ABSTRACT

Value Sensitive Design (VSD) is an established methodology employed in accounting for human values in the design of computer systems. In this paper, we suggest that VSD has the potential to contribute more broadly as computer technologies increasingly permeate our everyday physical environments. We present a new direction for VSD, extending the current methodology beyond the current computational system boundaries and into the physical spaces that such systems are designed to be a part of. Central to our discussion is the notion of physical spaces, in particular this paper specifically focuses upon the augmentation of physical spaces with digital, interactive content, proposing a three staged methodological framework entitled Value Identification Mapping. This framework enables a value driven exploration of a physical space prior to any digital augmentation, privileging physical space to play a determining role in the design of digital interactive content. In doing this, we suggest such designs will become value-sensitive and context-specific, thus contributing to digital augmentation in ways that is conducive to human wellbeing.

Author Keywords

Value Sensitive Design; Hybrid Space; Contextual Values; Value Identification Mapping.

ACM Classification Keywords

H.5.1. Information Interfaces and Presentation (e.g. HCI): Evaluation/methodology; J.5 Arts and Humanities: Architecture

INTRODUCTION

The study of human values has long been recognised as important in disciplines such as anthropology [14], sociology [25] and psychology [19, 21]. Within more technology-based disciplines, communities such as CSCW and Participatory Design have also long embraced overarching human values such as cooperation, participation and democracy in their de- sign methods. Consideration of how values relate to the design of human computer interaction has led to a rise in the number of HCI papers featuring values (Borning and Muller). However within this area there are still developments to be made in order to bring about a wider use of such an approach.

Value Sensitive Design (VSD) has developed an established theory, offering a principled and comprehensive framework for accounting for a set of (universally held) human values throughout the design process [13]. The field of HCI is often required to respond to questions of human values [3] and yet despite VSD's demonstrable commitment to working with human values [2, 11, 18, 16], it

remains an under-represented area within HCI research and practice. As the nature of the human relationship with computers becomes increasingly complex however, Sellen et al. [22] believe that greater finesse will be required in order to determine and understand values in the context of large systems and sets of systems that users operate within. They state "Much effort also needs to be expended on determining what is desirable within a place, an institution, or a society" [22].

Given that the VSD methodology accounts only for the de- sign of a computer technology, it does not engage with large systems,, nor does it play a decisive role in determining what might be a desirable technology for a place, an institution, or a society. As such, Sellen et al. [22] believe a broader approach to working with human values in HCI is required: particularly as digital, interactive content becomes increasingly public, permeating all aspects of our lives both overtly and covertly. They assert a greater understanding will be required regarding the con- texts that digital, interactive content relates to, believing in an increase in the importance of how people interact with "the environment [and] with every- day objects" [22]: as opposed to a sole focus upon how people interact with computers.

A significant additional criticism of VSD is that it cannot design computer technology which accounts for contextual human values due to its reliance upon prescribed lists of universal values to inform design [17, 3, 22]. In this sense, VSD is thought to overclaim as a result of its prescription of values not being able to account for the much broader range of human values that are in existence, and play out differently depending upon context and culture [3].

In recognition of the positive contribution VSD makes to designing computer technology, there is confidence within the field of VSD of the development of new methods for broadening and extending its reach [16, 3]. Our research has been motivated from a values perspective (and in line with Sellen et al.'s observation), and by the apparent lack of consideration for the physical space in which digital interactive content is being designed for. The goal of our research therefore is to explore the potential for the dig- ital augmentation of physical spaces to become a new VSD thread.

Our research is particularly underpinned by the aforementioned, recent critiques of VSD [3, 16] that have called for a broadening of the remit of VSD, and we have been further influenced by Sellen et al.'s [22] view that "determining what is desirable" with respect to the digital augmentation of physical spaces will become an important part of the values discussion.

Our specific contribution to the field of VSD is a new three stage method entitled Value Identification Mapping. This method supports the pre and early stages of design decision-making relating to the digital augmentation of physical spaces. Value Identification Mapping develops VSD beyond its current boundaries of

designing computer technologies to incorporate a novel, context-specific approach, accounting for and privileging the physical spaces they are designed to become a part of.

