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COMBATING BARRIERS TO INCLUSIVE DESIGN: EVALUATION OF AN INCLUSIVE DESIGN TOOLKIT

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1 Introduction

This research is based on a number of studies of barriers to inclusive design [1-4], in particular the authors' own investigation of drivers for, and barriers to, inclusive design within the UK consumer product industry [4], where two mail surveys were conducted: one with 177 industrial design consultancies, and the other with 152 consumer product manufacturers and retailers. It was found that major drivers for inclusive design were similar for manufacturers, retailers and design consultancies, while top barriers to inclusive design differed for manufacturers, retailers and design consultancies. In parallel to the survey, requirements of inclusive design support were captured from manufacturers, retailers and design consultancies [5]. Based on the findings of the studies [4-5], a toolkit aimed to raise the awareness of inclusive design and highlight barriers to inclusive design was developed [6], and this paper will focus on the evaluation of the toolkit.

2 Development of the *i~design Primer* and the *i~design Toolkit*

The inclusive design toolkit was developed based on the findings from the study of barriers and drivers for inclusive design [4] and requirements captured from the potential users [5]. Common main drivers for inclusive design included '*consumer demands for inclusive design*', '*business case*', and '*tools for practising inclusive design*'. Prevalent barriers were '*perception barriers*', followed by '*technical barriers*'. For manufacturers, the top two barriers to inclusive design were '*the lack of business case*' and '*perceived sacrifice of aesthetics*'; for retailers, the top two barriers to inclusive design were '*perception that inclusive design is more expensive*' and '*perception that it can be complex to design inclusively*'; for design consultancies, the top two barriers were '*lack of inclusivity requirements from design commissioners*' and '*lack of budget for user research*'. It appeared that manufacturers, retailers and design consultancies all tended to consider that major barriers were from the other parties rather than from themselves. This revealed a hidden barrier about communication between designers and design commissioners [4]. Figure 1 summarises the main findings of the authors' study on barriers to inclusive design, where 'M', 'R' and 'D' each represents 'Manufacturers', 'Retailers', and 'Design consultancies'.

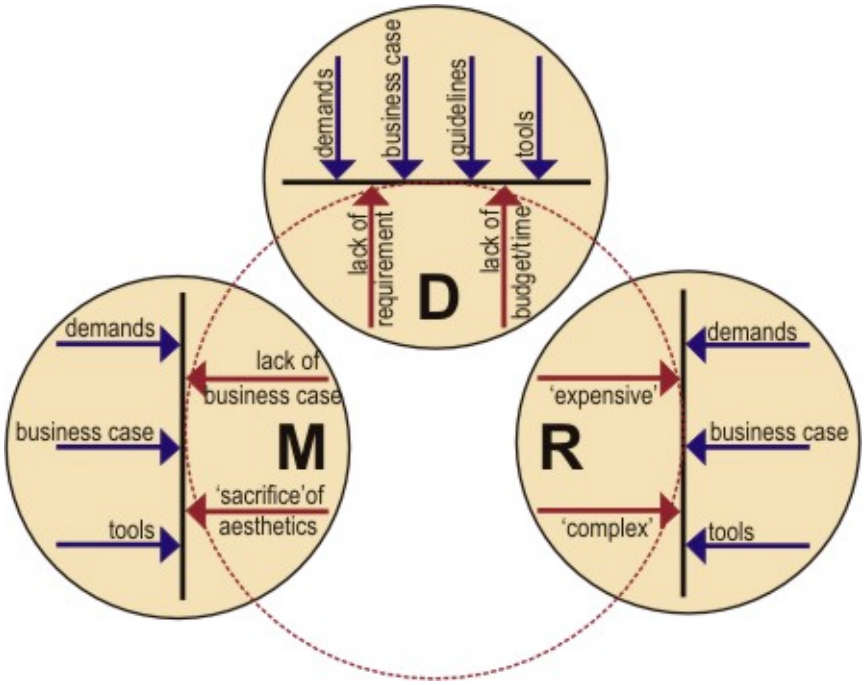

Figure1. Barriers and drivers for inclusive design

The findings of the authors' study on drivers and barriers to inclusive design [4] suggested that common drivers for inclusive design could be used in combating barriers to inclusive design; different barriers for manufacturers, retailers and design consultancies should be better communicated between the parties involved. Consequently, an *i~design Primer* (in a form of a booklet) addressing common drivers was designed and evaluated [7]. The evaluation result suggested that information about inclusive design should be provided at different levels, i.e. from simple to in-depth [7]. Hence the implications of the study of barriers [4], the findings from the evaluation of the booklet [7], and the requirement captured from manufacturers, retailers and design consultancies [5] were used to create a framework of an *i~design Toolkit* for inclusive design (Figure 2), where 'attention', 'awareness', 'information' and 'communication' were identified as the focus of each component tool. The component tools included:

