INTERNATIONAL CONFERENCE ON ENGINEERING DESIGN, ICED'07
28 - 31 AUGUST 2007, CITE DES SCIENCES ET DE L'INDUSTRIE, PARIS, FRANCE

INDUSTRY RESPONSE TO INCLUSIVE DESIGN: A SURVEY

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ABSTRACT
There are great potential benefits to a company of engaging in inclusive design (ID), that is, in designing for a wide range of potential users, including those who are older or have disabilities. Doing so can have significant commercial benefits, tapping into a large and growing number of older and disabled consumers, as well as meeting legislative requirements. However, while many companies agree with this, many still target young, able-bodied people. As part of the research into ID, it is important to understand why this is so and to identify barriers to and drivers for the adoption of ID by industry. Furthermore, it is useful to identify whether there are any groupings amongst companies that would influence their adoption of ID and the strategies for convincing them of its usefulness. This paper therefore presents the results of exploratory statistical analysis of data from a questionnaire survey of industry's response to ID, consisting of 99 response sets from companies representing manufacturing, retailing, ICT, design and communication industries predominantly in the south of the United Kingdom. Both cluster and factor analysis were applied to the set of companies to elicit groupings on the basis of their responses to questions. These groupings are used to identify four main kinds of companies that respond to ID in different ways. Suggestions are provided for how ID materials can be tailored to meet the needs of these companies, by emphasizing different barriers and drivers and their application to the particular needs of these kinds of companies.

Keywords: Inclusive design, industry, barriers, drivers

1 INCLUSIVE DESIGN AWARENESS
The population of the developed world is ageing [1], resulting in a large, growing and influential group of older and disabled consumers with considerable spending power [2]. In addition, this change in demographics has prompted the introduction of legislation, such as the UK Disability Discrimination Act [3] and the Americans with Disabilities Act [4], that require companies to consider older and disabled people in the design and provision of services. Widening one's target market to include such users therefore makes sense commercially, legally and ethically. This involves taking into account the needs, abilities and desires of these users, and results in products and services that are better matched to them and their needs. For example, in the UK, B&Q developed a successful range of power tools, by following these principles and consulting with a wide range of users [5].
However, although there has been some increase in levels of awareness and some efforts at more inclusively designed products, many products still cannot be used easily (or at all) by many older and disabled people [6,7]. It seems that many companies are failing to adequately address these users' needs, despite the availability of supportive approaches such as Inclusive Design (ID) [2,6].
In order to encourage and enable companies to effectively design for older and disabled people, we need to understand why this is the case. This paper therefore presents results from a UK survey into the barriers that stop companies from adopting inclusive design and the motivations that encourage them to do so. As well as describing the key barriers and drivers, we examine the factors involved in the companies' response, identifying distinct types of companies with respect to their response to inclusive design and the barriers and drivers that they face. We discuss how these different types of companies can best be addressed in efforts to promote and equip inclusive design practice.

1.1 Previous studies of industry

Previous studies have also sought to understand the barriers and drivers to ID and related approaches. Surveys in the US [8] and Japan [9] identified a range of barriers and drivers for universal design, covering areas such as regulation, training, data, demand and interest. In the UK, a survey found that "design for all" was widely known and understood but not widely practised within the design community. Lack of time, client backing, money and awareness of the possible market were reasons given for this [10]. Also in the UK, some small-scale studies [11,12] suggested approaches to increase the uptake of ID, and more recently, Dong et al conducted a fuller study of barriers and drivers [13].

Other related work includes case studies on the uptake of ID within individual companies (e.g. [5, 14]). These highlight the importance of factors such as engaging key people in companies, appropriate training and a good business case. However, it is difficult to know how generalisable these factors are.

The uptake of ID can also be discussed from a theoretical perspective. For example, Macdonald recently discussed the universal design phenomenon in Japan, suggesting that a key reason for its widespread uptake was its match with the existing cultural and corporate values of cooperation, philanthropy, regard for the customer and the well-being of society as a whole [15].

These results indicate some of the key barriers and drivers to inclusive design but there is still a long way to go in our understanding. In particular, more needs to be known about how companies vary in their response, which would enable better tailoring of efforts and material. The study by Dong et al. [13] surveyed two separate groups, one of manufacturers and retailers and one of design consultancies, and found differences in the ways in which they perceived major barriers to ID. However, the use of different questionnaires for the different groups limited the ability to make comparisons across groups and to identify other factors that affect company response.

2 THE INCLUSIVE DESIGN QUESTIONNAIRE

We therefore conducted the survey described in this paper, building on the previous study by Dong et al [13]. We expanded the previous work by targeting large organisations as well as small and medium-sized enterprises (SMEs), by expanding the sample size and by using a single questionnaire across the whole sample. This allowed more reliable analysis and comparison across the range of companies. We also investigated companies' demographics, current position and business drivers in more detail in order to enable examination of their impact on companies' response.

Some of the survey results are reported elsewhere [14] and are described briefly here to enable fuller discussion and comparison. However, this paper focuses on how companies group together in terms of their response to inclusive design, and what this implies for how we can reach and influence them.

