A CORPUS-LED STUDY INTO HOW 'DESIGN' IS REPRESENTED IN DESIGN THINKING RESEARCH

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1. An overview of Design Thinking: characterisations and criticisms

For nearly 40 years, design researchers have argued that the way designers think is unique amongst professionals. Archer [1979, p.18]—a pioneering theorist in this area—claims there to be a "designerly way of thinking". Similarly, Cross [1982] calls for further investigation into Designerly Ways of Knowing. At the time, neither Archer nor Cross could express how designers' cognition may be characterised. Donald Schon [1983] however is credited with making an important contribution in this area [Koskinen et al. 2011]. Schon argues that each design problem is unique, suggesting that in design practice "problems do not present themselves […] as givens" [p.39]. They instead need to be constructed during the design process. Accordingly, design problems are often "puzzling, troubling, and uncertain" [Schön 1983, p.40]. Schön [1983, p.21] criticises theorists for applying "scientific theory and technique" in describing design activity. Instead, Schön [1983, p.49] suggests that researchers should acknowledge the value of the "intuitive processes" of designers. In illuminating the capabilities of designers, Schon paved the way for a form of investigation termed "design thinking research" [Cross 2001, p.53]. Such research is argued to have begun in the 1990s [Cross 2001]. Today, there exists a large body of literature on Design Thinking [Johansson-Sköldberg et al. 2013].

Design Thinking is argued to be integral to design practice [Dorst 2011] and pivotal in design education—indeed leading institutions publically promote the teaching of Design Thinking [e.g. Loughborough University n.d; Open University, n.d].

Because of its purported significance, it is important to unpick Design Thinking research. Existing literature critiques the existence of Design Thinking. For example, Norman [2009], labels Design Thinking a "myth". Norman however moves on to commend its use in "spread[ing] the word that designers can add value to almost any problem" [Norman 2009]. Other researchers are more critical of the evidence. Kimbell [2011, p.292] argues that research has yet to produce "a definitive or historically informed account of design thinking, nor any explanation for why [designers] might have a particular cognitive style". Similarly, Johansson-Sköldberg et al. [2013, p.121] claim that within the academic literature there exists "no sustained development of the concept" termed Design Thinking.

This paper aims to further unpick existing Design Thinking research. A contribution in this area is significant as Design Thinking research holds a pivotal place in design research. This study will attempt to elucidate how the word 'design' is framed in a body of Design Thinking research. It does this through conducting a discourse analysis using methods from the field of 'corpus linguistics'.

2. An introduction to corpus-led discourse analysis

In the social sciences, the term 'discourse' relates to the manner in which social groups or institutions

construct meaning through their use of written or spoken language [Flowerdew 2013]. The production of discourse is context dependent. It is influenced by the culturally and historically specific situations that groups find themselves in [Searle 2002].

The term 'discourse community' describes the collection of individuals making up such a group [Swales 1990]. When conducting written or spoken communication, discourse communities do not preference given words or phrases over others in an accidental manner. Rather, the choice of words "expresses an ideological position" [Stubbs 1996, p.107] on a given issue. In turn, ideological stance is pivotal in identity formation [Rabinow 1991]. It is also important in allowing discourse communities to differentiate themselves from other collections of individuals [Rabinow 1991]. The importance of choice of words is such that theorists tend to characterise discourse communities by the ways on which they speak on given issues [Flowerdew 2013]. Theorist often use the term 'ways of speaking' to characterise discourses employed by discourse communities. Ultimately, ideological positions help discourse communities to claim legitimacy and exercise power in society [Rabinow 1991]. Swales identifies several characteristics of discourse communities. Most relevant to this paper, a community "has a broadly agreed set of common public goals" [Swales 1990, p.471]. Communities may express such goals explicitly or tacitly [Swales 1990]. In acknowledging the role of discourse communities in constructing meaning, researchers may for example refer to, the 'discourse of managerialism', 'the discourse of advertising', 'gay discourse' or 'Christian discourse' [Flowerdew 2013].

Because language is entrenched in civilisation, it is difficult to recognise the manner in which discourse communities ascertain claims to legitimacy and power [Rabinow 1991]. The process termed 'discourse analysis' highlights ways of speaking employed by groups [Rabinow 1991]. Discourse analysis enables researchers to critique the power groups wield and their claims to legitimacy [Rabinow 1991]. Discourse analysts cannot assume that any statement made by any member of any discourse community is objectively valid. They must instead be guided by textual evidence [Teubert 2010]. Analysis involves investigation of the words discourse communities use in constructing meaning. Researchers attempt to qualify why these words may be persuasive to listeners or readers.

Discourse analysts therefore examine the 'pragmatics' of discourse construction [Hyland 1998].

The language used by an individual (individuals are termed 'speakers') conveys the ideologies of the discourse community to which they belong. The following excerpt (taken from a reader's letter printed in a women's magazine advice column) illustrates this point:

"My husband runs his own business and is a workaholic. Last year he kept putting off our plans for a break and I got so fed up I went away with four friends. We had a great time, even though I missed him. I want a holiday for just us this year but he keeps saying I'd probably have a better time if I went with them. How can I get him to see I'd rather go with him?" (Adapted from Thompson and Hunston [2003, p.6])

Thompson and Hunston [2003, p.7] argue this excerpt reflects "a particular economic system […and…] a particular system of family life" (they do not name this social group). This socioeconomic system commends the following values: people engage in work in order to be paid; work should not infringe on other aspects of life; work should not be enjoyed as much as holidays; spouses should behave as a discrete entity. This system frames forms of behaviour that contravene these values as abnormal and thus discourages them [Thompson and Hunston 2003]. The manner in which this system frames the above helps it (and its members) claim legitimacy and exercise power.