- *i~design Demonstrator* (objects including a cube model showing the context of inclusive design; a manikin model with data for inclusive design in one place; several products as examples of inclusive design and exclusive design; and a number of pictures illustrating the diversity of end-users – all these were used to engage people in the topic and attract their immediate attention).
- *i~design Primer* (a booklet with introduction to inclusive design and design exclusion; user data, market models, case studies and key references – it aimed to raise the awareness of inclusive design).
- *i~design Informer* (a resource pack comprising detailed data on user capabilities, selected guidelines, detailed business case studies from industry; and a comprehensive reference list – this is an extended version of the *i~design Primer*, aiming to provide detailed information for interested users).
- *i~design Communicator* (it contains a pyramid model demonstrating how easily each party: manufacturer, retailer and design consultancy tended to see one side without knowing the other two and how this became a barriers to communication. It also contains a graphic model showing different partners to be involved in the inclusive design process,

and a set of cards with comments of one party on another party which illustrate misunderstandings).

The '*Demonstrator*' and the '*Primer*' aimed to raise the awareness of inclusive design and combat perception barriers to inclusive design by providing examples and successful business case studies; the '*Informer*' aimed to combat some of the technical barriers to inclusive design by providing relevant data and information; and the '*Communicator*' aimed to highlight the communication barriers between designers and design commissioners [6]. The *i~design Toolkit* aimed to raise the awareness of inclusive design and highlight barriers to inclusive design. Details of the development of the *i~design Toolkit* were presented in [6], and this paper presents the result of evaluation of the key component tool *i~design Primer* and the whole *i~design Toolkit*.

