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Is British HCI Important? A topic-based comparison with CHI

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We have applied topic modelling to the full-text British HCI and CHI corpora in order to automatically derive one hundred topics and their trends. We use these to compare the distributions of topics and changing foci of two conferences over the last five years. These data suggest that that, while the two conferences have significant overlap, they make quite distinct contributions to HCI.

Visualisation. HCI. CHI. Topic Modelling. Research Portfolio. Introspection. Bibliometric Analysis. Cohesion. Discussion. Coherence. Overview. Trend Map. Self-Organising Maps. Contrasting. Corpora.

1. INTRODUCTION

Human-Computer Interaction (HCI) research encompasses an extremely rich and diverse set of communities, interest groups and disciplines. It has evolved and expanded rapidly as its researchers have embraced new challenges and developed new theories, methodologies and technologies. In such a complex, rapidly changing environment it can be difficult for new researchers to discern the differences between premier conferences in the field.

In this paper, we compare and contrast the British HCI conference (BHCI), a compact flagship HCI forum, against the largest and most popular conference in this field: CHI. Our aim is to use automated topic modelling algorithms to impartially and quantitatively characterise the differences between the two conferences.

There have been many studies that have characterised the HCI community and its publications including the development of taxonomies [Quinn, 2011], analysis of authors [Bartneck 2009 and Kaye 2009] and visual explorations of the area [Henry, 2007]. In addition, there has been work into mapping conferences [Liu 2014 and Padilla 2014] and evaluation of conference processes [Thimbleby, 2012].

Many of the above papers have relied upon qualitative analysis in order to come to their conclusions, for example, to classify publications against research areas and keywords. Our analysis uses Latent Dirichlet Allocation [Blei, 2003] to derive a single topic model from the combined full-text corpora of the two conferences. Papers are assigned probabilistically to the topics and it is these quantitate data that we use examine the differing foci and trends of the last five years of both conferences.

2. ANALYSING BHCI AND CHI

The BCS and ACM digital libraries provided us the papers for the last five years (2009 to 2013) of both conferences. Raw text was extracted automatically from each PDF document and stored as simple, unformatted text files. We automatically removed stop words, capitalisation, numbers and symbols from the text files. In addition, we employed the Stanford CoreNLP library[1] to tokenise and lemmatize the words inside the text files.

Once the input data was processed, we extracted the core research concepts from combined corpora of the two conferences. We utilised topic modelling with Latent Dirichlet Allocation as defined by McCallum [McCallum, 2002] to reduce the documents to 100 different topics. Each topic consisted in a list of 7 labels that defined a single research concept.

[1] http://nlp.stanford.edu/software/corenlp.shtml

One side effect of the automatic document capture and topic modelling process is that some of the topics do not contribute meaningful research concepts and so were removed, for example:

94: data algorithm feature accuracy detection detect machine
79: data collect log record tool collection lab

After removing meaningless topics, we were left with 80 topics representing the conferences. For each of these topics, we conducted a trend analysis as per Padilla et al [2014]. We categorised each topic into 'growing', 'sliding', 'peak', 'trough' or 'plateau' trends as seen in Figure 1.

Figure 1: The five categories of trends.

After categorising each topic into one of the five trends, we then calculated the percentage contribution of each topic to both conferences. For example, topic 0 (family home member) comprises 1.06% of the research in CHI, but only 0.91% in BCHI.

Finally, using these contribution percentages, we calculated a ratio figure between BHCI and CHI, as well as vice versa. This ration figure expresses how much focus one conference puts on a topic over another. For example, topic 4 (story narrative character) comprises 1.41 times the percentage of BHCI as CHI.

In the next section, we will discuss these categorisations and calculated figures to compare and contrast the overlap and differences between BHCI and CHI.