Researchers' belief systems, prejudices and political positions are argued to intrinsically affect how they interpret textual data [Widdowson 1995]. These issues (which create what is termed 'researcher bias') may skew the outcomes of discourse analysis [Widdowson 1995]. Methods synonymous with the field of 'corpus linguistics' help to decrease research bias in discourse analysis. Essentially, corpus linguistics techniques involve the use of computers to facilitate the analysis of bodies of text. Corpus-led inquiry necessitates the identification of a target population (the type of language to be investigated). An appropriate sample of this genre of language is then gathered (via transcription in the case of spoken language). Once collected, this body of data is termed a 'specialised corpus'. The creation of a specialised corpus ensures that ALL text from the sample population is put forward for semantic analysis. This process helps reduce bias through preventing researchers from predominantly analysing texts which may support their political positions [Baker 2012]. The specialised corpus is then made digitally

accessible and uploaded into specialised computer programs called concordance software. 'Concordancers' provide quantitative insights into how speakers use nodes (given words or terms) that are impossible to achieve through exclusively conducting manual readings of texts [Flowerdew 2013]. Such objective measures aid in overcoming a reliance on hunches, thus further helping to reduce research bias [Baker 2004]. Concordancers also order and present text in ways which facilitate qualitative analysis. The combination of empirical and qualitative methods provides a holistic evaluative picture of textual data [Mautner 2009].

Concordancers facilitate several empirical measures. Quantitative measurement of the frequency of appearance of given nodes helps researchers investigate the role occurrence plays in representing particular ideologies. For example, the node 'homosexual' occurs far more frequently (8.41 per million words) than 'heterosexual' (3.86 per million words) in British English language [Baker et al. 2006]. The difference in relative frequencies reflects how sexuality is framed in society: traditionally, homosexuality is perceived as being "problematic and non-standard" [Baker et al. 2006, p.75]; thus, the term 'homosexual' appears more frequently as speakers are more likely to debate homosexuality than they are to question the value of heterosexuality [Baker et al. 2006]. Researchers may also choose to elicit the rate of dispersion of a given node. This process provides insights into idiosyncrasies in the corpus. For example, though the node 'abortion' is used relatively frequently in a corpus of newsletters produced by a Catholic church, its incidence is limited to particular issues of said publication [Baker et al. 2006]. Thus, any analysis of how this node is framed is not indicative of the corpus as a whole.

In addition to investigating the discrete characteristics of a particular corpus, aspects of a specialised corpus should be compared with corresponding aspects of another (reference) corpus [Baker 2004]. Often reference corpora are very large and contain text from very many speakers. These characteristics negate the effect of individual speakers' idiosyncrasies, enabling reference corpora to serve as norms by which to judge specialised corpora. Such comparisons provide further quantitative data which serve as a point of reference to begin qualitative analysis.

It is important to identify words which are used in conjunction with given nodes. This process aids investigation into the manner in which nodes are used to construct meaning. Qualitative analysis of 'concordance lines' (a visual illustration of how nodes are employed in snippets of text) is supported by statistical measurement of co-occurrence. The latter process is termed the study of 'collocation'. A combination of qualitative and quantitative analysis enables Stubbs [1995] to demonstrate that the lemma 'cause' (a lemma is the 'stem form' of a given word—in this case the lemma 'cause' takes into account incidences of 'cause', 'causes' and 'caused') overwhelmingly occurs with words to suggest the presence of undesirable occurrences such as cancer or accidents. Stubbs' conclusion aids reflection on the dictionary definition of this node. Commonly, dictionaries define 'cause' neutrally, as "something which produces an effect" [Stubbs 1995, p.3]. Stubbs argues that 'cause' should instead be defined as it is typically used. Such a characterisation expresses a node's semantic prosody—its "pragmatic meaning" [Flowerdew 2013, p.164]. Often, rather than being neutrally framed in given discourse communities, particular nodes tend to have either a positive or negative semantic prosody [Flowerdew 2013].

It should be noted that corpus-led enquiry does not entail the study of human biology or psychology. It therefore does not shed light on whether speakers employ pragmatic meaning consciously or unconsciously [Teubert 2005]. At this stage, it is also important to briefly highlight differences between corpus linguistics and another method of deciphering information from bodies of language, namely 'text mining'. Both methods make use of computers to aid the analysis of collections of language. In corpus linguistics, this body of data is discretely bound or 'closed' (i.e. it was collected at a certain date(s) and time(s)). Text mining methods differ in that software is used to create machine-learning algorithms to characterise constantly emerging streams of language [Wiedemann 2013]. As will become evident, the aims of this research make corpus linguistics the preferred cannon of analysis.

The field of corpus linguistics has existed for over half a century with dedicated centres in leading universities worldwide. Corpus-led studies are also conducted in commercial settings [Nesi 2013]. Despite their significance, corpus-led methods have seldom been applied in investigating how discourse is constructed in design research. They have not been used to analyse how meaning is generated in the locus of this article, Design Thinking research. This paper describes a pilot study on how the node

'design' is represented in a corpus of abstracts from papers written on the subject of Design Thinking. The articles are published in the leading journal 'Design Studies'. This paper aims to contribute knowledge on how legitimacy and power are exercised in Design Thinking research.

This article begins by summarising existing explorations of 'ways of speaking' within design research, and then specifically, Design Thinking research. After rationalising the design of the specialised corpus, this paper describes the analysis of empirical data and presents a discussion of findings. It concludes by suggesting the results may enable the Design Thinking research community to critically reflect on the way it writes on the subject of Design.