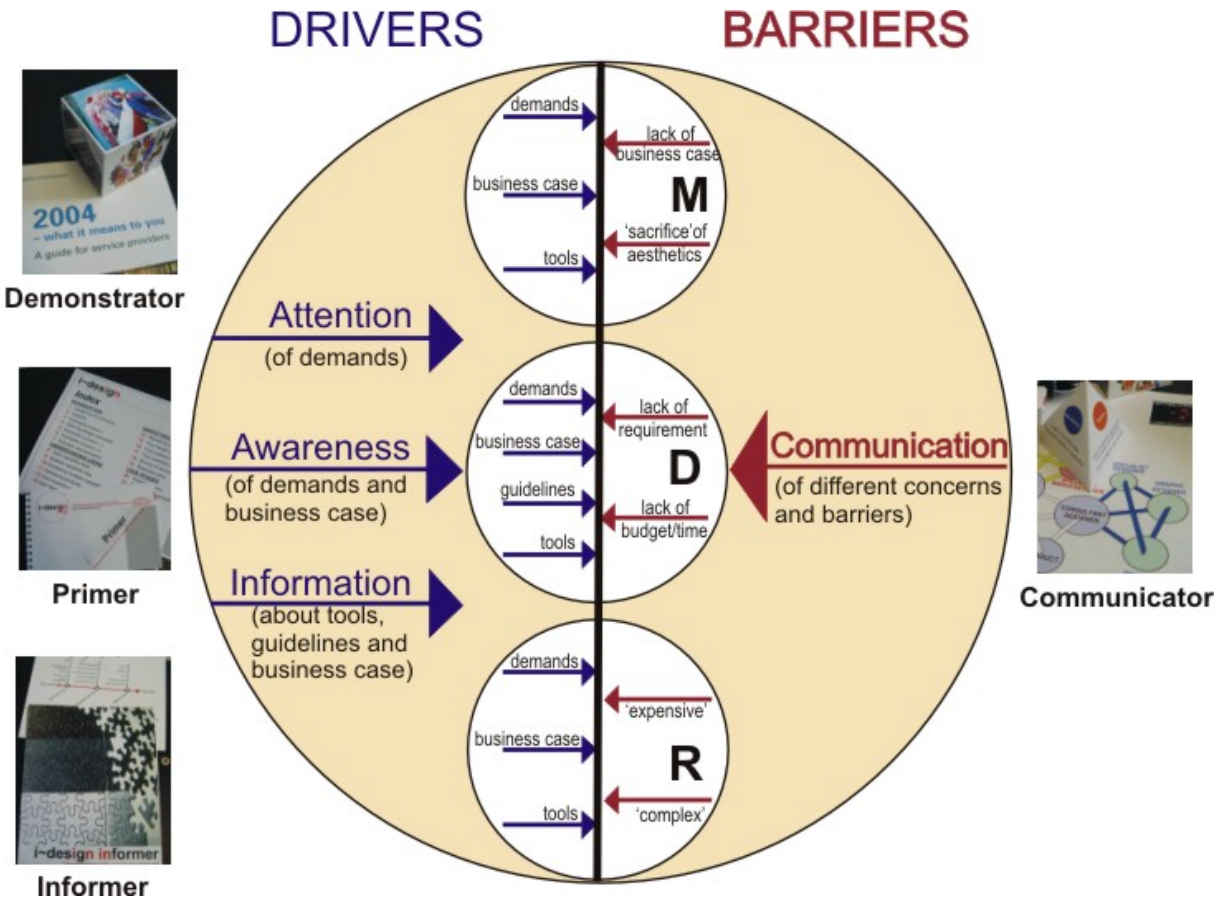

Figure 2. Toolkit developed according to barriers identified and requirements captured

3 Methodology

The Kirkpatrick Model, one of the most established models for evaluating new methods, tools and training programmes in academia and industry [8] was used as the framework of evaluation of the toolkit. The model is a conceptual framework to assist in determining what data are to be collected. It contains four levels of evaluation, and each answers an important question (Table 1).

Table 1. Kirkpatrick Model of evaluation

Level of evaluation	Definition	Sample questions
1) Reaction	Reaction is defined as what the participants think of the particular tool.	'Do the participants like the tool?'
2) Learning	This level of evaluation is concerned with measuring the learning of principles and facts presented in the tool.	'What did the participants learn from the tool and how easy was the tool to use?'
3) Behaviour	This level of evaluation is about the measurement of job performance.	'Did the participants change their behaviour based on what was learnt?'
4) Results	Evaluations at this level are used to relate the results of the tool to organisational improvement.	'Did the change in behaviour positively affect the organisation?'

In addition to the four levels of evaluation listed in Table 1, validation was considered to be another important level of evaluation. So the questions "*Did the tool raise the participants' awareness of inclusive design?*" and "*Did the tool address the barriers to inclusive design?*" were also asked.

The evaluation of the toolkit were conducted in two stages:

Stage one: the evaluation of the *i~design Primer* one year after its first introduction to industry. Participates of this evaluation were selected from those who had previously received the booklet. Feedback was collected via email and telephone interview.

Stage two: the evaluation of the *i~design Toolkit* immediately after its introduction to industry. Participates included two manufacturers, two design consultancies and one retailer (Table 2). Feedback was collected via questionnaire and on spot interview. The procedure of the evaluation is illustrated in Figure 3.

Table 2. Profile of the participants in the evaluation of the *i~design Toolkit*

Participant company	Size	Evaluators and their knowledge of inclusive design
Design Consultancy a	Medium	Eight consultants in different disciplines (not familiar with inclusive design)
Design Consultancy b	Large	A designer and a design researcher (practise inclusive design)
Manufacturer a	Small	Director (hardware designer) (not familiar with inclusive design)
Manufacturer b	Large	Technical projects manager (practise inclusive design)
Retailer a	Small	Manager (not familiar with inclusive design)

Fig. 3-1 Introduction to the toolkit

Fig. 3-2 Interaction with the toolkit

Fig. 3-3 Answering questionnaire

Figure 3. Evaluation procedure of the *i~design Toolkit*

4 Results

In total 28 participants responded to the evaluation of the *i~design Primer*, and 13 participants responded to the evaluation of the *i~design Toolkit.* The results are presented according to the Kirkpatrick Model.

4.1 Evaluation of the *i~design Primer*

Reaction: Data collected from the evaluation suggested that respondents found the *i~design Primer* informative and useful: 92% of them would like to keep the booklet as a reference. Although not asked to, seven respondents circulated the *i~design Primer* among their colleagues; another six respondents volunteered to help disseminating the *i~design Primer* "when it is formally published."

Learning. Two evaluation questions were relevant to this level of evaluation, namely:

Question 1: What did you learn from the booklet?
Question 2: How easy is the booklet to use?