Table 1. Questions in Parts 1 to 3 of the Questionnaire

Part 1. Company Profile
1. Number of employees
2. How many people use your products / services?
3. How many companies represent most of your sales?
4. Global profile (UK, EU, USA, Global)
5. Does your organisation have a post for corporate social responsibility (CSR)?
Part 2. Current Understanding
1. Have you heard of the following terms? (Inclusive Design, Universal Design, Design for All)
2. What do you think they mean?
Part 3. Current Company Position
1. What level of awareness of Inclusive Design is there in your organisation?
2. How inclusive do you think your products / services are?
3. What level of effort is utilised to make your products / services inclusive?
4. Is your organisation interested in making your products / services more inclusive?
5. How aware is your organisation of:
A. The DDA (Disability Discrimination Act in the UK) or ADA (Americans with Disabilities Act)?
B. British Standard BS7000-6 (Managing Inclusive Design)?
C. Other legislation and codes of practice?

2.1 Questionnaire Design

The survey was conducted through a questionnaire, divided into six main parts: company profile; understanding of inclusive design (ID); company position on ID; drivers for it; barriers to it; and approaches to increase its use.

The first three parts addressed the respondent's context, allowing us to investigate the impact of aspects such as company size and awareness of ID on companies' response to it (see Table 1). Part 1 requested demographic information, and Part 2 examined awareness and understanding of ID and related terms. At the start of Part 3, the following definition of ID was provided to ensure that subsequent responses were given with a common understanding: "a process whereby designers, manufacturers and service providers ensure that their products and services address the needs of the widest possible audience, irrespective of age or ability" (derived from the DTI's Foresight programme). This section then examined various aspects of the current company position on ID.

Parts 4 and 5 of the questionnaire then examined drivers for and barriers to ID (Table 2). Lists of possible barriers and drivers were provided, derived from those identified by Dong et al [13], and respondents were asked to identify which ones applied to their organisation and to give an indication of their importance. Finally, Part 6 (not shown due to lack of space) elicited responses to possible approaches for encouraging ID.

Table 2. Questions in Parts 4 and 5 of the Questionnaire

Part 4. Drivers for Inclusive Design
1. How much do you agree with the following five statements:-
A. Legislation is a major driver for Inclusive Design within our organisation.
B. British Standard BS7000-6 will help us to practise and manage Inclusive Design.
C. Social responsibility motivates our organisation to consider Inclusive Design.
D. Demographic and consumer trends are driving our organisation's commitment to Inclusive Design.
E. Brand enhancement is a key driver for Inclusive Design within our organisation.
2. How effective do you think Inclusive Design could be in helping you to achieve the following commercial benefits?
A. Entrance to a new market
B. Increase the size of your potential market
C. Achieve a larger share of your current market
D. Increase customer loyalty
E. Increase revenue through increased usage
F. Increase customer satisfaction
G. A source of Innovation and Differentiation
If there are other key benefits for your organisation, please specify
3. How effective do you think Inclusive Design could be in enhancing your brand?
Part 5. Barriers to Inclusive Design
1. Please respond to the following statements on barriers to Inclusive Design with respect to your organisation.
A. There is little or no internal support for Inclusive Design
B. Implementing Inclusive Design would require significant cultural change
C. We lack the knowledge and tools to practise Inclusive Design
D. There is no justifiable business case to support Inclusive Design
E. There is a lack of time and budget to support Inclusive Design
F. There is a perception that Inclusive Design is too difficult
G. Inclusive Design compromises the aesthetics of the design
H. Inclusive Design is not a perceived need of our end users
I. There is a stigma associated with Inclusive Design
J. Inclusive Design is seen as an unachievable goal
Which three of the above barriers do you perceive as most important and why?
Which three of the above barriers do you perceive as least important and why?
Are there any other significant barriers to the adoption of Inclusive Design within your organisation?

2.2 Questionnaire Distribution and Sampling

The questionnaire was distributed by post and on-line to companies in the United Kingdom (UK) between March 2005 and May 2006. Complete responses were obtained from 99 distinct UK companies and organisations, mostly from the design, manufacturing and retail sectors. Note that the previous paper [14] referred to a dataset of 101 companies, but subsequent analysis revealed some cases of multiple responses from the same company, resulting in a final dataset of 99. Many of these responses were obtained through industry contacts, while others were recruited by phoning organisations identified through a web search. Targeted sectors included telecommunications and IT, consumer electronics, household durables, energy, medical-pharmaceuticals, transport and fast moving consumer goods (FMCG). The sample is spread across England, but with a concentration of companies (43 out of 99) from London and the South-East. In addition, a significant proportion of the companies (22 of 99) are larger national or international companies without a specific UK location, and there is a small number of companies from elsewhere in the UK. This sampling pattern means that the resulting analysis may not be applicable to SME style companies in the north of England and Scotland, other than nationals and multi-nationals with distributed sites.