3. DISCUSSION

While there has been previous work examining CHI trends using topic mapping and hierarchical cluster analysis [Padilla 2014 and Liu 2014], in this paper we present a novel way of comparing and contrasting two apparently similar communities: British HCI and CHI. We discuss in more detail our findings and show that while there is, as expected, some overlap, there are important differences between the two communities and areas where the British HCI is leading HCI research.

What overlap is there between the top topics?

In Table 2a, we list the top ten topics for both conferences, so we can compare the overlap of popular topics between the two. Despite these conferences focusing on similar areas, only four of the topics are repeated (shown in bold): 5 (social network friend), 19 (game player play), 51 (designer prototype idea), and 90 (mobile device phone).

Additionally, these four common topics do not appear in the same order, and therefore with the same level of importance between the two conferences. This is surprising, as you might expect two conferences, both dealing in HCI, to have a similar focus.

This difference in top topics between the two conferences lead to us creating a simple Relevance Score (R) where we took the product of each percentage contribution for each topic, so we could see the top ten common topics. Table 2b, therefore, shows a list of topics ordered by R with the four common topics taking the top four spots in this new ranking system. The other six top common topics are also topics which appear the top ten topics for either BHCI or CHI.

What are the common trends?

In Table 3, we list the 19 topics where our automatic trend analysis has determined that BHCI and CHI have followed the same trends over the last 5 years.

Of these 19 topics, 10 of them are plateaued, meaning there has been no significant increase or decrease of papers in these topics and as such can be considered as 'evergreen' topics which have been present for a significant period of time. None of these 10, however, are popular enough to appear as a top topic in either conference or our Relevance Score, meaning that although they are evergreen, they are no longer very common.

In contrast, 9 of the topics have shown significant movement in their trends over the last five years. Only one of these, however, has been showing significant growth in both BHCI and CHI, that being topic 7 (health, therapist, intervention). This then, can be considered the one consistent up and coming topic in HCI, especially as it doesn't (as of yet) appear as a top topic.

Two of these topics have instead shown decline, both of which reference traditional web topics: 81 (search tag query) and 89 (product consumer market [online]). This, however, is perhaps to be expected as much of the traditional web research is likely to be published in WWW instead.

In addition, there are four topics both BHCI and CHI agree have peaked and are starting to decline. Importantly, however, although these topics have apparently peaked, they do not appear as top topics in either BHCI or CHI. This would seem to point to topics which have not yet made a huge

mark in HCI and might not make a lasting impact yet.

Finally, there are two topics which have gone through a trough and are starting to grow again. Interestingly, of all of these agreed topic trends, the only one which appears as a top topic comes from this group. Topic 77 (physical material digital) although apparently being in a slump, is still a top topic in CHI.

What is published more in BHCI or CHI?

To answer this question, we calculated the percentage of the each conference that a topic contributed to. We were then able to calculate a normalised ratio between BHCI and CHI for each topic and order the topics accordingly. This is shown in Table 4.

What is readily apparent is that CHI has approximately 13 times more focus on crowdsourcing (topic 31), 5 times more on flexible displays (topic 63), as well as just over twice the focus on exergames (topic 17) that BHCI.

In contrast, however, BHCI has a much stronger focus on the use of computers for helping the vulnerable or disabled. Indeed, the top three topics with the biggest BHCI to CHI ratio concern autism and social skills (topic 18), care of the young or elderly (topic 85), and accessibility for the visually impaired or blind (topic 99). All three of these topics are approximately twice as popular at BHCI as they are at CHI.

Moreover, if we order the topics by their contribution to BHCI and to CHI (like we have done in Table 2a), we can compare where in the full list each of these top three topics appear, as shown below:

Topic #	BHCI	CHI
18 (child autism cool)	14th	67th
85 (older adult age)	15th	60th
99 (blind accessibility impaired)	22nd	63rd

Table 1: *BCHI Topics with the most difference vs. CHI*

This difference in focus between the two conferences means that there is research at one which doesn't exist as meaningfully in the other.