The first question received feedback from 19 respondents. A summary is given in Table 3, with the keywords about what was learnt in the left column, frequency of mentions in the middle column, and example quotations in the right column. Main issues learnt were '*refresher of what is known (and unknown)*', '*awareness*', and '*data*'.

Table 3. Response to the evaluation of the *i~design Primer* regarding Learning

What did you learn from the booklet?		
Keywords	Frequency of mentions	Examples (direct quotations)
'Refresher'	8	"Very good booklet… certainly gets the point across and puts into words what we tend to do sub-consciously when designing or developing products"
		"… keeping us up-to-date on what is going on … expanding our knowledge … making sure that we focus on certain aspects that we have taken for granted … It refocuses our mind, …so the thing I certainly learnt from it is 'not to be complacent about what we've known' and make sure that we keep on the top of what is actually happening in industry"
'Awareness'	5	"The depth and breadth of the subject, it is a specialised area, I have also learnt that it is something I should be aware of"
		"That the need and potential for inclusive deign is tremendous and it is still early days"
'Data'	4	"I think the main thing we've learnt is the statistics. They are quite useful"
		"What most useful is that it actually provide some figures, some data…some of the data is quite interesting. We understand principles of inclusive design. But the data is very useful, very helpful"
'Aesthetics'	1	"I guess this is about aesthetics… It is not about chunking knobs, switches ... in our industry, that's what people think of [inclusive design]"

The second question received positive feedback from 19 respondents. So a further enquiry "*What makes the booklet easy to use*?" was made and Table 4 lists the reasons respondents gave. In summary, what made the *i~design Primer* 'easy-to-use' were its '*conciseness*', '*effective communication*', '*good format*', '*good examples*', and '*clarity*'.

Table 4. Reasons for the 'ease of use' of the *i~design Primer*

How easy is the booklet to use? And why?		
Reasons	Frequency of mentions	Examples (direct quotations)
"Concise"	7	"The booklet was a good length for a quick look into inclusive design with good use of images, text, charts and web addresses if the reader wishes to look more into the subject."
"Effective communication"	7	"Very easy, very well laid out, very concise, It is not something that was too academic and impenetrable." "Very good! Because the subject itself is quite difficult to communicate. It is excellent in terms of communication."
"Good format"	4	"Nice size, good simple introduction to the subject with graphic appeal."
"Good examples"	4	"I like the photos and examples in particular, and the fact that it's quite quick to read."
		"You've got some very good examples which capture what inclusive design is all about. That's what makes it a good booklet."
"Clear"	3	"It is very clear and it is very well laid out, so from that point of view, it is easy. Your grey boxes are a quite nice idea, focusing on specific information and references. It does make it very clear. It leads you through quite clearly."

Behaviour. This level of evaluation was addressed by Question*: Is there any change in your behaviour based upon what was learnt from the i~design Primer?* The feedback to this question was not clear-cut. Altogether 21 responses were received, among which 6 were positive, 13 were neutral or equivocal, and 2 were negative. The positive examples are as follows:

> "*I think it will be, I don't think now it has been yet. But it will be because I've been thinking some of these things more. Next time when I'm going to buy a kettle, I'll be considering some of these points*."

> "*So far, it's emphasised to me the importance of making our displays simple and as clear as possible in our hardware designs*."

The neutral or equivocal feedback is as follows:

> "*Not overall, however I am now aware of the subject and consider it a bit more*."

> "*I cannot point to a change in our approach, but would say that we welcome this general initiative you are taking*."

A couple of respondents said they would not change their behaviour. For example, one respondent said because technology in their market sector evolved at a rapid rate, they simply could not change their underlying approach within a value-for-money framework. Another respondent said probably because he was already familiar with the concept of inclusive design.

Results. This level of evaluation was addressed by Question*: Is there any (actual or envisaged) impact of the i~design Primer to your company?* Altogether 19 responses were received, among which 12 were positive, 3 were neutral and 4 were negative.

Examples of positive feedback are as follows:

> "*What I have done is to put it into a common file directory. I told people to go and have a look at it. So it helps younger designers*."
>
> "*…Your booklet would be ideal as a quick reference guide for people on the early learning curve, to know what's out there, what should be considered, as part of the design process. As a professional designer, I hope we have the information; your booklet provides a very nice overview*."