2.3 Sources of Bias

At several points, though not in all sections, respondents indicated their level of agreement on a four-point scale. Both ends of these scales were anchored (*e.g.,* Strongly disagree-Strongly agree or Not effective-Very effective). It should be noted that such scales are biased, with respondents tending away from disagreement, particularly strong disagreement. Nevertheless, they can indicate the relative strength of different aspects of company position, such as the response to different drivers, and there was evidence that the distribution of responses over all companies used the entire range of the scales indicating no systematic floor or ceiling effect or undue central tendency. In addition, the questionnaire yielded self-report data that may have been representative only of the individual responding rather than the company and may have represented idealistic or inaccurate self-perception of the company's status and policies. Some self-selection is also likely in the company sample, as organisations with prior awareness of and interest in inclusive design are more likely to want to participate. The sample may, therefore, display a more positive response to inclusive design than UK industry as a whole. We took this into account by examining companies' awareness and interest levels and including these in the analysis, identifying some differences in response based on these levels. These differences are encapsulated in the descriptions of the distinct clusters given in Section 4.1.

3 BASIC FINDINGS: COMPANIES AS A WHOLE

Before looking at how companies differed in their survey responses and how they grouped together, it is useful to have an overview of the findings from the sample as a whole. These results are presented in more detail in [14]. Contrary to what would be expected if positive bias occurred, we found that about half of the respondents rated their companies as low or very low (on a four-point scale) on current inclusivity and on effort invested in ensuring inclusivity. In addition, 39 and 22 (out of 99) indicated low or very low awareness and interest respectively. Given the self-selection in the survey, the general levels of awareness, inclusivity, effort and interest may well be even lower than these.

Respondents then indicated their level of agreement with various drivers for and possible commercial benefits of inclusive design (as shown in Table 2). Key drivers were demographic and consumer trends, social responsibility and brand enhancement, and key commercial benefits were increasing customer satisfaction and producing innovation and differentiation. Key barriers identified by the study were: (E) a lack of time and budget for supporting ID, (C) a lack of knowledge and tools for practising it, and (H) that ID was not a perceived need of the end users. In addition, the lack of a justifiable business case for ID was identified as the most important barrier by 13 of the 99 companies.

4 GROUPING COMPANIES BY SIMILARITY OF RESPONSE

The similarities and differences between companies' responses were examined in order to identify whether there are any groupings amongst companies that would influence their adoption of ID and the strategies for convincing them of its usefulness. Key groups of companies were identified using a hierarchical cluster analysis of the companies on the basis of their questionnaire responses. A factor analysis of the companies was also conducted to increase the confidence in the groupings and identify the influence of the different groups on the data variance of the set as a whole.

4.1 Cluster Analysis

Cluster Analysis is a well-established, exploratory multivariate statistical technique that is traditionally used to group and classify objects in a dataset [16]. It uses iterative numerical methods of classification to extract the underlying similarity structure in data on the basis of certain metric and linkage method assumptions. The technique used was hierarchical agglomerative and the similarity metric was Euclidian distance. Results from a set of linkage methods with varying properties were used to validate the result. The study aimed to examine the structure of the dataset and to elicit the natural groupings of companies across the entire sample based on their questionnaire responses. In this way, insight was gained into the grouping of companies according to their expressed perceptions and responses to drivers and barriers to inclusive design.

Clustering Methods

The analysis was performed using SPSS for Windows Release 12.0.1 on a dataset of 99 respondent companies. Some of the question variables were nominal with a value of 1 or 0 denoting agreement or disagreement with a statement. The rest were ordinal with levels corresponding to a scale of perceived agreement with or effectiveness of a statement, or to different demographic characteristics. The clustering options appropriate for these variable types were chosen in SPSS.

In order to reduce the undesired weighting of some questions due to multipart responses, 39 of the original question set were chosen as clustering variables, by selecting representative portions of the multipart questions. For example, question 1.4 on global profile had a four part answer. To avoid this same question counting four times in the analysis, a single part of its answer was chosen to represent the question in the cluster analysis. The questions selected can be seen in the example response vectors in Table 3 on the following page. An analysis of the full question set was run as a comparison with this reduced set to ensure that the variable reduction did not greatly alter the resulting cluster solution.

The dataset was then clustered using the squared Euclidian distance metric. A number of linkage methods were run: single linkage (nearest neighbour), complete linkage (furthest neighbour) and Ward's method (minimum variance), to establish the clustering's stability over different linkage rules. The output was collated as clustering dendrograms (see Figure 1), which are graphical representations of the clustering process. In these, individual companies are listed along the top, and a tree-like structure shows how these cluster together, with connections nearer the top of the diagram indicating more tightly-knit clusters. No scree plot was generated as interpretation of the dendrograms was made on the basis of the entire tree with no preferred cluster solution.