3. Existing research on 'ways of speaking' in design research

The words academic researchers use to construct meaning "are shaped by the discipline" to which they belong [Bazerman 1988, p.47]. Thompson and Hunston [2003] use the following excerpt from an article written by the applied linguist John Swales to illustrate the importance of discourse communities in academia:

"The importance of this research increases as the focus moves out of experimental settings and into contexts where the interactions have immediate social and physical consequences, as in setting involving the delivery of health services". (Adapted from Thompson and Hunston [2003, p.7])

Appearing in the journal 'Applied Linguistics', Swales' paper exists within a discourse community comprising individuals who "write and read papers like [Swales']" [Thompson and Hunston 2003, p.7]. The position taken by Swales reinforces the value systems of this discourse community in the following manner:- applied research is more significant than theoretical research [Thompson and Hunston 2003]. Conceivably, authors aiming to publish in the journal 'Theoretical Linguistics' may argue that theoretical research is the more significant investigative purpose. Swales' excerpt shows that academic research, like all human communication, resides within discourse communities [Thompson and Hunston 2003].

Design literature contains limited instances of studies which explore how meaning is constructed in academic design research communities. Examples of such research are summarised below. In investigating influential 'participatory design' research papers, Finken [2003, p.70] argues that researchers foreground "certain truths"—namely that participatory research exists solely to benefit users. Concurrently, these narratives background the fact that participatory design research also serves to promote the role of designers [Finken 2003]. Finken's discourse analysis therefore highlights how common goals are expressed in the participatory design discourse community. Kannabiran et al. [2011] analyse the use of language in generating knowledge on how Human Computer Interaction (HCI) design research frames sexuality. Kannabiran et al. [2011, p.699] claim the existence of "discursive rules" within HCI design research, namely that sexuality is framed in terms of "general cultural norms" which ignore the existence of anything other than traditional gender categories. Kannabiran et al.'s research therefore suggests the presence of common goals concerning sexuality in the HCI discourse community. Ghassan and Blythe [2013] investigate ways of speaking conducted by competing factions in HCI user experience (UX) research on the data collection tool termed 'cultural probing'. This tool is used in different ways by contrasting groups of UX researchers. Because of this, cultural probing can yield both ambiguous and determinable results. Quantitative UX researchers promote the benefits of the ambiguous data this tool provides. In contrast, qualitative UX researchers highlight the determinability of the results of cultural probing. These ways of speaking reflect publically aired claims of disciplinary legitimacy amongst these contrasting groups of UX researchers [Ghassan and Blythe 2013].

There exist few attempts at unpicking the construction of discourse in Design Thinking research. New and Kimbell [2013, p.139] argue that the Design Thinking research community habitually "caricature[s]" the way in which scientists think in order to claim intellectual territory which is distinct from that of the scientific community. Through undertaking a close reading of existing texts, Ghassan [2013] creates a critical design intervention which condenses claims in Design Thinking literature in the form of poetic verse.

None of the aforementioned research in this section employs corpus-led techniques. Blythe's [2014] investigation into how the HCI Research Through Design (RTD) community constructs meaning in peer-reviewed articles is the only existing example of corpus-led analysis in design research. Blythe reflects on the idea that the word 'design' can be deployed as either a noun or as a verb in the English

language. Upon examining his corpus of RTD abstracts, Blythe [2014, p.704] notes that the node 'design' occurs most commonly as a noun (77.5% of the time)—"as in 'the design', or 'the design process' or 'the design approach'". 'Design' is far less likely to exist as a verb, for example "designing interfaces" [Blythe 2014, p.704]. When employed as a noun, design is used in an "honorific" context, elevating the position of the field and its members [Blythe 2014, p.704]. Blythe's investigation suggests that in RTD, the word 'design' is rarely associated with negative contexts. Blythe suggests that textual patterns employed by the RTD community may be interpreted as aspects of an emergent discourse in this area. This paper moves on to discuss the design of the corpus which will be used in the pilot study.

4. The design of the specialised corpus

Representativeness: the journal 'Design Studies'

In justifying the design of a specialised corpus, researchers must rationalise what type(s) of language it is meant to represent [Biber et al. 1998]. In turn, the representativeness of a particular corpus governs "the kinds of research questions that can be addressed and the generalizability of the results of the research" [Biber et al. 1998, p.246]. In this vein, a corpus will be limited in terms of how generalizable insights gleaned from it are [Biber et al. 1998]. For example, though Baker's [2004] corpora of gay and lesbian fictional prose provide insight into how homosexuality is constructed in these genres, these insights cannot be generalized across fictional works from all genres.

This paper uses a corpus of material taken from articles disseminated in Design Studies. Factors concerning this journal's history, scope and standing are taken into consideration in justifying its use. First published in the late 1970s, Design Studies was the first journal to frame design as an "object of enquiry" [Downton 2003, p.40]. The journal's long history is a sign of its place as a trusted source of knowledge for design researchers worldwide. In terms of scope, researchers from a uniquely broad range of design disciplines are invited to publish in Design Studies [Elsevier, n.d.]. The journal's broad remit should therefore facilitate the publication of a broad range of insights on given themes. Regarding standing, Design Studies has the highest impact factor of any academic design publication. Research disseminated in the journal is therefore of the highest quality.

The above exploration indicates that a corpus containing material from papers on Design Thinking published in Design Studies will be representative of trusted, high quality research from a broad range of design-related areas. The study will therefore support a contribution exploring how meaning is constructed in high quality Design Thinking research. In terms of limitations, the pilot will not be able to contribute to an understanding of how discourse is constructed in non-Design Thinking specific research (for example, research on user-centred design).

The search engine Google Scholar will be used to undertake a systematic analysis of the target population in order to build the specialised corpus.