To support our contribution, we present a case study of a public-facing business, exploring the role of its physical space and associated objects from a values perspective. We have explored how human values are embedded and communicated through the tangible objects that comprise a specific physical space. This leads us to argue that physical space should become a determining factor at the beginning of a values-led design process that aims to digitally augment a physical space. Furthermore, we suggest that an additional, formative stage in such design processes is required to facilitate value-sensitivity in this respect.

The paper is structured as follows; we initially consider an overview of VSD before moving on to two important critiques of VSD which have influenced our work. We then describe our case study, which culminates in the introduction of Value Identification Mapping: our contribution to VSD. Finally we show that our methodology has broad ranging contributions and wider applications within the field of HCI .

VALUE SENSITIVE DESIGN: OVERVIEW AND CRITIQUE

Value sensitive design seeks to add a humanistic element to the field of computational system design through the consideration of human values [12, 10, 9, 13, 11]. At its core is the acceptance that technologies affect people in both positive and negative ways. Moreover, without investigations into human values within the design of such technologies, the negative effects may begin to outweigh the positives [10]. VSD's fundamental purpose is to ensure such considerations are at the heart of technological designs, coupled with concern for values that centre on human wellbeing, human dignity, justice, welfare and human rights [10].

Underpinning the VSD methodology are the *values of ethical import*, and within this context values are defined broadly as being things a person or group of people think are important in life [11]. Though not an extensive list these include: human welfare, ownership of property, privacy, freedom from bias, universal usability, trust, autonomy, informed consent and accountability. Central to VSD is the notion that the human values of ethical import should in themselves be a design criteria, in addition to more traditional criteria of reliability, efficiency and correctness.

Whilst VSD is considered an important starting point in developing a value-centred approach to designing technology, it requires further refining and development in order for it to reach its potential. As such Le Dantec et al. [16]

have identified a number of issues that form the starting point of this paper. More specifically, two areas are pertinent to our case study :

• Discovery and contextualisation of values and the lack of tools to support these processes.

• The ordering of conceptual and empirical phases of the VSD methodology.

Values of ethical import have a heuristic purpose, in that they can help determine which values should be considered in a design. Le Dantec et al. [16] consider this list of ethically grounded values to be limiting as a heuristic device, leading to a privileging of a pre-defined set of values rather than those that might be discovered through investigation. Resulting from this is the a priori production of values, rather than their emergence from within the context of design. Le Dantec et al. [16] suggest VSD has "operationalised as a methodology for refining system design around a set of pre-conceived values, promulgating an agenda of design on a largely fixed classification of values, rather than inquiring about the values present in a given context and responding to those values." Through the discovery of values *in situ* their visibility is assured, ensuring that a fixed classification is not relied upon and that they remain relevant to the context in which they are discovered.

Our work does utilise prescribed lists of universally held values, in that we employ an established model of values within the first stage of our research. However, they are used as a starting point for the development of a methodology, which seeks to elicit local values from a specific context. Through evaluating their usefulness and their limitations, we suggest that prescribed lists play a much less fundamental role within a design processes.

Turning to the lack of methods Le Dantec et al. [16] identify specifically that VSD does not provide guidance on which methods are effective or appropriate for engaging a particular context of use in questions of value. Of this, they call for more prescription in methods and less in terms of values. We start to prescribe methods that address the inhibition of value discovery due to the lack of empirical instruments and the privileging of the values of ethical import that Le Dantec et al. [16] have identified. In doing this, the nature of the work we have undertaken continues along an evolutionary path that Borning and Muller [3] have identified as increasingly moving towards evocative heuristics rather than prescriptive lists of values.

VSD's iterative tripartite process consists of the following phases:

• A conceptual phase, consisting of philosophically in- formed analyses of the central constructs and issues under investigation;

- An empirical stage, involving socio-scientific re- search on the understandings, contexts and experiences of the people affected by the technological design;
- A technical stage that analyses current technical mechanisms and designs in support of these values.

Investigation of values occurs during the conceptual phase, "an investigation that gains analytical power from the heuristic values of ethical import: the empirical phase serves to refine against a conceptual framing based on known values rather than enabling a process of discovery and engagement" [16]. This is seen as a limitation, leading to the suggestion by Le Dantec et al. [16] that the empirical phase ought to precede the conceptual phase in or- der to ensure values are discovered at the inception of design development.