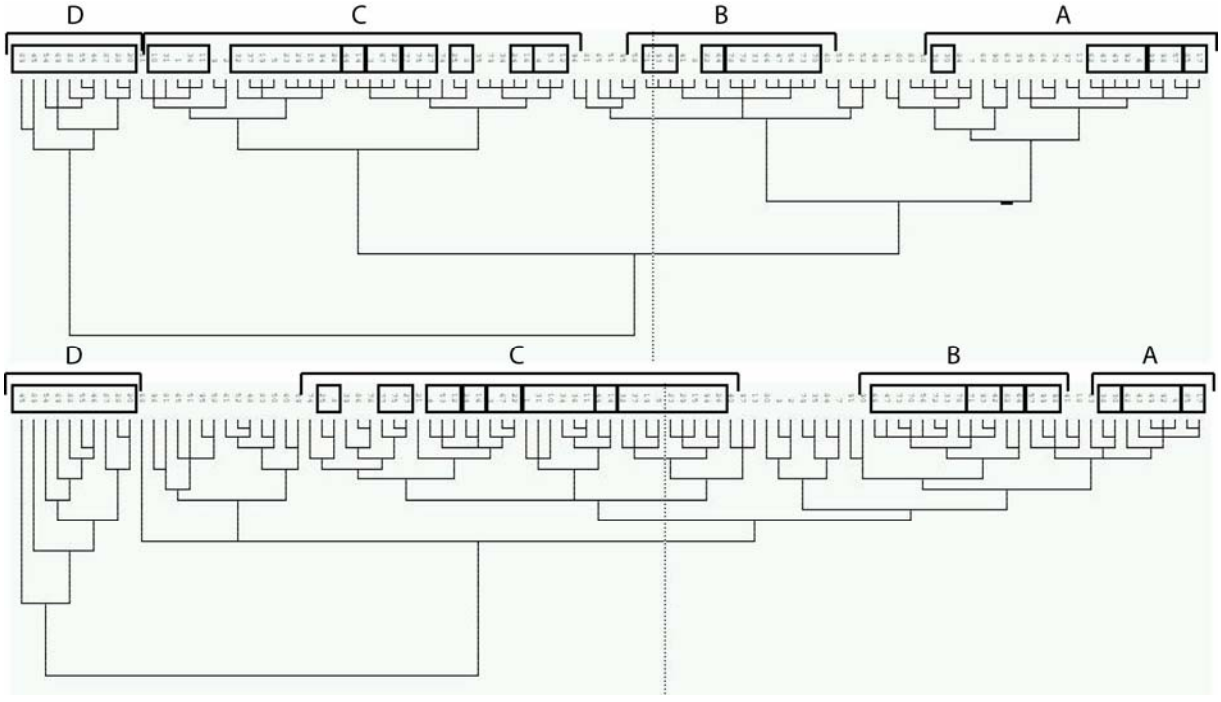

Figure 1. Dendrograms of the cluster analysis results on the companies with (top) Ward's method and (bottom) complete linkage. Boxes and letters indicate clusters in common.

Table 3. Example response vectors, showing the responses given by company 6 (in cluster A) and company 28 (in cluster D). The responses marked D indicate where the respondent ticked "Don't Know".

		Part 1					2	3						4												5									6			
Cluster	Co	1	2	3	4d	5	1a	1	2	3	4	5a	5b	1a	1b	1c	1d	1e	2a	2b	2c	2d	2e	2f	2g	3	1a	1b	1c	1d	1e	1f	1g	1h	1i	1j	1a	1b	1c	1d
A	6	1	4	2	0	0	1	3	3	3	4	3	1	2	D	4	3	3	3	3	3	4	3	4	4	4	0	0	0	0	0	0	0	0	0	0	4	3	3	4
D	28	4	5	4	1	1	0	2	2	2	2	3	1	1	D	2	4	D	2	2	2	2	2	2	3	1	1	0	1	1	1	0	0	1	0	0	3	3	2	3

Cluster Analysis Results

The results were variable with differing, but related, dendrogram structures for Ward's method and complete linkage. Single linkage produced a very pronounced chaining effect whereby companies joined one steadily growing cluster at each iteration of distance. This is a well-understood indication that interpoint distances are small and there is a homogeneous space with little cluster differentiation. Instead the clusters can be considered to be higher density regions in the cluster space. This suggested that differences in the resulting dendrograms were the result of small differences in the effects of linkage methods and not due to numerical instability or other effects of statistical data variability.