The use of Google Scholar

The frequently updated (several times a week) bibliographic on-line tool Google Scholar (GS) enables access to peer-reviewed research [Brezina 2012]. In conducting corpus-led discourse analysis, Brezina [2012] uses GS' advanced search facility to perform a systematic analysis of populations of physics and applied linguistics papers. As GS was not designed to perform linguistic analyses, care must be taken when using it to facilitate corpus-led research. Brezina's [2012, p.323] search of articles containing a particular expression ("fit into place") highlights the notion that not all the results yielded in a given GS search will present suitable material. Indeed, of the 700 hits, only 300 were suitable. This impreciseness is partly due to the fact that GS tends to duplicate data in the results it presents. Thus, in compiling corpora from GS searches, researchers must make informed decisions as to the validity of including each text [Brezina 2012].

An initial GS search for articles appearing in the journal Design Studies precipitated over 4000 results. Given the research aims, this search was narrowed to include only papers devoted to disseminating knowledge on Design Thinking. Theoretically, a strategy for accomplishing this could involve locating papers containing the keyword 'Design Thinking'. GS however does not currently permit a keyword search. It does though enable searches for words or phrases contained within the title of papers. Thus, a

GS search for articles containing the exact phrase 'Design Thinking' in the title was initiated. Data collection took place on 17th August 2015.

The focussed GS search led to 26 results. A proportion proved to be citations taken from the bibliography contained within research papers. The GS query also led to some articles being included more than once. Both citations and duplications were discounted in the process of designing the specialised corpus. In addition, it was important to make informed decisions regarding the inclusion of certain other results. The GS search produced the article 'Thinking in Design Teams—an analysis of team communication' [Stemfle and Badke-Schaub 2002]. The paper's title does not contain the exact phrase 'Design Thinking'. However, upon reading it, it became evident that this article focusses on Design Thinking. It was therefore included. As well as unearthing articles, the GS query located editorials summarising the contents of special issues. One such example is 'Interpreting Design Thinking' [Stewart 2011]. Editorials condense arguments made in peer-reviewed papers contained within respective journal issues. As such, conceivably, editorials will contain phrases or terms borrowed from contributing authors. Their inclusion may skew the data, therefore editorials were discounted. As a result of the above considerations, material from 15 papers (54% of the articles resulting from the advanced GS search) went forward for inclusion into the specialised corpus. The 15 papers are (in alphabetical order): [Goldschmidt 1994], [Galle and Kovács 1996], [Liu 1996], [Dorner 1999], [Louridas 1999], [Dorst 2001], [Ho 2001], [Stemfle and Badke-Schaub 2002], [Oxman 2003], [Carmel-Gilfilen and Portillo 2010], [Adams et al. 2011], [Burdick and Willis 2011], [Tonkinwise 2011], [Goldschmidt and Rodgers 2013], [Blizzard et al. 2015]. As is evident from this list, the most recent article was disseminated in 2015, the least recent in 1996.

The Design Thinking Corpus

As every word contributes to how speakers generate meaning, an analysis of any part of a particular text may elucidate how meaning is constructed [Thompson and Hunston 2003]. However, speakers' efforts at constructing meaning are condensed in particular parts of spoken or written text. In academic research articles, discourse is condensed in abstracts [Thompson and Hunston 2003]. As such, there are many examples of corpus-led analyses of abstracts (e.g. [Hyland and Tse 2005], [Blythe 2014], [Nagano 2014]). This paper analyses a corpus of abstracts created from the 15 aforementioned Design Thinking articles. Henceforth, this specialised corpus is termed the 'DT Corpus'. The longest abstract contains 230 words, the shortest, 72 words. At 1790 words, the DT Corpus is small in size. It can be argued that the short length lends itself to manual analysis: a researcher may be able to make claims on discourse-related findings from simply reading the text. As noted however, researcher bias skews analyses conducted through manual reading [Baker 2004]. Computerised techniques provide a more objective measure of the use of language in a corpus [Baker 2004]. Conceivably, given the length of the corpus, it would be possible to apply simple (non-corpus linguistics) computerised analysis tools to the corpus. One such example is the 'Navigation' tool in 'MS Word'. It enables researchers to highlight particular words or terms that may be of interest. Concordancers are however a far more powerful apparatuses for they enable statistical analyses. They also physically order text in such a way as to make it readily amenable to qualitative analyses (see section 5 below). There are therefore tangible benefits to analysing small corpora with corpus linguistics techniques.

It should be noted that not all small corpora are suited to being analysed in this way. A small corpus containing language on a widely diverse range of topics may not provide enough evidence to substantiate claims for the presence of discourse streams. A small corpus containing a narrow genre of language is however well-suited to analysis with corpus-led methods [Nesi 2013]. Examples of such bodies of text are provided below. A corpus of fewer than 5000 words of abstracts and titles provides insight into how meaning is constructed in engineering research [Nagano 2014]. Mautner's [2009b] corpus of 2200 words of Tony's Blair's thoughts on Anti-Terror legislation offers understandings into how Blair allies himself with British citizens. The DT Corpus investigates a narrow genre of language. This justifies its size. The DT Corpus was uploaded to the concordancer 'Sketch Engine' [Brezina and Gablasova 2015]. Influenced by Blythe's [2014] study, there follows analysis and discussion on the node 'design'.

5. Representation of 'design': analysis of the DT Corpus and discussion

Parts of speech: 'design-as-noun'

In node frequency analysis, words which primarily aid grammatical structure (such as prepositions) tend to feature most frequently in corpora. Words which construct meaning tend to be found further down the frequency list [Mautner 2009b]. In, for example, the aforementioned 'Blair' corpus, the 9th most frequently occurring word is the first indicator of meaning [Mautner 2009b]. The DT Corpus differs from the above as the first indicator of meaning—'design'—is the 4th most frequently occurring node. 'Design' is therefore extremely important to speakers. Its importance to the corpus indicates the need for further empirical research into how this node is deployed.