Re-ordering the phases of VSD's methodology might also go some way towards ensuring that values are not reflected upon after the design and implementation of a system, as often occurs with VSD projects [16]. Retrospectively evaluating values relating to technological artefacts is useful as a reflective tool, but this does not inform sensitive design at its inception. We suggest it is the initial phase of value exploration that forms the fundamental basis for the further development of value sensitive approaches to the design of digital interactive content.

HUMAN VALUES AND THEIR RELATIONSHIP WITH DESIGN AND PHYSICAL SPACE

The most influential modelling of human values have been carried out by Rokeach [19] and Schwartz [21], which have resulted in a substantial body of research and evidence that has been developed over the past fifty years. Schwartz's model of Universal Values is the most widely adopted and robustly measured example, demonstrating that there are relatively few values in the human motivational system and that they are found consistently across different cultures worldwide. Schwartz defines values as transcending specific situations [21], showing that all people hold all the values in the model, all of the time and to some extent - but their balance varies from person to person.

Given their fundamental shaping of the human condition, and people's attitudes towards technology, there is an important and co-dependent relationship between human values and design. Values are a fundamental component of the design process, in this particular case we take digital interactive content as the context. In order to respect the people whose experiences might be affected by the design of digital interactive content it is essential to take into account their values and ensure they are not negatively affected. A design tradition which has placed values at the heart of its practice is Participatory Design (PD) , one which considers stakeholder participation in the design of technology as fundamental.

The inclusion of values within the core design criteria of PD echoes Friedman's call for such an approach within VSD. However there is a recognition within PD that methods for involvement of stakeholders outweigh the practice of value identification. Iversen et al say of this " instead of worrying about which method to adopt in order to capture stakeholders' needs for design, or what methods can strengthen stakeholders' ownership and commitment, the focus should be on how methods can be best used to work with values during the design process." This focus upon values as the driving force behind the design of digital interactive content forms the central argument within our research.

By introducing digital interactive content into a physical space there will be effects upon the space itself and the way in which people interact within it. This introduction of technology into a space changes its nature, turning it into a digitally augmented physical space. Such spaces tend to be described as 'hybrid', suggesting this brings together two distinct elements to form something new, with the nature of hybrids often aiming to form something better. In this sense, we can understand digital augmentation of physical space as a means of attempting to somehow improve that particular space. Ciolfi [5] believes however that theoretical and methodological approaches are too limited with respect to technologies which affect physical spaces and subsequently the human relationship with them. A need for further identification in developing new ways of understanding physical spaces with respect to their digital augmentation, is also identified by Ciolfi (4) particularly in terms of how their "features support and affect our physical presence and further experiences with the environment . . . in order to shape the way in which a system will be embedded in the space itself."

Three main areas that have in- formed the design of digitally augmented, physical spaces in recent years. (6) They are:

- The structural affordances of architecture and urban planning
- The movement and interaction associated with activities within a space,
- The experiential aspects of physical spaces, which seek to understand how people ascribe meaning to a particular space.

As technologies are increasingly brought beyond the desktop however, it is argued by Ciolfi and Banon (6) that "an ever-increasing interest in the physical environment where interaction occurs" will be required. This is particularly so with respect to designing interactions between ubiquitous computing and users. The need for developing theories and methods that underpin the "re-conceptualization of the interfaces an assembly of tangible physical elements (including furniture and everyday objects)" (6) is considered as vital in the design of ubiquitous computing.