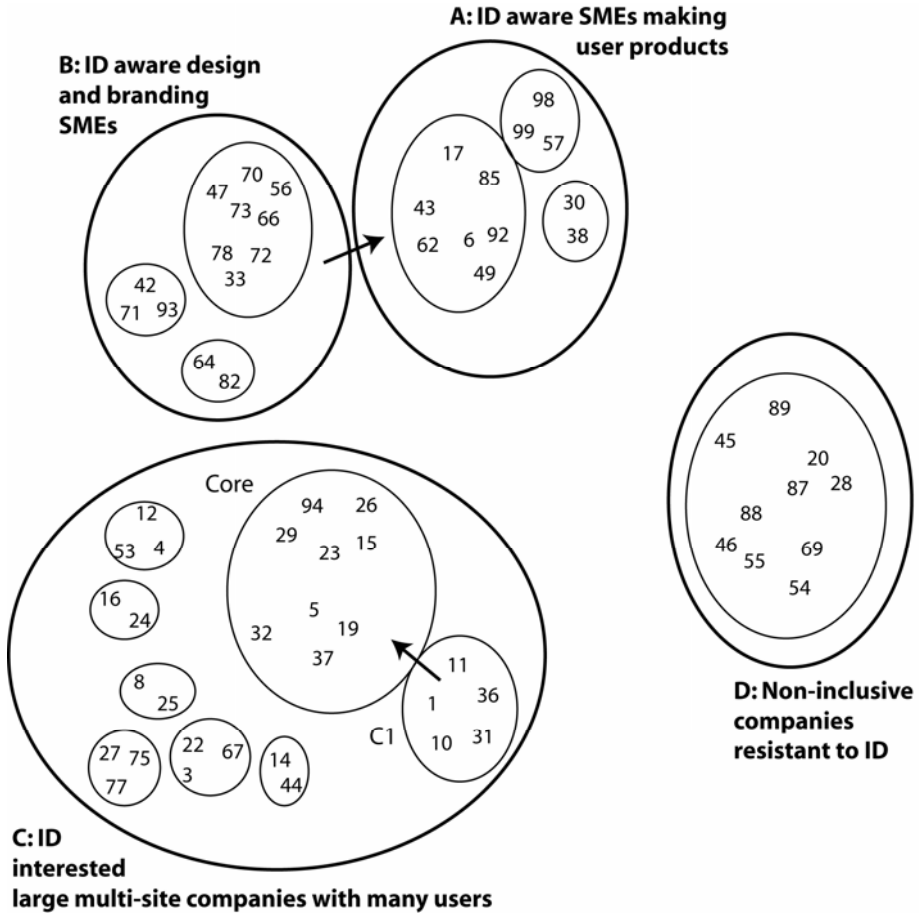

Figure 2. Core company clusters resulting from a comparison of Ward's method and complete linkage results. Numbers correspond to individual companies and relative distances between clusters indicate their distance from each other in the cluster analysis. Only companies in the core clusters are shown for reasons of clarity.

To test this and to continue the analysis, the dendrograms resulting from Ward's method and complete linkage were examined and the incidences of commonality of clustering tested. Core clusters were identified if they were common to both methods irrespective of higher distance linking that occurred later in the analysis (see Figure 1). The results are shown in Figure 2, which shows membership of the four key clusters, and the answer profiles of some example companies are shown in Table 3. Figure 2 also indicates the trend of satellite cluster joining and shows that cluster B joins cluster A at later

stages of the analysis. The analysis resulted in a number of companies whose cluster membership was not represented in the diagram or analysis on the basis that their membership was indistinct and variable. These unclustered companies represent a substantial group whose collective answer profiles were difficult to characterise and therefore unclear.
The core clusters were then scrutinised for differences in the profiles of their member companies' responses to questions, and a descriptive characterisation of each cluster was built up from these differences in answers:-

Cluster A: ID-aware SMEs making user products

The 12 companies in cluster A were small and locally based but produced products or services with many users (for example, they manufactured heating controls or designed public terminals). Only one of them had a corporate social responsibility (CSR) post. They had high levels of awareness and interest in inclusive design and were motivated by many drivers for it, with all of the companies identifying at least nine drivers for their organisation. They were particularly motivated by social responsibility and the whole range of commercial advantages.
However, this cluster divided into two sub-groups: the main core of this cluster saw few barriers to ID and was correspondingly high on current levels of inclusivity and effort spent on ensuring it. In contrast, the rest of the cluster perceived a variety of barriers; in particular, they felt that ID was not a perceived need of their end users. They also felt that it was hard to achieve and may have worried about the stigma attached to it. Perhaps as a result, they were only about average in their current inclusivity and the effort spent on it.

Cluster B: ID-aware design and branding SMEs

The 13 companies in cluster B were also small and locally-based. Unlike cluster A, however, they produced products with a limited number of users and a significant proportion (31%) had CSR posts. A reasonably high proportion of them were design and branding agencies. These companies had relatively high levels of current inclusivity and effort, but only average interest. They were motivated by several drivers for ID, particularly legislation, social responsibility and brand enhancement. On the other hand, they tended not to associate ID with improvements in market and revenue.
The cluster as a whole had low levels of barriers, but it did split into two groups. The core companies of the cluster had lower barriers and responded particularly well to British Standard BS7000:6 on practising and managing inclusive design. They also had high levels of awareness of ID, whereas the non-core companies actually had below average levels of awareness.
Although cluster B was a distinct cluster, it lay close to A in the cluster analysis and joined A at later stages of the analysis. Like A, it contained small companies and had relatively high levels of inclusivity, high numbers of drivers and low numbers of barriers, although none of these are as pronounced as in cluster A.

Cluster C: ID-interested large multi-site companies with many users

Cluster C was larger, with 29 companies. It contained a core group (core) of nine companies and a group (C1) of five companies fairly close to this core. There were also several related small groups of companies but their characteristics were not closely related to those of the core or C1, so they are not included in this discussion.
Cluster C represented a group of large companies, with many users. Many of them had global profiles and were spread over multiple locations. A high proportion (79%) had CSR posts. There were very few design or brand companies in this cluster and several telecommunications ones. The cluster had an average level of inclusivity and a slightly higher than average number of drivers for ID.
Cluster C divided into two main groups. The core companies tended to have low numbers of barriers, with the highest barrier (identified by 44%) being the need for cultural change. They recognised most drivers: legislation, social responsibility, brand enhancement and all of the listed commercial benefits.
The other group (C1) also recognised many drivers, but did not respond very positively to legislation or brand enhancement. Rather, it felt that demographic and consumer trends were a key driver for ID, along with some, but not all, of the possible commercial benefits, especially ID's potential to increase the size of the market and increase customer satisfaction. Unlike the core, C1 companies had fairly high levels of barriers. Especially high barriers were the need for cultural change and the lack of time and budget for practising ID.

