the product passes towards the consumer. At each stage a different cultural, economic and political context determines business people's tolerance for additional data entry overheads, the kind of interfaces that are appropriate and the form of representation information should take. (design meeting, home of interaction designer)

From IT entrepreneurship: friends and contacts in a mesh of social relations that make up Bangalore society, who embrace certain values, will band together if interests are best served, who have astute relations with members of the state government and the national trade board for their commodity, who share information strategically, and who will consider making their product traceable if benefits outweigh tax penalties. (fieldwork, Bangalore)

Analysis

The project deliberately set out to collect alternative readings of the value chain and these fed into the design of the consumer work to investigate spatial, temporal or social representations. A principal objective was to collect information about what producers were prepared to share in terms of confidentiality of business data, collection overheads, self image, etc. The team also sought to hear partners express their relation to the rest of the chain, noting the political issues. We can see a range of political motivations in the list, from educating others to improving local knowledge to eliminating actors who siphon off profit. However, the exercise of constructing the chain was also means to get partner teams talking together and negotiating their understanding of the issues. In this respect, the artefact (the value chain idea) inspired a new process (constructing the chain together) which mirrored the actual process of progressing along the chain. This

process involved identification and articulation of chain functions, politicizing them. And this chain became artefact again through drawing (Fig 1A and B), to become both a record and a further tool with which to negotiate meaning.

It is also clear from the accounts above that no single understanding of the chain existed in the research team (though the accounts are polarised versions). It is possible to see a mix of applied and abstracted description. The CS version is stark; others are progressively more social. Some versions of the chain presuppose an intervention while others reflect a greater interest in how chains exist and run through society. The difference between design- and social science-orientated disciplines reveals itself. But, in reality, although everyone adopted different positions as a starting point, individuals gave accounts drawing on different traditions at different times for different purposes. Particularly the HCI specialist (M3), who bridged subgroups, used multiple positions to keep a broad view of the issues alive. And moments of definition helped clarify problems.

For instance, in reviewing the possibility for an end-to-end numbering system based on events (the CS view), it became more apparent to the team that not only was the overhead of data entry too much to ask of small businesses (certain, but not all, data could be automatically ‘grabbed’), but there would be problems fitting third parties in. Bodies like the Fair Trade Labelling Organisation which certifies Fair Trade goods or Oxfam couldn’t operate in the chain using numbers, codes and events and would probably have to be ‘fed in’ through trade bodies or producers as intermediaries to attach them to the right parts of the right chain. The choice between creating a system to be used by single producers to communicate directly with consumers, or one that could only operate as a federalist syndicate reflecting a whole sector came into relief (Dearden and Light 2008). So, engagement with the engineering view threw attention on the socio-economic.

The blog

The other example to be examined here is less central to the research work of the project, but had a critical place in raising profile, building credibility and disseminating. The Fair Tracing blog (www.fairtracing.org) served as a main repository for any information or ideas in the team that were seen to have lasting significance. Further, the blog was public-facing, and comments, messages to team members and personal encounters reveal that it was read by interested people without a direct link to the project. The resource had major responsibility for giving the project an external image. But the blog was a compound object, free of syntheses or summaries. Many postings concerned tracing technologies and organisations interested in ethical production or sourcing, but others recounted Fair Tracing activities or those of Development projects using e-commerce. Encyclopaedic style entries sat next to stories, while other forms of writing, such as the abstracts of academic papers, and media, such as some video and extensive images, accompanied more narrative sections. Postings were tagged with themes that related to the purpose of the project, but new tags could be initiated by anyone – more folksanomic than hierarchical – and the chronological presentation of the blog meant that a pot-pourri of information met the casual visitor. In summary, the many voices of the project owners joined up as one

aggregated vision of making change, but did so as a collage, not a set of intentions or goals.

Analysis

The Fair Tracing blog, as a small part of the bigger whole, reflected the multiplicity of versions of the project in a typically Web 2.0 way, where plurality is enshrined and folksonomies challenge the ordered world of information management and hierarchies. By eschewing a single authorial position, it gave purchase for all comers to the project through its diversity and lack of single interpretation, but was still distinct enough to be part of the branding of the project as recognised by the team members. In a sense it was a perfect avatar of the project: pluralistic in nature and never committing to one perspective. It offered an interesting contrast between the coherence of individual posts published (in styles acknowledging the different writing traditions of different members' fields as well as preferences) and the arbitrary composite of posts viewed. With no overall design, extracted meaning is entirely situated and emergent. Its plurality encourages the multi-interpretation possible of the project, shown above in other respects.

Interpretation and Reflection: Boundary as Bridge

Much analysis has already been included. Here we look at the overall positioning of the project and what this might contribute to further work in the field, given our intention to support understanding of working with ICT in a Development context and to extract value from an 'amorphous' interdisciplinary research project.

The development process reflected an aim to work sensitively across cultures – reflected it, perhaps, too closely. Prototyping went on but without precise recommendations for an end-to-end tool. We have noted the breadth of the research question (entertaining much production, trade and consumption worldwide), the limit of researchers' time and reach (a factor of financing rather than personal competence, but nevertheless relevant), their ambitions to work collaboratively with their partners and to keep the bigger 'bridging' vision of the project in sight. Against this backdrop, individual findings, such as acceptability of methods and the reception of interfaces (presented in Light et al 2009, Light 2008, Kleine 2008, but not addressed here), become almost insignificant.