A CASE STUDY OF A LOCAL COFFEE MERCHANT: IDENTIFYING

VALUES IN PHYSICAL SPACES

A high street coffee and tea merchant that is located across three sites within one city for this case study, with the stakeholder being the owner of the company. It comprises a shop, which has been part of the city landscape since 1837 and two cafés; one of which also serves as a tea and coffee heritage centre, situated in the former parish hall. Considered locally as an exemplar of a thriving, independent business in the challenging environment of the British High Street, the stakeholder has embraced digital technologies, thereby demonstrating an innovative approach to retail and engagement with their customers. Their use of digital technologies has included the use of QR codes, social media, the development of experimental forms of film-making (ref our paper) and they have live-streamed an academic lecture about coffee farming. They are keen to continue developing their digital presence within the physical space of The Hall, which houses a large array of objects: both functional and decorative, including scales, scoops and canisters from the 1930s that have been refurbished by the team. The company has a vision for The Hall to become more than a cafe´ and 'more than a museum', a place where the community can 'be communal' whilst connecting to the provenance of tea and coffee in an authentic environment.

This particular company was chosen as a case study because it provided rich opportunities to investigate ways in which the aforementioned physical 'environment [and its] everyday objects' [22] could be considered within a values context. Further to this, they are in the early stages of considering how their physical space could be augmented with digital, interactive content. This provided an opportunity to frame our research within Sellen et al.'s belief that "determining what is desirable" [22] should become an important factor in digitally augmenting physical spaces. This belief resonated with our case study as the stakeholder has developed a strong sense of place, which could be compromised by the wrong type of digital augmentation and, therefore, would benefit from determining what is desirable in the first place. Our case study was formative and exploratory in nature, seeking to engage the stakeholder in questions of value in order to relate them to, and understand them within the specific context of the business and how values might be embedded and communicated through its physical space.

METHODOLOGY: DESCRIPTIONS, REFLECTIONS AND EVALUATIONS

The methodological framework we have developed is intended for use at the beginning of a design process , the aim of which is to digitally augment a physical space. Values are fundamental to the process values and has been designed to support the discovery of these. It comprises the following three key stages:

• The European Social Survey: This first step was chosen as it uses empirically established questions in order to elicit universal values, in this case from the

stakeholder. It aims to provide a starting point in engaging the stake-holder (the owner of the business) in questions of universal values.

• Contextualising Interview: This second step builds upon the ESS with the aim of contextualising the universal values into the local level of the stakeholder. This step allowed us to elaborate on the information gained from the survey and to dig deeper with respect to further investigation of interesting territory surrounding the meaning of the objects within The Hall.

• Interpretive Mapping: The third step, Artefactual analysis, was conducted in order to interpret how the contextual values could be embedded and communicated within the physical environment of The Hall.

We now describe each of the three key stages, discussing and reflecting upon the results of each. Each of the stages is then evaluated as a means of providing the guidance that Le Dantec et al. [16] believe will develop VSD into a contextually-sensitive methodology.

The ESS Survey:

Description: The European Social Survey is a shortened version of the Schwartz Value Survey (SVS), which is widely used by social and cross-cultural psychologists for identifying individual values. This model has been chosen as a result of criticism of Friedman's values of ethical import [3] , relating to their exclusive concern for technology. However, the Schwartz model has a more general focus upon universally held human values. It presents ten basic values recognized by people in all cultures: universalism, benevolence, tradition, conformity, security, self-direction, hedonism, power, stimulation and achievement. '.

The ESS identifies these values through presenting brief, third-person portraits of different people, e.g "Thinking up new ideas and being creative is important to him". The respondent then identifies to what ex- tent that portrait is like themselves. In total, there are forty portraits with each describing goals and aspirations pointing to the importance of a single, universal value type such as 'benevolence' or 'self-direction

Results and Reflections: Using the ESS scoring system, we ascertained the dominant values the stakeholder identified with were stimulation, self-direction, universalism, benevolence, conformity and tradition. We chose to work with these as a springboard for the rest of our methodological development. From this we were able to explore the relationship between universal and local values, finding the ESS survey provides a useful starting point from which to engage the stakeholder in questions of value. It was less useful in terms of attempting to

understand how these values might be embedded within and communicated through the physical space of The Hall. This finding supports Borning and Muller's [3] call for a tempering of universal values, as we found that they were too abstract and overarching in respect of attempting to relate them to the business of Atkinson's.

In summary, the ESS offers a valuable initial activity with which to engage stakeholders, as the results provided a general 'feel' for the values that were held by the stakeholder and built a firm foundation from which to develop the next s9ontextualize99ualising interview.