Cluster D: Non-inclusive companies resistant to ID

Cluster D was a tight grouping of 10 companies, containing a mix of different sized companies from a range of sectors and locations. It was strongly distinguished by its very low levels of inclusivity, very low numbers of identified drivers and fairly high numbers of barriers to ID. Low levels of inclusivity included low levels of awareness and understanding of ID, and of current inclusivity, effort and interest in ID. These companies particularly did not see the effectiveness of ID for achieving commercial benefits, and identified the following key barriers: that ID was not a perceived need of their end users, that it did not have a justifiable business case and that there was a lack of time and budget to support it. They were not very positive about possible approaches for encouraging ID.

4.2 Factor Analysis

We also carried out a factor analysis of the companies to increase the confidence in the groupings and identify the influence of the different clusters on the data variance of the set as a whole. This was conducted in SPSS v12 using Principal Component Analysis. Varimax rotation with Kaiser normalisation yielded a better fit to the four main factors. A total of six factors were identified, with four clear factors accounting for 78.4% of the cumulative variance. Brief descriptions of these factors are given for the purposes of comparison (see also Figure 3):-

Factor 1: ID-aware SMEs

This was by far the biggest factor with 46 of the 99 of the companies. It was comprised of small companies, most of which are locally-based, from a wide range of different sectors. The companies in it tended to have high levels of inclusivity, high numbers of drivers and low numbers of barriers. It also included all but one of the companies that specifically address issues to do with disability.

Factor 2:Large companies with some interest in ID

Factor 2 contained 29 companies, most of which were large (most with over 5,000 employees). Many of them had global profiles and over 50% of them were spread over multiple locations. There was a high incidence of CSR (corporate social responsibility) posts, a high incidence of manufacturing and telecommunications, and very few design or branding companies. This factor had roughly average levels of inclusivity on all variables, including the numbers of drivers and barriers.

Factor 3: Small design companies

This factor contained fourteen, mostly small, locally-based companies, with a higher than average proportion of companies that carried out design either alone or in conjunction with other activities (such as manufacturing). It had about average levels of inclusivity; numbers of drivers and barriers.

Factor 4: Non-inclusive companies

Factor 4 contained eight companies. Most were small and locally-based, although two very large ones were also included. It had very low levels of inclusivity on all measures: awareness, current inclusivity, effort and interest, although this was not as pronounced on interest. It had a very low number of drivers and a high number of barriers.

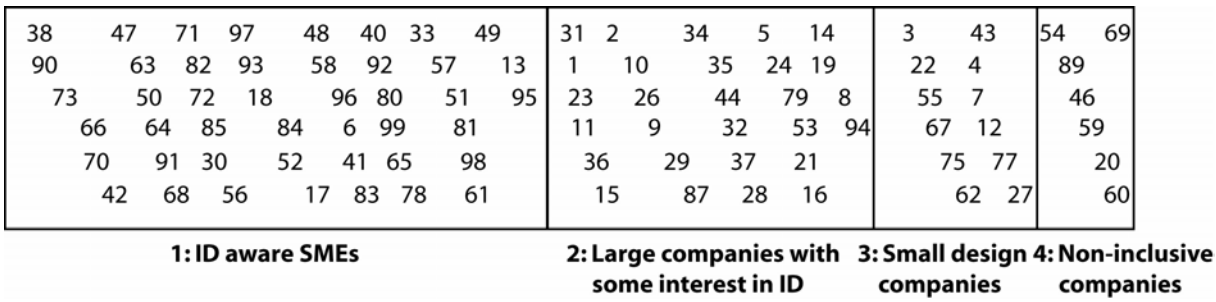

Figure 3. Factors identified by the factor analysis on the companies. Numbers correspond to individual companies. Their positions show the main factor related to a company and the strength of its factor loading: stronger loadings are placed towards the left of a factor. Only companies with factor loadings over 0.5 are shown.

Comparison with Cluster Analysis
Clusters A and B draw mostly from factor 1. The core of cluster C and group C1 come mostly from factor 2, with less closely related companies belonging to factor 3. Cluster D contains a mix of companies from factors 2, 3 and 4, although 60% of its companies come from factor 4. Unclustered companies come from a range of all the factors, but particularly from factors 2 and 3.

5 FACTOR ANALYSIS OF QUESTIONNAIRE BY QUESTIONS

The company groupings can also be usefully compared with a factor analysis previously carried out on the questions [14]. This analysis sought to establish the importance hierarchy of factors accounting for specific barrier and driver responses. By conducting a factor analysis on the questions rather than on the companies, we identified drivers, barriers and company characteristics that group together rather than identifying different types of companies. The factor analysis and its results are described in more detail in [14]. The factor analysis was conducted in SPSS v12 using Principal Component Analysis without normalised rotation of components. There were 101 cases (companies), as the full dataset was used before duplicates were removed (see Section 2.2). A subset of 26 questions representing the main questionnaire sections was chosen to ensure statistical validity by minimising sampling error. The analysis yielded four clear factors, accounting for 50% of the variance in responses (see Figure 4):-

Factor Q1: Awareness of ID and lack of corporate barriers to it
The main component in this factor was the level of awareness of inclusive design, followed by the current inclusivity of products and services. Companies responding positively to these also tended to respond negatively to barriers stemming from corporate or organisational factors, such as the lack of internal support, time, budget, knowledge and tools for ID and the need for significant cultural change.