A dispersion plot was created for the lemma 'design' (Figure 1). It is helpful to further clarify Figure 1. The X-axis (Corpus Positions) shows where (geographically speaking) instances of the lemma 'design' are found in the corpus. For example, the figure '10%' signifies a point 1/10th along the body of abstracts. The Y-axis (Frequency) illustrates the rate of appearance of the node 'design'. Figure 1 illustrates that use of 'design' is not limited to a minority of speakers. This notion helps build foundations for claiming the appropriate representativeness of subsequent analyses.
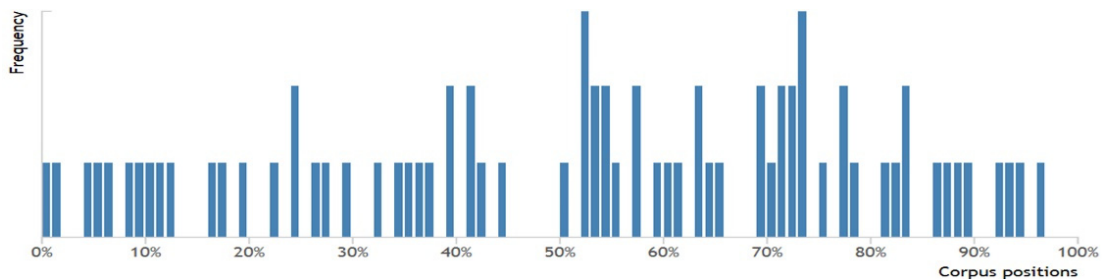

Figure 1. Word frequency list for the lemma 'design'

Sketch Engine categorises (tags) node use in relation to parts of speech (PoS)— namely whether/when for example, nodes appear as verbs, adjectives or nouns. The tagging procedure indicates that the lemma 'design' appears as a noun 66 times and as a verb on 8 occasions (see Figure 2).

Figure 2. PoS word class pertaining to 'design' in the DT Corpus

A close reading suggests Sketch Engine's calculation is inaccurate. Figure 3 shows the sentences in which the inaccuracy occur. In 'Sentence A' the section 'from brief to design' suggests the node 'design' is used as a noun. Sketch Engine's tagging of 'design' in sentence A is therefore correct. Sketch Engine's tagging in 'Sentence B' is however incorrect. In the term 'design PhD candidates', 'design' indicates a 'type' of PhD student—'design' is therefore employed as an adjective in Sentence B. In the DT corpus, the lemma 'design' therefore appears as a verb 7 times. It appears 67 times as noun (90.5% of its total incidence).

Figure 3. Incidences of the lemma 'design' employed as a verb in the DT Corpus

The error demonstrates that "small percentage" inaccuracies are a feature of Sketch Engine's PoS tagging system [Brezina and Gablasova 2015, p.19] and underscores the importance of close reading in semantic analysis. Regarding the representativeness of the DT Corpus, it is possible to argue that, overwhelmingly, 'design' is used as a noun in high quality Design Thinking research. This phenomenon provides an initial indication of a way of speaking in Design Thinking research.

To further explore phenomena observed in specialised corpora, it is important to reflect on relevant node behaviour in reference corpora. 'EnTenTen', a reference corpus comprising over 11 billion words from over 21 million texts, is used to investigate how 'design' is employed as a PoS in a broad cross-section of contemporary English. Available through Sketch Engine, EnTenTen includes texts from a very wide variety of sources, both colloquial and formal [Brezina and Gablasova 2015]. Figure 4 illustrates the results of the EnTenTen corpus analysis:

Figure 4. PoS word class pertaining to 'design' in the enTenTen corpus

Figure 6 shows that of its 6,012,171 appearances in EnTenTen, 'design' occurs as a noun 3,493,418 times (an incidence of 58.1%). (The rate of occurrence of 'design' in EnTenTen impedes a manual inspection for inaccuracies in the PoS tagging). Thus, in a broad-cross section of English, 'design' is far less likely to be employed as a noun than it is in Design Thinking research. Earlier it was noted that Design Thinking research caricatures scientists to claim intellectual territory [New and Kimbell 2013]. This is evidence of a common goal in Design Thinking research. The use of 'design' as a noun suggests a second common goal in Design Thinking research. Accordingly, it may indicate a further characteristic of the Design Thinking research discourse community.

It is important to reflect on the 'design-as-noun' finding with respect to Blythe's [2014] aforementioned study into RTD abstracts. Blythe argues that the overwhelming deployment of 'design' as a noun is indicative of an emergent discourse in this research community. Though the results of the DT Corpus study are not generalizable beyond Design Thinking research, they do raise the possibility that use of 'design-as-noun' may be more widespread in design research.

'Design' in context

It is important to explore the manner in which a node is used in conjunction with words which are in close geographic proximity to it. For a word to be considered meaningful to subsequent semantic analysis, it should accompany a given node within a 5:5 span (5 words the left or 5 words to the right of said node) [Baker et al. 2008]. Sketch Engine facilitates contextual explorations via enabling efficient visual inspection of 'concordance lines' (extracts of text situated around a given node). Space restrictions prevent an illustration of all the contexts in which 'design' is used in the DT Corpus. Figure 5 shows an edited selection of these concordances. Words which perform grammatical roles when they co-occur with nodes (through structuring sentences into cohesive units) tend to be ignored in semantic analyses. Qualitative investigation instead focusses on words which may indicate how discourse related to given nodes is constructed within corpora [Baker et al. 2006]. Figure 5 indicates that 'education' co-occurs with 'design' (see 'Sentence B'). This does not arouse heightened interest as Design Thinking is commonly a feature of design education. However, use of 'ill-structured' in 'Sentence A' does precipitate raised interest. It could potentially denote that 'design problems' are too time-consuming to tackle effectively. In this case 'ill-structured' would denote a negative association concerning design.