In asking about the difference between two production contexts, the team noted that a technical solution could not be simple. In asking about the needs and desires of different partners, the team established that the purpose of a Fair Tracing tool could be as diverse as the actors it might represent. In asking about the messages that were seen as important to communicate along the chain, the team recognised that any tool would never be a fixed representation but would forever be a site of contested meaning, made complex by subtleties of language, values, forms of expression - challenges brought to the fore in cross-cultural

work. In seeking to represent a socio-technical system to that system, the team accepted that there was no chance to be dispassionate observers; that the act of asking questions was as influential as any action research and that, before any actual implementation had an impact on relations, the fact of the research would enter and change the system.

In sum, the output of the research, when judged against other UK research projects, was deemed successful using various multi-disciplinary success criteria, including negatives like not exploiting representatives of small business. But was there value in trying to keep the bigger 'bridging' vision of the project in sight, when tackling any smaller part might have been more productive in conventional design terms? What kind of research team holds tenaciously to an idea even when they find that the pursuit of it stymies greater creativity at the implementation level? And is there anything from the experience that might feed into other projects to enable them to function more effectively, given that indeterminacy and multiplicity of interpretation sit at the heart of Development work?

The team collected a wealth of inconsistent but useful design information. The diversity of it speaks to creating a system with the openness seen in the project blog, described above, where voices from different actors form patterns in the eye of the beholder. However, openness is only useful if it is sufficiently structured that it can be exploited. For instance, the ECIS example shows the value placed on consistent standards in ethical data to underpin user rankings. And structuring proved contentious, since different actors had different purposes in wanting the tool and thus appreciated different functions. In our initial examination of issues, we pointed to values: deciding what is best for people's wellbeing and how this decision-making is managed between players (funders, researchers or the political hierarchy of intended beneficiaries). To ask whose wellbeing should be targeted is to ask whose functionality to embrace. In doing Development work, change for the greater good is a higher order purpose than embedding tools and thus not for an exogenous team to legislate upon, any more than they should presume to know *a priori* what is important locally. We have discussed some knots into which this agenda can tie a project; and we have pointed to Fischer's idea of developing environments (not solutions) to provide an interpretive background (2007). What we argue now is that the negotiations of the project offer a possible – just one possible – navigation of the political and ethical aspects of this wilderness.

Here we return to Erickson's question: How do designers begin when they are unsure of what they are making, what it should do, or who will use it? (1995). The ethical path would not seem to be the decisive one. It would be fair to say that the project boasted an ill-defined problem: a design landscape one forms as one goes through it (Dorst 2003). But it might be appropriate also to describe it as 'ill-defined research' in the sense that, at start, it is not clear *who* is the subject of the research, or more accurately, who it is appropriate to sample, and it is not clear *what* the research is to provide. The team began a discovery phase with participatory elements and never truly emerged from it, despite conducting valid research. The team eschewed an early synthesis of stakeholder perspectives and consequently never synthesised them. But they also created the space of spaces for political discussion and appropriation to take place.

There were ever more versions of an idea, each with its own constraints, and behind it always the same vision. Using the device of the boundary object we have shown how appropriation of the vision became possible. This would be of gentle theoretical interest were we not able to point at two startling appropriations (India, ECIS) that could not have been predicted. While one cannot deliberately design boundary objects, in using the boundary object as conceptual device for analysing the project and its many elements, we are reminded of the role that inscription of meaning plays in trans-disciplinary and trans-cultural contexts like those experienced throughout the activities described in this paper. Thinking in terms of boundary objects and boundaries gives one cause to ask which boundaries are being crossed and how they are maintained. Sensitivity to conditions and relations, the intention to include partners in defining and articulating the research question and desire to deliver something of moral value all position the research, despite its all-too-typically exogenous origins. It is, then, not so much that there is something to learn from the project, as recognising how tenacity and flexibility permeated it and to what effect. It is offered as a project to think with when designing other interventions. Presented here, in yet another interpretation – i.e. as we have seen it and accompanied by our analysis – it draws attention to what each set of actors perceives to set them apart (unique values) and, in this way, suggests a responsive approach to issues that are not unique to Development. Indeed, we expect to see similar issues pervade a greater number of projects if, as promised, pervasive computing brings digital technology to colonise more aspects of life.

In summary, through this analytical process, we are made mindful that artefacts are socio-material forms. Similarly, examples from the Fair Tracing project also show how process can be framed as such socio-material objects. For this reason we have come to recognise that the final product, so to speak, of the project was, in fact, a process that has been capable of holding form across contexts and communities while remaining plastic enough to take on the values and meanings inscribed by local communities and players. The device of the boundary object helped us realise that, while this condition naturally poses many challenges for the ‘design’ goals that motivated the project, the result is a necessary consequence of holding steadfast to the core values of designing collaboratively in Development – values that remained constant across all contexts.

It is interesting to reflect, and this paper begins to do so, what happens in a design research project for a socio-technical system that seeks to occupy multiple spaces with enough interpretive flexibility to allow it to become meaningful and embedded in the wider world. The strength of the idea (the connection between producer and user, the value chain, the drive for ethical behaviour, the moral tool) has qualities of the boundary object. And the way that different team members formed a loose aggregate provided the open weave that allowed the boundary object to endure in an endlessly pre-designed – and therefore fertile – condition.

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