Contextualising Interview:

Description: We developed a semi-structured interview in order to contextualize the ESS results into the local level of The Hall. This was achieved through probing the ESS responses which had led to the identification of the stakeholders dominant universal values. The universal value of 'benevolence' for example, was identified strongly with, against the ESS portraits of "He wants to care for other people" and "He tries to support those he knows". In light of this, we presented the stakeholder with his ESS results and asked him to consider in what ways he cared for and supported others in the context The Hall. This was translated by him into the contextual level through the identification of activities which develop and maintain strong relationships with independent suppliers from around the world. Through an open- coding of the interview transcript, we identified nine local values that were attached to the stakeholder's relationship with source suppliers, which in this case were values relating to being sustainable, ethical, knowledgeable, involved, productive, connected, reciprocal, passionate and equal.

Results and reflections: In total, twenty-one contextual activities were identified through probing the ESS responses, resulting in ninety- four local values As with the first stage, we extracted six dominant local values from the contextualising interview. These were determined by how many times they appeared in the transcript. They were sustainability, knowledge transfer, progression, experimentation, support and trust, with knowledge transfer emerging as being particularly dominant and forming a significant thread that ran through fifteen of the twenty-one activities.

This process proved to be really useful in identifying the universal values the stakeholder had identified strongly with. In particular, the stakeholder contextually interpreted his values in ways that we could not have identified through the sole use of the ESS. For example, in identifying strongly with the ESS value of universalism, the stakeholder believed that this value was manifest in his business through trading with small-scale global farming initiatives, the hosting of both cultural and educational events, sourcing of pack- aging materials and use of

recycled objects. Such insights provided us with a rich picture of how the ESS values could be translated into the contextual level, enabling us to start considering the physical space of The Hall in the context of values. In essence, this stage served to reify the abstraction of the universal values as it revealed a range of concrete factors to consider, thus grounding our research firmly within the context of The Hall.

Although the contextualising interview proved to be invaluable for engaging a very specific context, it also presented tensions in terms of navigating the complexity of the data it generated. This was particularly the case in considering the ninety-four 'local' values that were extracted from the interview transcript in terms of interpreting, evaluating and prioritising values. This enabled us to identify six dominant local values of sustainability, experimentation, progressive-ness, support, trust and knowledge transfer that Le Dantec et al. [17] would describe as having been produced in situ. It is interesting to note that there is no great overlap in terms of the ten ESS universal values and the six contextual values, suggesting that universal and contextual values are inherently different things, which is indicative that universal values alone cannot lead to a contextually-relevant solution.

In terms of strengthening value sensitivity (an activity that Le Dantec et al. [17] believe to be essential in contemporary HCI research where "there is a growing need to to understand and design for the local"), this stage of our methodological process was invaluable.

Interpretive Mapping:

Description: This stage utilised artefactual analysis and is the point at which our work starts to depart radically from traditional VSD, taking it into the realm of the physical space digital interactive content is designed for. To do this, we developed a large-scale panoramic image of The Hall, (Figure 1), which allowed us to start identifying and mapping objects within it that could be considered to embed and communicate the six local values of knowledge transfer, sustainability, progression, support, trust and experimentation.

Figure 2. Mapping the objects within The Hall

The most dominant local value of 'knowledge transfer' gave us a useful starting point as it permeates many of the twenty-one activities which also serves to contextualise the universal values. One such activity was the recycling of objects

Figure 1. Panoramic Image of The Hall

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(both functional and decorative) to be used within The Hall. The interview transcript revealed, for example, that the associated local values with this particular activity were those of knowledge transfer and sustainability. The stakeholder had originally intended for a broad range of knowledge to be communicated through the The Hall's physical space relating to (amongst other things) the farming, sourcing and production of coffee. As a means of achieving this, objects were selected by the stakeholder that included decorative vintage coffee grinders, a functioning vintage hand-pulled espresso machine and decorative coffee sacks from source suppliers. We found many, but not all of the objects within the The Hall could be related to the six dominant values, to varying degrees.