Figure 5. A sample of concordances for the node 'design' from the DT Corpus

To aid further qualitative investigation, Sketch Engine provides an expanded view of the sentences in which nodes appear. The expanded view (Figure 6) relates the speakers' assessment: that designers effectively structure ill-structured problems. Here, 'design' is not associated with a negative context.

Figure 6. An expanded view of a concordance search related to the node 'design'

An examination of concordance lines and expanded text for every incidence of 'design' reveals that this node is never associated with negative consequences in the DT Corpus. It is important to reflect on this notion with regards Kannabiran et al.'s [2011] aforementioned study of ways of speaking on sexuality in HCI design research. HCI design research frames sexuality in ways which ignore the existence of anything other than general cultural norms. The HCI community therefore seems reticent to speak on what it may deem to be 'uncomfortable issues' concerning sexuality. Similarly, the construction of discourse around design in the DT Corpus suggests an aversion to discomfort. It is well known that design can precipitate objectively negative consequences—for example the design of armaments can result in significant loss of innocent civilian life in wartime. In Design Thinking research the reticence to discuss negative consequences of design directly influences the representation of Design Thinking. A concordance analysis indicates that the process is not framed as a tool to conduct objectively negative activities. This suggests the presence of a public goal in the Design Thinking research discourse community. Norman [2009] argues that Design Thinking is a useful concept as it helps to disseminate the notion that design activity can help in tackling a multitude of problems. The corpus-led investigation indicates that Norman's [2009] argument may have to be amended. Rather than being a 'problem-solving process', a pragmatic characterisation of Design Thinking could necessitate the term—as employed in Design Thinking research—being characterised as a 'problem-solving process which does not create harm'. This pragmatic characterisation suggests a means of claiming power within the Design Thinking research discourse community for it helps legitimise Design Thinking activity.

In addition to the qualitative investigation of concordances, a statistical measure of co-occurrence was conducted on the DT Corpus. The statistical investigation was limited to words occurring within a 5:5 span of 'design' [Baker et al. 2008]. The 'Mutual Information (MI) score' test provides an indication of "how strongly" two words appear to co-occur in a corpus [Hunston 2002, p.72]. MI-score is suited to discourse analysis as it hints at the semantic behaviour of a node. A MI-score of 3 or higher is statistically significant. Pertinent to this study, MI-score may over-exaggerate the strength of collocation observed in smaller corpora. The 't-score' calculation takes corpus size into account and is thus a "measure of certainty of collocation" [Hunston 2002, p.74]. A t-score of 2 or higher is statistically significant. To ensure the strength and certainty of statistical analysis, this study discusses collocates that are significant in terms of both MI-score and t-score. Space restrictions prevent an illustration of all statistically significant collocates. Figure 7 shows an edited list—the list ignores commonly occurring functional collocates such as prepositions. Returning to Blythe's [2014] study, when 'design' is represented as a noun (as it primarily is) it is used in an "honorific" context, elevating the position of the field and—by association—its members. Similarly, collocation data demonstrates that in the DT Corpus, speakers focus on 'design research', the 'design problem', the 'design process' and the 'design framework'. High quality Design Thinking research therefore employs 'design' in an honorific context. The collocate 'paper' is not included in the discussion on 'honouring' design as articles are often termed 'papers' in academia. Similarly, as the corpus concerns Design Thinking research, 'thinking' is an expected collocate. The examples 'paper' and 'thinking' underscore the need to take contextual information into account when qualitatively analysing collocates [Hunston 2002]. The representation of 'design' in an honorific manner suggests a common goal and means of claiming legitimacy in the Design Thinking research discourse community.

	Frequency	T-score	MI
thinking	18	4.027	4.298
paper	9	2.822	4.075
research	6	2.356	4.713
problem	5	2.117	4.227
process	5	2.100	4.035
framework	5	2.083	3.865

Figure 7. Statistically signifcant collocates for the node 'design'

6. Conclusion

This pilot study has used corpus-led methods to analyse ways in which the word 'design' is constructed in a representative corpus of Design Thinking research abstracts. Its high occurrence suggests 'design' is very important to speakers. The overwhelming framing of 'design-as-noun' indicates a way of speaking on this node which differs from its framing in a broad cross-section of English. This occurrence suggests the presence of a public goal in the Design Thinking research discourse community. The observed 'design-as-noun' phenomenon mirrors the construction of 'design' found in Research Through Design corpus-led enquiry. More research is required to confirm whether the node's use as a noun is a common public goal across design research. The results of the pilot study suggest that high quality Design Thinking research also represents 'design' in an honorific context. These findings parallel conclusions from an existing corpus-led analysis of Research Through Design abstracts. Further research needs to be conducted to elucidate whether this framing exists across design research.

The results of the pilot indicate that high quality Design Thinking research does not engage in constructing negative representations of design. The process of Design Thinking is also not represented as a tool to conduct objectively negative activities. These points indicate the presence of further public goals in the Design Thinking research discourse community. The pragmatic characterisation of Design Thinking as a 'problem-solving process which does not create harm' suggests a means of claiming power within the Design Thinking research discourse community for it helps legitimise Design Thinking activity. Through not speaking on objectively negative issues concerning 'design', the Design Thinking research discourse community appears not to speak on issues that it may deem to be 'uncomfortable'. The unwillingness to broach areas which may potentially cause discomfort mirrors existing observations on the framing of sexuality in HCI design research. Further corpus-led research needs to be undertaken into possible 'uncomfortable' topics to ascertain whether such observations apply across design research. Because language is entrenched in civilisation, it is difficult for individuals to recognise the manner in which discourse communities ascertain claims to legitimacy and power. The author hopes that the small steps made in highlighting how power and legitimacy are constructed may enable the Design Thinking research community to critically reflect on the way it writes on the subject of Design. This may prompt more objective ways of writing on Design Thinking.