It is interesting, however, that none of the top three topics which are published more in BHCI appear within its top topics. Five of the topics more published at BHCI appear within its top topics and only one topic published more at CHI. These six are shown in Table 4 as bold rows.

What are the contrasting trends?

In Figure 2, we show the plots of the seven different topics where our automated trend analysis have assigned opposing trends. These broadly fall into two groups: where a topic is growing in one conference, but declining in another; and where a topic is peaked in one, but in a trough in the other.

Interestingly, there is only one topic which falls into the first group: topic 12 (image display camera) is growing in CHI, but sliding in BHCI over the past five years, as shown in Figure 2b. It is worth noting that although there is only one completely contrasting topic like this, it is surprising it exists at all in two conferences in apparently similar research areas.

After examination of the other group of opposing trends, it is apparent that there are two sub-groups. First, there are three topics which appear very close over the last five years, with only 2013 altering whether they are classed as a peak or a trough. These are shown as Figure 2c, 2d, and 2f and as they are so similar, we won't discuss them here in detail. The final three, however, show some interesting differences between BHCI and CHI.

Figure 2a, for example, seems to show that topic 33 (learn learning learner), which is now a top topic in BHCI, used to be much more popular within CHI, but has apparently slid in popularity there, while increasing in BHCI.

Figure 2e also shows an interesting split between BHCI and CHI. Although topic 91 (sensor device light) has been classed as a trough in CHI (most likely due to the large drop in 2011) and a peak in BHCI, it is still much more popular in CHI. Indeed, topic 91 is the 3rd top trend in CHI.

Finally, Figure 2g confirms why topic 63 (display shape bend) is, as previously discussed, an area which CHI focusses on more than BHCI. In the last three years, while it has been a popular topic in CHI, it has had almost zero interest in BHCI.

Again, these contrasting trends show that, while there is as expected, overlap between CHI and BHCI, they both have their own foci and research interests.

4. CONCLUSION: IS BRITISH HCI IMPORTANT?

As the UK is one of the top 3 contributors to CHI [Bartneck, 2009], one might expect that the research in BHCI would be mirrored at CHI, however, we have shown this is not the case.

While there is understandable overlap in both topics and trends between BHCI and CHI, it is

surprisingly small. We instead show that the conferences have quite separate foci: in that the majority of the top topics in the two conferences differ, and there are significantly different publication rates in many of the topics as indicated by the ratio data. In addition, there are several topics which exhibit opposing trends over the last five years.

This shows that despite BHCI being a smaller event, it makes a distinct and significant contribution, as it publishes internationally leading research on important topics which would otherwise not receive as much attention. For example, proportionally twice as many BHCI papers discuss autism and social skills, care of the young or elderly, and accessibility for the visually impaired or blind than CHI.

In addition we have presented a methodology for comparing related conferences that we believe is both objective and quantitative, and that requires little human resource.

We hope that this paper will contribute to, and help stimulate, the debate concerning the differences between CHI and BHCI and would very much welcome feedback, comments and observations on results or the methodology presented in this paper.

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***Table 2a:** What overlap is there between the top topics?*

#	BHCI Top Topics	%	CHI Top Topics	%
1	51: designer prototype idea phase scenario team …	2.82%	90: mobile device phone screen app smartphone iphone	2.10%
2	90: mobile device phone screen app smartphone iphone	2.54%	34: touch finger hand screen device surface multi-touch	1.81%
3	19: game player play gaming gameplay immersion fun	1.97%	91: sensor device light sense wearable power prototype	1.78%
4	84: window display zoom view space large lens	1.53%	51: designer prototype idea phase scenario team create	1.74%
5	47: behavior factor perceive influence motivation pers…	1.49%	5: social network friend facebook media online …	1.70%
6	14: map location navigation route place spatial direction	1.46%	77: physical material digital space object metaphor …	1.52%
7	21: emotion emotional positive negative expression aff …	1.36%	19: game player play gaming gameplay immersion fun	1.48%
8	5: social network friend facebook media online relatio…	1.30%	12: image display camera visual view depth screen	1.37%
9	33: learn learning learner training skill student education	1.30%	36: team organization software management product …	1.31%
10	10: persona product attribute aesthetics dimension eva…	1.29%	98: cursor mouse selection movement error distance …	1.25%