Figure 3. Skeleton Panoramic

Results and reflections: Using the panoramic image (Figure 1), we systematically identified and mapped twenty-eight objects that could be considered to transfer knowledge, both explicitly and implicitly (Figure 2). For example, small cards are placed next to unfamiliar objects within The Hall. These cards are used for explaining what objects are and were mapped as transferring explicit knowledge. In contrast, other objects such as coffee syphons were mapped as transfer- ring implicit knowledge because although they communicate knowledge relating to production, they are not a standard feature within cafe ́s and there is no supporting information to explain what these objects are.

Following the identification and mapping of knowledge transfer objects, we then considered whether or not the remaining five values were communicated through these objects. In or- der to do this, a skeleton panoramic of The Hall was created

(Figure 3). Using this panoramic as an experimental canvas (Figure 4) we interpreted how and if, the knowledge transfer objects embedded and communicated the remaining dominant local values of sustainability, progression, experimentation, support and trust that had been identified in the contextualizing interview.

In this case study the following insights gained through employing the Value Identification Map were:

• The value of sustainability was evenly distributed and prominently embedded and communicated in The Hall.

• Dominant local values of support and trust are represented only negligibly.

• The entrance area represents all of the dominant local values: support, experimentation, knowledge transfer, sustainability and progression.

• A significantly large area of The Hall represents only the single value of sustainability.

• The value of progression is represented in clusters, which creates value-dense areas.

More generally, the following results emerged:

- The dominant value of sustainability could be obviously mapped against a range of objects within The Hall, including vintage wall-hangings, coffee sacks and refurbished seating. As a value sustainability was identified early in the process, being of central importance to the stakeholder within his business.
- The value of support was mapped onto objects considered to support the customer's understanding of the The Hall, such as the aforementioned explanatory cards placed next to unfamiliar objects.
- The value of progression denoted objects considered to be important in being experimental, such as situating an artisan bakery within the space, the use of a hand pulled cappuccino machine and the use of old coffee grinders as tables.

The Hall is a unique physical space and we believe that the sole use of a prescribed heuristic such as that of the ESS would lead to value-insensitive digital augmentation of this physical space. The development of interpretive mapping grounded our research explicitly within the context of The Hall, enabling an immersion within that context that we do not believe would have been possible otherwise. Through this process we discovered the value of sustainability

dominated the map, ranging from furniture through to the products used. Sustainability and care for the environment was mentioned frequently throughout the contextualizing interview, permeating all aspects of the business, thereby reinforcing the mapping technique. . The use of the panoramic images as 'working' canvases countered the notion of divorce that Le Dantec et al. believe results from imposing universal values upon a specific context. [17] In this sense the panoramic canvases removed the option of working with familiar heuristics and, as such, led us into un- charted values-discovery territory.

Interpretive mapping can be adopted and developed in projects that aim to privilege physical space within digital augmentation projects.

Each insight can be interpreted in different ways. For example, the prominent value of sustainability that is embedded and communicated in The Hall could become more evenly balanced through the development of digital interactive con- tent that does not focus upon sustainability or conversely, the stakeholder may wish to develop this value so that it be- comes a defining brand value. Alternatively, values can be approached in a purely spatial sense, leading to digital augmentation that creates varying levels of value density, dependent upon project aims.

OVERALL EVALUATION

Our key contribution to the field of VSD is the *Value Identification Map* (Figure 5)a bespoke, creative interpretation of a physical space that identifies how local values are embedded and communicated throughout. This technique has the potential to become a powerful, design decision-making tool for informing the digital augmentation of a physical space resulting from a unique way of 'seeing' and understanding. A crucial strength of the Value Identification Map lies in the visual representation of values, enabling designers and stakeholders to clearly identify key values. Visual presentation of the physical space ensures connection of space, objects and values, leading to more informed decisions regarding digital interactive content.

One very encouraging aspect of the use of the is the ease in understanding the Value Identification Map by the stakeholder . We attribute this to him being engaged in questions of value within the first two stages of the methodological framework, and careful design treatment of the Value Identification Map. In the case of The Hall, this process opened up a formative design phase that can inform digital augmentation through enabling value-sensitive consideration of its physical space.

The stakeholder was asked to reflect upon the Value Identification Map in terms of its influence upon how he perceived The Hall, if he agreed with the values identified, and if any values were thought to be missing. He was also asked to consider whether or not the Value Identification Map would influence the potential development of digital interactive content for The Hall, to which he responded positively and plans to employ the technique for this purpose.