The potential significance of the discourse streams identified here is not confined to the world of academic research. The fields of research and practice are by no means separate silos. Academics engage in enterprise activities. Some also write articles and books which are widely disseminated in the world of professional practice. Through this engagement, researchers have the opportunity to influence how designers' discourse on Design Thinking is constructed. Scholarly research also informs teaching practices which of course inform the manner in which students understand issues. Graduates go on to become practicing designers. This provides another route for academic 'ways of speaking' to potentially influence how Design Thinking is represented in professional practice.

The author calls for larger scale corpus-led studies on both Design Thinking and other areas of design research to further unpick means of constructing power and legitimacy.

References

Adams, R. S., Daly, S. R., Mann, L. M., Dall'Alba, G., "Being a professional: Three lenses into design thinking, acting, and being", Design Studies, Vol.32, No.6., 2011, pp. 588-607.

Archer, L. B., "Whatever became of design methodology?", Design Studies, Vol.1, No.1, 1979, pp. 17-18.

Baker, P., "Acceptable bias? Using corpus linguistics methods with critical discourse analysis", Critical Discourse Studies, Vol.9, No.3, 2012, pp. 247-256.

Baker, P., "Querying Keywords Questions of Difference, Frequency, and Sense in Keywords Analysis", Journal of English Linguistics, Vol.32, No.4, 2004, pp. 346-359.

Baker, P., "Using Corpora in Discourse Analysis", Continuum, London, UK, 2006.

Baker, P., Gabrielatos, C., Khosravinik, M., Krzyżanowski, M., McEnery, T., Wodak, R., "A useful methodological synergy? Combining critical discourse analysis and corpus linguistics to examine discourses of refugees and asylum seekers in the UK press", Discourse & Society, Vol.19, No.3, 2008, pp. 273-306.

Baker, P., Hardie, A., McEnery, T., "A glossary of corpus linguistics", Edinburgh University Press, Edinburgh, 2006.

Bazerman, C., "Shaping Written Knowledge: The Genre and Activity of the Experimental Article in Science", University of Wisconsin Press, Madison, Wisconsin, USA, 1988.

Biber, D., Conrad, S., Reppen, R., "Corpus linguistics: Investigating language structure and use", Cambridge University Press, UK, 1998.

Blizzard, J., Klotz, L., Potvin, G., Hazari, Z., Cribbs, J., Godwin, A., "Using survey questions to identify and learn more about those who exhibit design thinking traits", Design Studies, Vol.38, 2015, pp. 92-110.

Blythe, M., "Research Through Design Fiction: narrative in real and imaginary abstracts", Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, ACM, New York, USA, 2014, pp. 703-712.

Brezina, V., "Use of Google Scholar in corpus-driven EAP research", Journal of English for Academic Purposes, Vol.11, No.4, 2012, pp. 319-331.

Brezina, V., Gablasova, D., "Is There a Core General Vocabulary? Introducing the New General Service List", Applied Linguistics, Vol.36, No.1, 2015, pp. 1-22.

Burdick, A., Willis, H., "Digital learning, digital scholarship and design thinking", Design Studies, Vol.32, No.6, 2011, pp. 546-556.

Carmel-Gilfilen, C., Portillo, M., "Developmental trajectories in design thinking: an examination of criteria", Design studies, Vol.31, No.1, 2010, pp. 74-91.

Cross, N., "Designerly ways of knowing. Design Studies", Vol.3, No.4, 1982, pp. 221-227.

Cross, N., "Designerly ways of knowing: Design discipline versus design science", Design Issues, Vol.17, No.3, 2001, pp. 49-55.

Dörner, D., "Approaching design thinking research", Design Studies, Vol.20, No.5., 1999, pp. 407-415.

Dorst, K., "The core of 'design thinking' and its application", Design Studies, Vol.32, No.6., 2011, pp. 521-532.

Downton, P., "Design Research", RMIT University Press, Melbourne, Australia, 2003.

Elsevier, "Design Studies", Elsevier.com, Accessed online at http://www.journals.elsevier.com/design-studies/ on 10th November 2014.

Finken, S., "Discursive conditions of knowledge production within cooperative design", Scandinavian Journal of Information Systems, No.15, 2003, pp. 57-72.

Flowerdew, J., "Discourse in English Language Education", Routledge, Abingdon, UK, 2013.

Galle, P., Kovács, L. B., "Replication protocol analysis: a method for the study of real-world design thinking", Design Studies, Vol.17, No.2, 1996, pp. 181-200.

Ghassan, A., "Design Thinking Set to Verse", In: Wallace, J., Yee, J., Durrant, A. (Eds.), Proceedings of the Praxis and Poetics, Research Through Design Conference, 2013, pp. 204-207.

Ghassan, A., Blythe, M., "On Legitimacy: Designer as Minor Scientist", In: Mackay, W. E., Brewster, S., Bødker, S. (Eds.), Proceedings of the CHI '13 Extended Abstracts on Human Factors in Computing Systems, ACM, New York, 2013, pp. 2149-2158.

Goldschmidt, G., "On visual design thinking: the vis kids of architecture", Design Studies, Vol.15, No.2, 1994, pp. 158-174.

Goldschmidt, G., Rodgers, P. A., "The design thinking approaches of three different groups of designers based on self-reports", Design Studies, Vol.34, No.4, 2013, pp. 454-471.