Factor Q2: Arguments for the commercial (rather than social) value of ID
A set of drivers, focusing on the commercial value of ID, grouped together: a convincing business case; effective marketing tools; and the usefulness of ID as a source of innovation and differentiation and as a means of obtaining a larger share of the company's current market. Positive responses to these variables were also associated with a negative response to social responsibility as a driver.

Factor Q3: Concern about the possible effects of ID on brand positioning
This factor included the barriers to ID caused by its possible negative effect on aesthetics and the stigma associated with it. These were also grouped with a concern for brand, although this was expressed more positively, with ID's potential for brand enhancement being seen as a driver for it. Other associated drivers were demographic and consumer trends and legislation.

Factor Q4: Effect of size (or type) of company on attitude to ID
The main component in this factor was company size, with larger companies clustering with the perception that ID would require significant cultural change (implying some resistance to such change) and with negative responses to the perceived usefulness of British Standard BS7000-6, the perceived importance of effective tools for marketing ID and the existence of a corporate social responsibility (CSR) post.

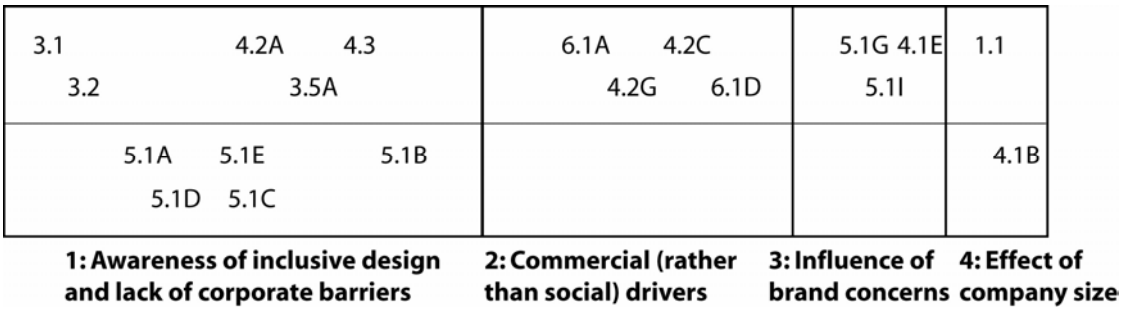

Figure 4. Factors from the factor analysis on the questions. Numbers correspond to questions. Their positions show the main associated factor and the strength of its factor loading: stronger loadings are placed towards the left of a factor. Questions below the line have negative factor loadings. Only questions with factor loadings over ±0.5 are shown.

6 SUMMARY AND COMPARISON

The cluster analysis yielded coherent clusters of 64 company respondents, the remaining companies' responses being too variable to identify them as members of any cluster. Although the data distribution was not tightly clustered and a number of cases were not decisively clustered, four common core clusters and related sub-clusters emerged using different linkage methods. These clusters were characterised by differences in company size, attitudes to inclusive design and the key barriers and drivers they experienced in implementing ID.

A factor analysis of the same questionnaire respondents increased confidence in these clusters, as it identified similar groups, which were further refined by the cluster analysis. The factor analysis also suggested that clusters A and B were predominant, cluster C less so and cluster D least, in their contribution to the overall data variance. The variance accounted for in Factor A, therefore, was due mostly to clusters A and B, both of which contained companies that responded fairly positively to ID.

A second factor analysis, carried out over the questions rather than the companies, provided further insight into the key issues that underlie the grouping of question responses. Although these issues do not relate directly to particular clusters, they highlight themes that emerge repeatedly in the survey.

7 COMMUNICATION STRATEGIES

It is clear from these analyses that barriers and drivers vary between companies and between types of companies. This means that tailoring materials to raise awareness of and equip companies for inclusive design would be useful. We suggest ways in which this can be done by examining the clusters in more detail. Elements that could usefully be emphasized or focused on in ID materials are described based on the particular barriers and drivers that the companies in each cluster face.

Cluster A: ID-aware SMEs making user products

Cluster A companies were SME manufacturers and designers of products and services for direct use by everyday consumers. They had high levels of awareness and interest in ID. They were also highly motivated to adopt ID, by a large range of drivers, particularly social responsibility and the whole range of commercial advantages. However, some of these companies felt that ID was not a perceived need of their end users and that it was hard to achieve in practice.

Therefore, for SMEs that produce products for everyday use, it may be effective to emphasize social responsibility and how it connects to their products. We can also usefully emphasize the commercial benefits in terms of market, use and user satisfaction. Many of these companies would also benefit from practical advice on how to implement ID in practice.

Cluster B: ID-aware design and branding SMEs

Cluster B companies were largely design and branding SMEs with high levels of current inclusivity and effort spent on ID. They were motivated by legislation, social responsibility and ID's potential to enhance brand, and they perceived low internal barriers to ID.