***Table 2b:** What overlap is there between the top topics?*

#	Topics Sorted by Relevance Score	BHCI %	CHI %	Relevance Score
1	90: mobile device phone screen app smartphone iphone	2.82%	2.10%	5.35
2	51: designer prototype idea phase scenario team create	2.54%	1.74%	4.89
3	19: game player play gaming gameplay immersion fun	1.97%	1.48%	2.91
4	5: social network friend facebook media online relato…	1.53%	1.70%	2.21
5	77: physical material digital space object metaphor aff…	1.49%	1.52%	1.86
6	34: touch finger hand screen device surface multi-touch	1.46%	1.81%	1.81
7	12: image display camera visual view depth screen	1.36%	1.37%	1.57
8	91: sensor device light sense wearable power prototype	1.30%	1.78%	1.49
9	14: map location navigation route place spatial direction	1.30%	0.98%	1.44
10	47: behavior factor perceive influence motivation pers…	1.29%	0.92%	1.37

***Table 3.** What are the common trends?*

#		Trend		Trend
1	7: health therapist intervention therapy client mental …	growing	42: woman gender mother ngo feminist man grasp	plateau
2	2: patient medical health care nurse doctor hospital	peak	53: label match metric similarity cluster corpus algorithm	plateau
3	27: privacy share sharing concern location friend disc…	peak	52: wikipedia article editor wikus edit editing wiki	plateau
4	9: service community public citizen resident local hom…	peak	83: news credibility article media opinion source topic	plateau
5	74: food behavior health individual weight eat meal	peak	71: pattern query temporal column row sequence cell	plateau
6	81: search tag query engine web topic expert	sliding	46: operator situation emergency automation firefight…	plateau
7	89: product consumer market online purchase cust …	sliding	8: item card recommendation rating trust recommender…	plateau
8	77: physical material digital space object metaphor …	trough	64: tilt badge bezel walk foot control accelerometer	plateau
9	28: craft material object product digital practice arte….	trough	59: dog animal pet tree owner wizard cat	plateau
10			85: older adult age younger care elderly senior	plateau

***Table 4.** What is published more in BHCI or CHI?*

#	BHCI : CHI	Ratio	CHI : BHCI	Ratio
1	18: child autism cool social skill teenager asd	2.58	31: worker crowd crowdsource turk mechanical pay mturk	13.15
2	85: older adult age younger care elderly senior	2.15	63: display shape bend force device flexible prototype	5.11
3	99: blind accessibility impaired disability visually impa…	1.97	17: exercise physical game rehabilitation exertion control play	2.40
4	92: password authentication image security pin graphi…	1.81	42: woman gender mother ngo feminist man grasp	2.18
5	**84: window display zoom view space large lens**	**1.74**	**91: sensor device light sense wearable power prototype**	**2.11**
6	89: product consumer market online purchase custom…	1.73	53: label match metric similarity cluster corpus algorithm	2.11
7	**33: learn learning learner training skill student education**	**1.70**	75: remote meeting video space camera room environment	2.11
8	**21: emotion emotional positive negative expression aff…**	**1.67**	88: robot agent behavior social robotic head communication	2.04
9	51: designer prototype idea phase scenario team create	1.62	87: twitter tweet sleep sentiment follower message post	2.00
10	**47: behavior factor perceive influence motivation pers…**	**1.62**	52: wikipedia article editor wikus edit editing wiki	1.96