Reflecting upon the stages of development and design of the Value Identification Map we identified the following:

- We found it to be particularly useful for making and recording observations through being able to see the whole space.
- It enables the visual identification of values through seeing the whole context of a space and all of the objects within.
- The stakeholder is able to immediately identify with the physical space and the objects. Through employing a purely visual method effective communication with the stakeholder can occur.
- Visual rather than text mapping enables a clear and unambiguous method of identifying key objects and values held within them.

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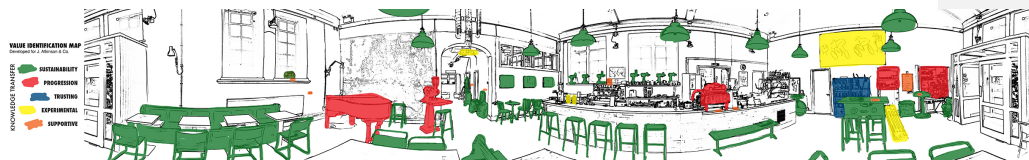
The Value Identification Map is a flexible tool: it does not provide any absolute 'solutions', rather it illuminates values-informed directions. For example, the Value Identification Map demonstrated a dominant local value of 'support' was not strongly represented within The Hall, and was only being communicated through small identification cards used to describe and communicate the heritage of some of the more unfamiliar objects. As a result of this, the stakeholder has started to develop design ideas for digital interactive content to develop and enhance how the local value of support is embedded and communicated within the The Hall.

The stakeholder has an intimate knowledge of The Hall, but had never considered it in terms of how values were communicated through its physical space or how values might inform the development of digital interactive content. It emerged that during the design of The Hall, the stakeholder had created a mood-board containing the phrase "To use a materials palette to reflect our brand values and communicate them to the customer." The Value Identification Map has encouraged reflection upon this original aim and illuminated the fact that there have been no tools to guide in the development of a "materials palette".

An important additional outcome of the case study is the role of the Value Identification Map in addressesing the lack of tools in eliciting contextual values, as identified by Le Dantec et al . As a result of this the stakeholder is now considering how further values might be represented within the physical space of The Hall. He felt values important to his business were now confirmed to be embedded and communicated in The Hall, and furthermore that their measurement has been facilitated. The stakeholder is keen to utilise the Value Identification Map further as a collaborative tool with which to engage appropriate designers in the digital augmentation of The Hall.

Previous VSD literature acknowledges the importance of working with a range a stakeholders in striving for design sensitivity (11). In light of this we acknowledge the potential limitations of working solely with the major stakeholder in terms of biasing the identification of local values. However, it was also apparent from the contextualizing interview that the company is very much values-led and the stakeholder presented us with a rich tapestry of values to investigate and unfold in our study. As a result of this we felt it was entirely appropriate to work with a sole stakeholder. The inclusion of multiple stakeholders such as staff and customers would have inevitably have enriched the process and indeed this is identified as an area for future research (as discussed below). An interesting insight to emerge from the contextualizing interview was the stakeholder's strong vision The Hall, suggesting he would direct any future development of digital interactive content. As a result of this, we felt it was entirely appropriate to work with a sole stakeholder.

FUTURE WORK AND WIDER APPLICATIONS

The first area for further work addresses the engagement of multiple stakeholders within the café space. Stakeholder engagement is fundamental to the development of a value sensitive approach towards the design and implementation of digital interactive systems. It is also vital in ensuring values held by multiple stakeholders are represented within the design of digital interactive content. As a tool for eliciting values the Value Identification Map offers the potential such engagement, which would also enable evaluation as to the effectiveness of this technique as a tool for eliciting contextualised values.

Consideration of stakeholders in a broader context, e.g the high street is also an important area of further work, leading to the possible overlapping of values in interesting and unexpected ways. The variety of businesses operating on the British high street offers the opportunity to experiment with the VIM across multiple sites in developing joint digital interactive content on a larger scale. By expanding this research across different sites there is the potential to collect interesting data relating to values held by businesses and customers within a city. However, a broader application of the VIM across different sites and multiple stakeholders requires further development and evaluation of the tool's effectiveness on a larger scale in order to enable the more complex assimilation of local values this would require.