We conclude that legislation, social responsibility and brand enhancement are all potentially good arguments for design and branding SMEs with smaller numbers of direct users. These companies are currently not highly motivated by commercial drivers and, given the importance of finance to companies in general, it may be useful to discover why. Perhaps they are not motivated by the *kinds* of commercial arguments suggested in the questionnaire (which focused on increasing market, usage and satisfaction) or perhaps they do not see how these apply to them. If so, it may be necessary to research how to apply these kinds of commercial drivers to these types of companies, or to discover other commercial advantages of ID that do work with them. Alternatively, they may simply not be convinced by the arguments. In that case, we need to show better proof that ID can do what we claim it can for this kind of company. In short, if commercial arguments are to be used, they need to be better developed and applied to the kind of company in this cluster.

Cluster C: ID-interested large multi-site companies with many users

The main group of cluster C contained large multinational and national companies with many users, average inclusivity and high levels of drivers for ID. The existence of a distinct group of large companies is backed up by factor Q4 which identified an effect of company size on attitude to ID. The core of cluster C had low internal barriers to ID and high awareness of the social, commercial and other advantages of implementing it. A sub-group C1 contained similar large companies but reported

fairly high numbers of internal barriers, especially a need for cultural change and lack of time and budget for ID.
It seems that, for large nationals and multinationals, inclusive design often has problems integrating into the company culture. This culture is often more engrained and established in large companies and introducing new ideas and ways of working can be difficult. One possible strategy is to try to influence management in a top-down approach, but this is not always possible and materials, advice and training are needed to show how ID can work with and around the existing situation, and how it can be introduced without requiring large amounts of changes.

Cluster D: Non-inclusive companies resistant to ID

Cluster D companies were mixed in size and sector. They had little awareness or interest in ID, low understanding and appreciation of the drivers for ID (particularly its commercial benefits), and fairly high numbers of barriers, particularly associated with a perceived lack of commercial value and need.
It appears that a big difficulty for companies who have not adopted (or even been aware of) inclusive design ideas is often a perceived lack of commercial value and need for ID. It is important that the initial awareness-raising material emphasizes and gives concrete proof of commercial value and the need that the end-users (especially the end-users of the particular company) have for ID.

Insights from Question Factors

Insight into effective communication strategies can also be obtained from the factors identified by the second factor analysis carried out over the questions. These represent key issues underlying the grouping of question responses. They are: (1) the relationship between awareness of ID and corporate barriers; (2) the significance of commercial considerations for ID, response to which does not always match to concern about social responsibility; (3) concerns about the effect of ID adoption on company image, and (4) the effect of company size on the need for significant cultural change.
These issues suggest that material addressing corporate barriers (such as those experienced by cluster D) is vital. It may also be helpful to deal with commercial and social drivers for inclusive design separately; indications of this are also apparent in cluster B, but more work is needed to clarify this. Some types of companies may also need material showing how ID can enhance brand rather than compromise aesthetics. More details on these suggestions are given in [14].

8 CONCLUSIONS

A cluster analysis of companies' responses to an inclusive design survey was conducted in order to identify whether there are any groupings amongst companies that would influence their adoption of inclusive design (ID) and the strategies for convincing them of its usefulness. Coherent groupings were indeed found, indicating four key types of companies, with different kinds of drivers and barriers to ID. These were backed up by findings from a factor analysis of the same responses. Based on these, we have suggested ways of tailoring materials for raising awareness of and equipping ID, to make them more effective in meeting individual companies' needs.
In summary, the results suggest that there is a group of (12 out of 99) SMEs that produce products for direct use by everyday consumers, and that have high levels of awareness and interest in ID. They are motivated by the commercial, social and user benefits of ID, so these would be useful aspects to emphasize in ID material. Many of these companies would also benefit from practical advice on how to implement ID in practice. Another group of 13 SMEs contain more design and branding companies, and show fairly high levels of current inclusivity and effort spent on ID. Material for them could usefully focus on legislation, social responsibility and ID's potential to enhance brand. If commercial arguments are to be used, they need to be better developed and applied to this kind of company. A further grouping of 14 companies (part of a larger group of 29) shows that some larger, multinational companies are aware of the value, commercial effectiveness and nature of ID, but are often hindered by the need for cultural change. They need advice on how to introduce and adapt ID within a large company's existing culture. A final group of 10 companies shows that some companies (both large and small) have little awareness or interest in ID. In particular, they fail to recognise the commercial value of or need for ID, and so awareness-raising materials need to give concrete proof of ID's commercial value and of the end-users' need for it, particularly in the context of the specific company.
An accompanying factor analysis of the questions in the survey identified some key issues that underlie companies' responses: the relationship between awareness of ID and corporate barriers; the

significance of commercial considerations for ID; concerns about the effect of ID on company image; and the effect of company size on the need for significant cultural change. Although these issues do not relate directly to particular clusters, they highlight themes that emerge repeatedly in the companies surveyed and in the resultant clusters and suggestions as a whole.
Further work will build on these results by interviewing representatives of the different kinds of companies identified in this paper, in order to obtain a deeper understanding of their situations and needs. We will also develop a range of ID awareness-raising and training material for industry, taking into account the needs of these different kinds of companies.

ACKNOWLEDGEMENTS

The survey was funded by the EPSRC as part of the i~design 2 project. Some initial survey work was conducted by the Centre for Inclusive Technology and Design (CITD) and funded by the UK Department of Trade and Industry.

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