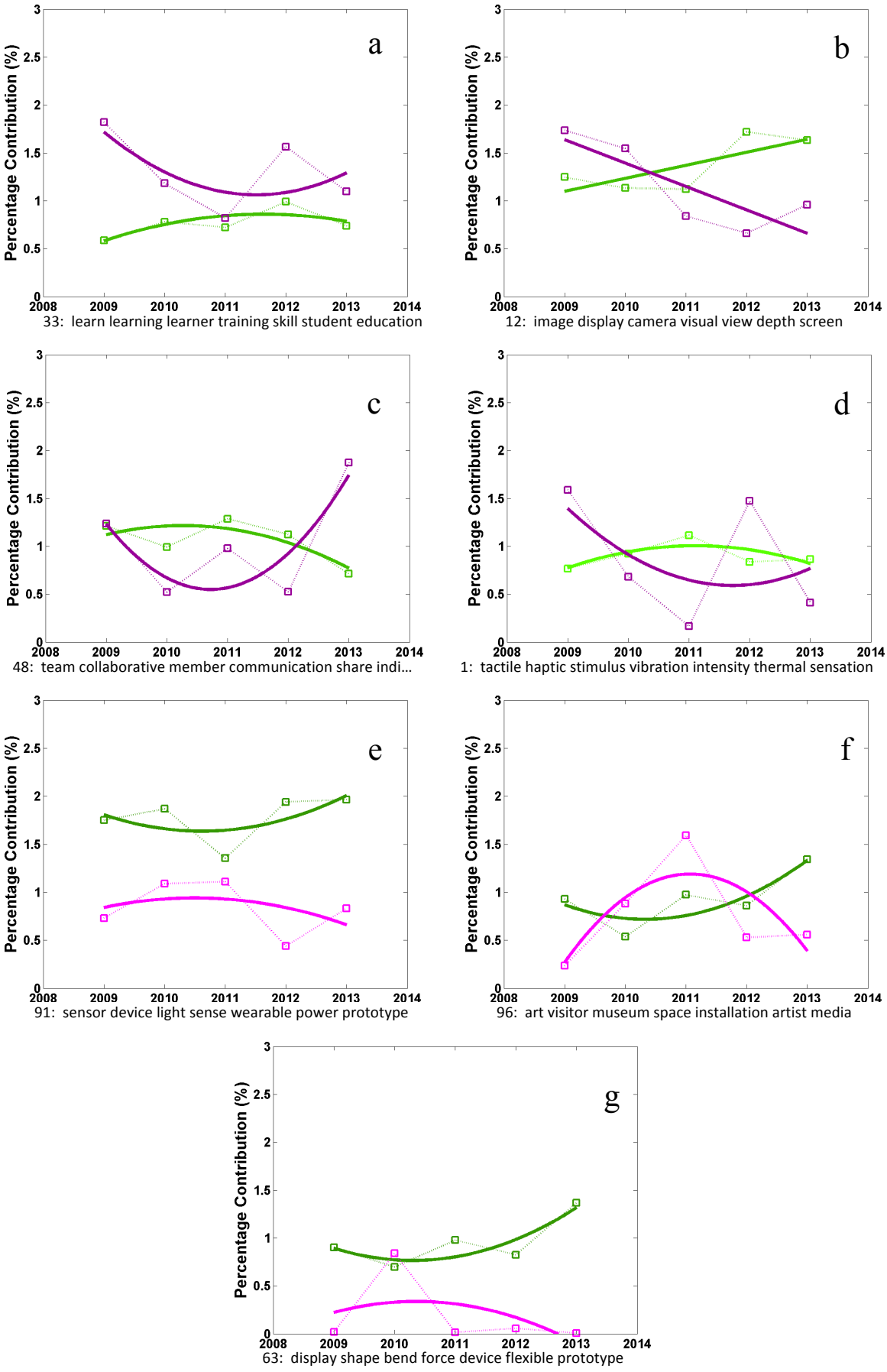

Figure 2: The graphs above show the seven topics where our automatic trend analysis has assigned opposing trends. CHI trends are shown in green whilst BHCI trends are shown in purple.