In particular, three respondents mentioned that they had adopted the *i~design Primer* for **1)** team designing work, **2)** negotiating with a potential client, **3)** brain-storming. These facts showed that the *i~design Primer* had a real impact on the company.

Examples of neutral feedback are as follows:

> "*At present probably not, because I have not disseminated the information. But within this company anyway, we have the awareness already… It is like that you plant seeds in people's mind, when they think about it in the future, they do tend to geminate it. You cannot expect that it necessarily happens simultaneously…*"

The negative feedback was due to reasons irrelevant to the *i~design Primer*, for example, '*business focused more on materials*', or '*projects did not allow freedom to do research*.'

Validation. Question: *Do you think the i~design Primer has helped raise awareness of inclusive design?* was relevant to validation. Altogether 16 responses were received, and 9 were positive, 6 were neutral and 1 was negative.

Examples of positive feedback are as follows:

> "*Yes. It prompts internal discussion. That's healthy*."
>
> "*It certainly did raise an awareness…It did make you think whenever you design something…instead of focusing purely on the client's brief, it gave you an extra framework to look at…it did give me another piece of paper to say [to clients]… perhaps to sell it better to the client and add more value than somebody else…We actually applied it to a product here … what it did is to prompt us to ask different questions…*"

Examples of neutral feedback are:

"*Not awareness as that was already in this company but the extent of the problem yes.*"

"*It depends who you are speaking to. We are already aware of it. It presents the essential issues quite simply and easily. So I believe everyone who received a copy of it will benefit from it.*"

The negative feedback was from a respondent who did not manage to read the booklet because he had been very busy. But he said: "*if you can get people to read it, yes, it will raise the awareness.*"

4.2 Evaluation of the *i~design Toolkit*

The feedback on the *i~design Toolkit* was collected from a simple evaluation questionnaire, where two groups of questions were asked; one focused on 'validation', and the other was structured according to the Kirkpatrick Model. The evaluators were coded using the form XY0 (i.e. two letters and one number). The first letter showed their familiarity with inclusive design (L: know little; B: know basics; F: familiar; I: no indication of familiarity); the second letter showed the type of companies they were attached to (D: design consultancy; M: manufacturer; R: retailer); the number was randomly assigned for differentiation. In total, 13 evaluators were involved, among whom three knew little about inclusive design, four knew the basics of inclusive design and three practised inclusive design. The other three did not provide any indication of their knowledge about inclusive design. In Tables 5 and 6, '✓' represents positive feedback (i.e. 'Yes'); '✗' represents negative feedback (i.e. 'No'); '-' represents no comments.

Validation. Two questions were designed to validate the *i~design Toolkit, i.e.* to evaluate whether the toolkit fulfilled its aims of raising awareness of inclusive design and combating barriers to inclusive design. The feedback was positive, as summarised in Table 5, where comments from respondents are also presented.

Evaluation using the Kirkpatrick Model. Table 6 summarises the responses to the four levels of evaluation according to the Kirkpatrick Model. The feedback on 'Reaction' was positive: 11 out of the 13 evaluators liked the *i~design Toolkit*. All but three evaluators specified what they learned from the *i~design Toolkit.* It seemed that different people learned different things from the toolkit – this was understandable as people had different background, different experience and different interests. Three evaluators did not make comments: it was not known whether this was because they learned nothing or because they could not specify what was learned. The feedback on 'Behaviour' and 'Results' was not that clear-cut, although the majority of the comments were positive. It should be borne in mind that other factors might have influenced the answers. For example, the evaluator might find that the *i~design Toolkit* useful but could not change his behaviour because of other reasons; the behaviour change of an individual might not affect his organisations if the individual was not in an influential position.

Table 5. Response to validation questions

ID	Does the toolkit help raise the awareness of inclusive design?	Does the toolkit help combat industry barriers to inclusive design?	Comments
BD1	✓	✓	“Very interesting!”
LD2	✓	✓	
ID3	✓	✓	
LD4	✓	✓	
ID5	✓	✓	
BD6	-	✓	“Data quantifying population size vs. ability level will be useful to calculate market size for a product.”
ND7	✓	×	“Educational kits are welcomed by designers.”
BD8	✓	×	
LM9	✓	✓	“Very useful!”
FM10	✓	✓	“How can this message get to the world of industry?”
LR11	✓	✓	
FD12	✓	-	
FD13	✓	×	“Theoretically stands up. The delivery and strategy of strategy of spreading the message needs some thought.”