Ho, C. H., "Some phenomena of problem decomposition strategy for design thinking: differences between novices and experts", Design Studies, Vol.22, No.1, 2001, pp. 27-45.

Hunston, S., "Corpora in Applied Linguistics", Cambridge University Press, Cambridge, UK, 2002.

Hyland, K., "Persuasion and context: The pragmatics of academic metadiscourse", Journal of pragmatics, Vol.30, No.4, 1998, pp. 437-455.

Hyland, K., Tse, P., "Hooking the reader: A corpus study of evaluative that in abstracts", English for specific purposes, Vol.24, No.2, 2005, pp. 123-139.

Johansson-Sköldberg, U., Woodilla, J., Çetinkaya, M., "Design thinking: past, present and possible futures", Creativity and Innovation Management, Vol.22, No.2, 2013, pp. 121-146.

Kannabiran, G., Bardzell, J., Bardzell, S., "How HCI Talks about Sexuality: Discursive Strategies, Blind Spots, and Opportunities for Future Research", Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, ACM, New York, USA, 2011, pp. 695-704.

Kimbell, L., "Rethinking Design Thinking: Part I", Design and Culture, Vol.3, No.3, 2011, pp. 285-306.

Koskinen, I., Zimmerman, J., Binder, T., Redstrom, J., Wensveen, S., "Design Research Through Practice: From the Lab, Field, and Showroom", Morgan Kauffman, Waltham, MA, USA, 2011.

Liu, Y. T., "Is designing one search or two? A model of design thinking involving symbolism and connectionism", Design Studies, Vol.17, No.4, 1996, pp. 435-449.

Loughborough University, "Design Ergonomics–Course Information", Available at: <http://www.lboro.ac.uk/departments/lds/ug/design-ergonomics/>, [Accessed 10.11.2015].

Louridas, P., "Design as bricolage: anthropology meets design thinking", Design Studies, Vol.20, No.6, 1999, pp. 517-535.

Mautner, G., "Checks and balances: how corpus linguistics can contribute to CDA", In: Wodak, R., Meyer, M. (Eds.), Methods of Critical Discourse Analysis, Sage, London, UK, 2009, pp. 122-138.

Mautner, G., "Corpora and Critical Discourse Analysis", In: Baker, P, (Ed.), Contemporary Corpus Linguistics, Continuum, London, UK, 2009b, pp. 32-46.

Nagano, R. L., "Mini-Corpora in the Language Classroom: Title and abstract Mini-corpus", Practice and Theory in Systems of Education, Vol.9, No.1, 2014, pp. 29-40.

Nesi, H., "ESP and Corpus Studies", In: Paltridge, B., Starfield, S. (Eds.), The Handbook of English for Specific Purposes, Handbooks in Linguistics Series, Wiley-Blackwell, Oxford, UK, 2013, pp. 407-426.

New, S., Kimbell, L., "Chimps, designers, consultants and empathy: A 'theory of mind' for service design", Proceedings of 2nd Cambridge Academic Design Management Conference, 2013, pp. 139-152.

Norman, D. A., "Design Thinking: A Useful Myth", Available at: <http://www.core77.com/blog/columns/design_thinking_a_useful_myth_16790.asp>, [Accessed 12.10.2015].

Open University, "Maths, Computing and Technology-Research-Design Thinking", Available at: <http://mct-research.open.ac.uk/research/subtheme_designthinking>, [Accessed 12.10.2015].

Oxman, R., Rabinow, P., "Think-maps: teaching design thinking in design education", Design studies, Vol.25, No.1, 2004, pp. 63-91.

Rabinow, P., "The Foucault Reader", Penguin, London, UK, 1991.

Schon, D. A., "The Reflective Practitioner", Temple-Smith, London, 1983.

Searle, J., "Situated literacies at work", International journal of educational research, Vol.37, No.1, 2002, pp. 17-28.

Stempfle, J., Badke-Schaub, P., "Thinking in design teams—an analysis of team communication", Design Studies, Vol.23, No.5, 2002, pp. 473-496.

Stewart. S. C., "Interpreting Design Thinking", Design Studies, Vol.32, No.6, 2011, pp. 515-520.

Stubbs, M., "Collocations and semantic profiles: on the cause of the trouble with quantitative studies", Functions of Language, Vol.2, No.1, 1995, pp. 23-55.

Stubbs, M., "Text and Corpus Analysis", Blackwell, London, UK, 1996.

Swales, J., "Genre Analysis: English in Academic and Research Settings", Cambridge University Press, Boston, UK, 1990.

Teubert, W., "Meaning, Discourse and Society", Cambridge University Press, Cambridge, UK, 2010.

Teubert, W., "My version of corpus linguistics", International Journal of Corpus Linguistics, Vol.10, No.1, 2005, pp. 1-13.

Thompson, G., Hunston, S., "Evaluation: an introduction", In: Hunston, S., Thompson, G. (Eds.), Authorial Stance and the Construction of Discourse, Oxford University Press, New York, USA, 2003, pp. 1-26.

Tonkinwise, C., "A taste for practices: Unrepressing style in design thinking", Design Studies, Vol.32, No.6, 2011, pp. 533-545.

Widdowson, H. G., "Discourse analysis: a critical view", Language and literature, Vol.4, No.3, 1995, pp. 157-172.

Wiedemann, G., "Opening up to Big Data: Computer-Assisted Analysis of Textual Data in Social Sciences", Forum Qualitative Sozialforschung / Forum: Qualitative Social Research, Vol.14, No.3, 2013, Available at: <http://nbn-resolving.de/urn:nbn:de:0114-fqs1302231>, [Accessed 04.03.2016].

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