In answer to the call for a stronger, more defined methodology of VSD, the Value Identification Map is a tool through which to address the collaborative nature of a values sensitive approach. This in turn could lead to a method of value elicitation that enables groups to collaborate with designers in drawing out important local values within physical spaces. As yet a step-by-step guide to using the Value Identification Map has not been developed but we see this as a critical next step. Such a tool would enable users of the guide to develop local values with the Value Identification Map supporting this process, serving as a value sensitive starting point to projects involving the design of digital interactive material.

Collaboration is also an issue approached by Borning and Muller [3], who propose that "methods from participatory design, collaborative ethnography and action research be used to inform the methods of VSD." This suggestion stems from the notion that values inherently influence participants and that by including more collaborative methods, the design of digital interactive content might become more appropriate to the stakeholders. A similar approach is taken in the case study by employing visual techniques such as artefact analysis and the creation of the Value Identification Map to develop a creative and inclusive approach.

It is inevitable that introducing the Value Identification Map to multiple stakeholders and sites will lead to value conflicts. People hold the same values but to differing degrees, potentially leading to disagreement and trade offs as a result of differing priorities. For example, staff and customers might not share the same values as the stake-holder did in our case study, thereby requiring a more detailed and complex evaluation in order to synthesize and make sense of local values. How such values are mediated between and represented is a fundamental consideration in developing a value driven design approach. Representing such conflicts on a Value Identification Map is an important next step in order to provide a beneficial guide for designers and stakeholders.

Furthermore, the application of the Value Identification Map to multiple sectors, such as heritage and leisure, would enable the technique to be developed and used in contexts that differ greatly to that in which it was created. The tool itself is generic, offering a neutral process through which contextually specific values can be elicited.

CONCLUSION

The contribution made by this paper to VSD and more generally to the field of HCI is a methodological framework consisting of three stages, as a result enabling value identification to inform the digital augmentation of physical spaces. By drawing upon the importance of human values in the design of technology, we approached the issue of their under-representation within HCI research and practice.

More generally, Value Sensitive Design has been understood to be a methodology that operates within the context of developing computational systems. We suggest that this is impeding its progress into much broader spheres of design research and practice, where it could make significant contributions as a value-driven and experimental design methodology. Our case study has served to push the boundaries of VSD's remit and responds to issues raised by Le Dantec et al. [17] regarding the need for a more experimental, in situ approach to VSD in order to appropriately contextualize human values.

Our exploratory case study makes two significant contributions:

- The development of Value Identification Mapping: a technique with which to deal with human values, the design of digital interactive content and its potential effects upon physical spaces. This has the potential to be used for collaboration with a variety of stakeholders across varying contexts.

- The opening up of a new VSD space that extends value sensitive approaches beyond the design of computational systems and into the physical spaces that they are designed for. This addresses the relationship between human wellbeing, physical space and the design of digital interactive content.

Throughout the process of developing the Value Identification Map, we adopted an experimental and emergent approach that was influenced by John Law's notion of "mess in social research" [15]. This notion acknowledges that when researching with people, it is inevitable that there will be an element of uncertainty and "mess". We did not work with a defined set of research methods but developed them based upon insights that emerged at each stage. It is this process we suggest, that gives this case study a richness in terms of approaching the contextual design of digital interactive content, as it is an approach that is not embedded within the world of computing. Within our research we have established that working with human values is fundamental in the design of computer technologies [9] but our approach has illuminated a new, more far-reaching direction. At the heart of our research was concern for how the design computer technologies will affect human values as a result of their increasing presence within our built environments. This is a design issue that designers of computer technology, interior designers, service designers, urban planners and architects (amongst others) will increasingly be called upon to consider, accounting for Thackara's view that "When it comes to innovation, we are looking down the wrong end of the telescope: away from people, toward technology" [23].

Value Identification Mapping moves designers to the right end of the telescope, engaging them with people, values and physical space prior to technological consideration. In doing so, the digital augmentation of physical spaces will become sensitive to human values.

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