Table 6. Feedback on ‘Reaction’, ‘Learning’, ‘Behaviour’ and ‘Results’

ID	Do you like the toolkit?	What did you learned from the toolkit?	Will you change your behaviour based on what was learned?	Will the change in behaviour positively affect your organisation?
BD1	✓	“Using inclusive design increases in market size may be bigger than you’d expected.”	“Yes or no – we already use these ideas.”	“Not sure, I hope so.”
LD2	✓	“It has raised my awareness of the impact of poor design on impaired users.”	“Yes, I will think more about inclusive design.”	“Yes.”
ID3	✓	-	“Yes.”	-
LD4	✓	“There is a big opportunity to open markets through this approach.”	“Yes, it will be an input into the design process.”	“Yes.”
ID5	✓	-	-	“Yes.”
BD6	-	-	“Yes, I will.”	-
ND7	✘	“These are standard industrial design tools that should be used by designers.”	“No, as explained in previous question.”	“No, as already explained.”
BD8	✓	“Practical information backing up the concept.”	“Yes, I will include it more in my discussion with clients.”	“Yes.”
LM9	✓	“That inclusive design need not be for specialists (i.e. don’t be afraid of it).”	“I will, but only for some designs.”	“Hopefully. Too early to say.”
FM10	✓	“Practical examples and data – a picture says a thousand words.”	“Yes, I will include inclusive design in new briefs.”	“Yes.”
LR11	✓	“Got a better understanding of issues and problems”	“Yes, I will ask further questions to customers.”	“Yes, awareness of the organisation will be raised.”
FD12	✓	“More statistics!”	“No. I think inclusive design is inherent in what we already do.”	“No.”
FD13	✓	“It has added to our current understanding.”	“No – Inclusive design is inherent in our process.”	“Yes, if adopted throughout. This may take time.”

5 Discussion

The use of the Kirkpatrick Model as an evaluation framework was effective, as it helped structuring questions in a way that enables quick capture of information regarding the usage of the *i~design Primer* and *i~design Toolkit*. For this study, the feedback was collected primarily through questionnaires and interviews. Not many people replied emails, so telephone interviews were followed up. It was easier to get response via telephone interviews and there was also an advantage to clarify answers when conducting such interviews. For example, when the respondent said the booklet was very easy to use, then a follow-up question "what makes it easy to use" can be asked. It was effective to handout and collect questionnaires at the on spot interviews, but such questionnaire must be brief enough. Since the results were kept anonymous – there was no chance to clarify answers. It was felt that some questions, for example, those related to 'Reaction', 'Behaviour' and 'Results' would be answered even better if observation could be carried out – although for this study, observation was not an possible option.

Since the evaluation of the *i~design Primer* was carried out a year after its first introduction to industry, the feedback was rich and reflected its impact on industry to a certain extent. The *i~design Toolkit* was evaluated immediately after its introduction to the potential users, so only simple feedback was received. Two evaluators raised the question about how to deliver the toolkit to industry – this is relevant to the follow-up and future work.

The authors are currently carrying out a project sponsored by the Department of Trade and Industry of the UK to raise awareness of the commercial imperatives of inclusive design. Part of the work involves a survey to assess current attitudes towards inclusive design in the UK, in which a much broader range of industry sectors is involved, including telecommunications and IT, banking, media, consumer electronics, energy, automotive etc. It is expected that barriers facing different industry sectors can be identified and approaches to increase the usage of inclusive design can be developed and delivered through a series of high-impact workshops with industry, thus establishing the commercial case and develop the skills for inclusive design in the UK. The evaluation of the *i~design Primer* and the *i~design Toolkit* has provided insight into the current project.

6 Conclusion

This paper focused on the evaluation of an inclusive design toolkit which was developed to raise the awareness and combat barriers to inclusive design. The Kirkpatrick Model was adopted as the evaluation framework. The component tool, *i~design Primer* and the whole *i~design Toolkit* were both evaluated, and feedback was received from 41 industrialists in respect of 'Reaction', 'Learning', 'Behaviour', 'Results' and 'Validation' – all these levels of evaluation received positive feedback. It was found that the *i~design Primer* was a good tool in raising awareness of inclusive design; the *i~design Toolkit* was effective in raising the awareness of inclusive design and helped in combating perception barriers to inclusive design. Further work includes improving the toolkit and disseminating it effectively to industry to help a wider adoption of inclusive design.

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